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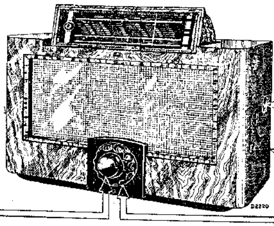
PHILIPS
SERVICE MANUAL

FOR RECEIVER
TYPE 785AX.



GENERAL.

The receiver is of the superheterodyne type, having seven tuned circuits with band filter for selectivity, and is equipped with :—

Monoknob, operating:
- Tuning, with rough and vernier adjustment.
- Volume control.
- Variable selectivity combined with variable tone filter.
- Wave-change and gramophone switch.

Adaptovisor scale, comprising :—
- Visual tuning by means of cathode ray indicator (TV4).
- Station scale with special shadowless illumination, wave-range and gramophone indication by means of illuminated arrows.

Delayed automatic volume control.

Filter for suppressing interfering signals at the image frequency.

Quality correction (A.F. feed-back).

Loudspeaker with anti-directional cone.

Mains aerial.

Sockets for gramophone pick-up.

Sockets for extension speaker (5.5 ohms).

Safety contact, cutting off the current from the receiver when the backplate is removed.

Mains voltage switch for adapting the receiver to suit 110 v., 125 v., 145 v., 200 v., 220 v. and 245 v., with automatic indicator on the backplate.

Wave ranges :—
- Short wave : 16.5—51 m. (18.2—5.89 M.C.).
- Medium wave : 195—585 m. (1,540—513 K.C.).
- Long wave : 720—200 m. (416—150 K.C.).

Weight : nett approx. 33 lb.

Dimensions : width, 21 in. ; height, 14 in. ; depth, 9¼ in.

DESCRIPTION OF CIRCUIT.

Short Waves.

Aerial circuit: S32 inductively coupled to S33.

Grid circuit of L1: (FC4) tuning condenser C10, trimmer C28. R37 prevents parasitic oscillation of the pentode section of L1. C6 prevents radiation of the oscillator frequency.

Oscillator grid circuit: S19, tuning condenser C11, parallel padding condenser C20, grid condenser C31 and grid leak R9.

Oscillator anode circuit: S18 with damping resistance R38.

Medium Waves.

Aerial circuit: S7 coupled inductively (and capacitively via C27), to S9.

Bandfilter: 1st circuit: S9, coupling coil S29, coupling condenser C30, tuning condenser C9, trimmer C13, and

2nd circuit: coupling condenser C30, coupling coil S30, S11, tuning condenser C10, trimmer C15.

Oscillator grid circuit: S14, tuning condenser C11, parallel padding condenser C16, series padding condensers C35 and C19, grid leak R9. The series padding condensers serve also as grid condenser.

Oscillator anode circuit: S16.

Long Waves.

Aerial circuit: S7-S8 coupled inductively (and capacitively via C27), to S9-S10.

Bandfilter: 1st circuit: S9-S10, coupling condensers C29 and C30, tuning condensers C9, trimmer C13, and

2nd circuit: coupling condensers S29 and C30.

S11-S12, tuning condenser C10, trimmer C15.

Oscillator grid circuit: S14-S15, tuning condenser C11, parallel padding condenser C17 (C16), series padding condensers C34 and C18 (C35 and C19), grid leak R9.

The series padding condensers serve also as grid condenser.

Oscillator anode circuit: S16-S17 and anti-parasitic resistance, R42.

I.F. aerial filter: S6, C12. This filter short circuits the aerial for signals at this frequency in order to prevent whistles.

Image frequency filter: the two condensers C26 and C14, together with the first coil in the bandfilter, form a filter circuit for signals which are higher than the frequency to which the bandfilter is tuned to the extent of twice the I.F. (image frequency). This circuit prevents interference due to signals at that frequency.

I.F. CIRCUITS.

First Bandfilter.—S20, C21, S21, C22 tuned to the I.F. The coupling between S20 and S21 is variable, thus providing variable bandwidth, i.e., variable selectivity.

Minimum bandwidth is equivalent to maximum selectivity; maximum bandwidth giving minimum selectivity. The bandwidth control is combined with the variable tone filter R22, C42, C43, and also controls the feed-back (R41).

Second Bandfilter.—S22, C23, S24, C24 also tuned to the I.F.

The anode of the diode detector (first diode anode of L4) (Pen4DD) is connected to a tapping of the second circuit to reduce damping.

Detector and A.F. Circuits.

Detector circuit: first diode anode of L4, cathode R19 (volume control) (R16-R15), R17, S24, diode anode of L4. The A.F. voltage across R19 is fed to the **A.F. amplifier.**

The A.F. voltage is applied to the grid of L3 (TDD4) via C33 (C33 and C41), grid leak R20, the tone filter and R21. R21-C44 decouple the I.F.

The amplified A.F. voltage across coupling resistance R27 is passed to the grid of L4 via coupling condenser C45, grid leak R29 and R30. S26-S27 is the speaker transformer. C46 and C48 suppress any remaining I.F. voltage. R30 and R32 prevent oscillation of L4.

Visual Tuning Indicator.

When the receiver is tuned, the direct voltage across R16 of the potentiometer R15-R16 is applied to the triode portion of L6. The anode current (the current through R14), or the voltage drop across R14, decreases. The deflector plates in the tuning lamp connected to this anode then receive a higher voltage, the screening action is reduced and the breadth of the light bands increases. Correct tuning is indicated by maximum light bands.

Quality Correction.

By returning a portion of the voltage across the secondary of the speaker transformer, via the potentiometer circuit S25, C47, R34-S31, R24, R41, to the grid circuit of L3, it is possible for the A.F. amplifier to deliver greater power with less distortion. S25, S31 and C47 insure that the amount of feed-back is correct for every frequency. R41 is adjusted in combination with the bandwidth and ensures correct adjustment of the feed-back for every setting.

Automatic Volume Control.

The adjustment of L2 (VP4B) is not delayed. The rectified I.F. voltage across R25 is applied to the control grid of L2 via R13-C49 and thus regulates the amplification of the valve L2.

Control of the operation of the mixer valve L1 (FC4) is delayed.

The voltage at the second diode anode of L4 (that is, the voltage across C36) is fed to the fourth grid of L1 via R5.

Without signal this anode voltage is positive (via R33).

On a small signal this voltage is reduced via R28 by a portion of the delay voltage across R25.

This is a small reduction only, as the resistance cathode-anode (of the second diode of L4) is small compared with that of R28 when the anode is positive. On a larger signal this reduction is so great that the second diode-anode of L4 becomes negative in respect of its cathode. Now the resistance cathode-anode is great in respect of R28 and therefore practically the whole delay voltage across R25 is applied to C36 (i.e., the grid of L1).

Supply.

L5 supplies the direct voltage to C1.

S5, R1 and C2 form the smoothing filter.
Anode voltage for L1, L2, L4 and L6 is fed direct from C2.

Anode voltage for L3 as well as the screen grid voltages are tapped from potentiometer R4-R6. Anode voltage for L3, screen voltage for L2 and the voltage for the screen grid of L2 is decoupled by C5.
Voltage for grids 3 and 5 of L1 is decoupled by C4.

Grid bias for L1 and L3 is obtained from the voltage drop across the bias resistances R7, R8 and R23 (R24-R41-S31), decoupled by C32 and C3 respectively.

R8 is short circuited on radio reception ; on gramophone the short circuit is removed and the mixer valve quenched.

Grid bias for L2 is provided by the potential difference across R12, (decoupled by C37).

L4 is biased by the voltage difference across R1, decoupled by R10-C8.

C51 suppresses mains interference.

Mains Aerial.

When the mains aerial switch is pointing downwards, the aerial circuit is connected to the first R.F. circuit. In the upward position this circuit is connected via C25 to the mains. The outdoor aerial must be removed from the apparatus before the switch can be set to mains aerial.

The receiver is provided with extension speaker sockets for use with an extension speaker having an impedance of 5.5 ohms.

TRIMMING THE RECEIVER.

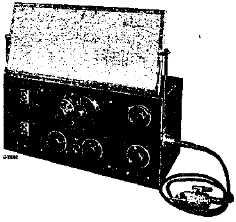


Fig. 1.

The receiver need not be uncased for trimming; by placing the receiver on its left-hand side upon a piece of felt and removing bottom and back plates, all the trimming points are easily accessible.

Re-trimming is required—

1. When replacing coils or condensers in the I.F. or R.F. sections.
2. If the receiver is unselective (see pages 7 and 8).

In trimming, use is made of the following—

1. Service oscillator GM2880 (fig. 1).
2. Output indicators: Universal testboard type 4256 or 7629.

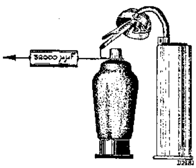


Fig. 2.

3. Auxiliary receiver or aperiodic amplifier GM2404.
4. Test prod, for connection to the auxiliary apparatus.
5. 15° jig for establishing the relation between the position of the condenser and the scale.
6. Insulated box spanner: 6 mm.
7. Insulated box spanner: 8 mm.
8. Insulated trimming screwdriver.
9. Wax for locking trimmers.
10. 25 μμF condenser.
11. 0.1 μF condenser.
12. 32,000 μμF condenser.
13. 10,000 ohms resistance.
14. 25,000 ohms resistance.
15. Trimming transformer.

The following Artificial Aerials are used:—

1. For I.F.: a condenser of 32000 μμF.
2. For medium and long waves: standard artificial aerial.
3. For short waves: short wave artificial aerial as supplied with service oscillator GM2880.

Always use the customer's valves when trimming. If the octode valve becomes defective during trimming, re-trim the receiver (allow new valve to warm up). When applying the damping resistances or connecting up the auxiliary apparatus, take care that no short circuit occurs between the anodes of L1 or L2 and the chassis, otherwise the full anode voltage is placed across the I.F. transformers, which would burn out. Before commencing trimming, soften the wax on the trimmers (for example, with a soldering iron).

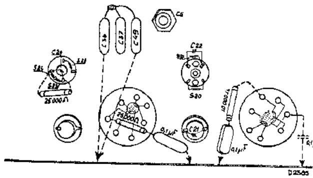


Fig. 3.

A. The I.F. Circuits.

Earth the receiver.

1. Switch receiver to long waves.
2. Set volume control to maximum } Monoknob. ↗
3. Selectivity at minimum }
4. Place A.V.C. out of action by short circuiting C49 and C36 (see fig. 3).
5. Connect output indicator to extension speaker sockets via the trimming transformer.
6. Short circuit S31, connect grid 1 of L1 to chassis.
7. Apply modulated signal of 128 K.C. via 32,000 μμF to the fourth grid of L1 (Fig. 2).
8. Damp S20 with 10,000 ohms and 0.1 μF in series between the anode of L1 and the chassis (see Fig. 3). Damp S23/24 with 25,000 ohms (see Fig. 3).
9. Trim C23, C22, C23, in that order for maximum output (see Fig. 7).
10. Remove damping and then damp S21 with 10,000 ohms and 0.1 μF between grid of L2 and chassis (see Fig. 2A). Damp S22 with 25,000 ohms and 0.1 μF between anode pin of L2 and the chassis.
11. Trim C24, C21, C24, in that order, for maximum output (see Fig. 6).
12. Lock the trimmers with wax, remove damping resistances and artificial aerial.

B. The R.F. and Oscillator Circuit.

I. For Medium Waves.

1. Switch receiver to medium waves.
2. Volume control to maximum } Monoknob. ↖
3. Sensitivity to maximum }

4. Fit 15° jig (see Fig. 4).
5. Set variable condenser to the jig (minimum capacity).
6. Apply modulated 1,442 K.C. signal via standard artificial aerial to aerial sockets.
7. Trim for maximum output in the following order: **C16**, C15, C13, C15, C16 (see Fig. 6).
8. Lock C13 and C15 and see that output does not change while the wax is setting.
9. Earth the first grid of L1 through 0.1 μF condenser.

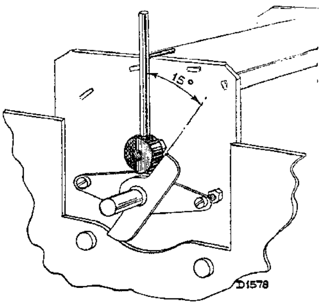


Fig. 4.

10. Adjust service oscillator to 546 K.C.
11. Connect auxiliary receiver via 25 $\mu\mu$F condenser (see Fig. 5). Connect output indicator to the auxiliary receiver and tune the latter to 546 K.C.
12. Tune the condenser of the receiver under test to maximum output (centring).

Centring is carried out in the following manner :—
Set variable condenser as accurately as possible to maximum output.

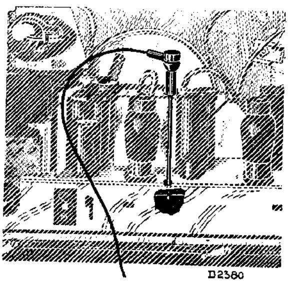


Fig. 5.

Mark position of condenser and make a note of output (Position 1).

Turn the variable condenser to the left until the output is one-third of the value at Position 1, and make a note of the condenser position (Position 2).

Turn back the condenser to the right so that the output is again one-third of the value in Position 1. Mark position of condenser (Position 3).

The correct position is then exactly mid-way between Position 2 and Position 3. Repeat this process, proceeding from the more correct position of the condenser as found.

13. Remove auxiliary receiver and the earth condenser on grid 1 of L1 and reconnect the output indicator to the receiver under test.
14. Trim C19 for maximum output.
15. Lock C19.
16. Readjust service oscillator exactly to 1,442 K.C.
17. Set variable condenser to the 15° jig.
18. Lock C16; adjust to maximum output while the wax is setting.

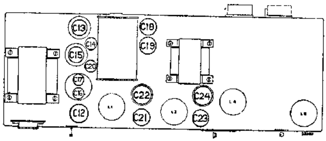


Fig. 6.

II. For Long Waves.

1. Switch receiver to long waves.
2. Adjust service oscillator to 395 K.C.
3. Tune apparatus for maximum output.
4. Adjust C17 for maximum output.
5. Lock C17; if necessary readjust while wax is setting.
6. Adjust service oscillator to 160 K.C.
7. Turn variable condenser to maximum.
8. Turn back variable condenser to the second maximum output point.
9. Trim C18 for maximum output.
10. Lock C18 and if necessary readjust while the wax is setting.

III. For Short Waves.

1. Switch receiver to short waves.
2. Set variable condenser to 15° jig.
3. Adjust service oscillator to 17.05 M.C.
4. Fit the artificial aerial for short waves.
5. Open C20 until first maximum output point is obtained.
6. Lock C20.

C. Image Frequency Filter.

1. Switch receiver to short waves.
2. Adjust service oscillator to 1,000 K.C.
3. Greatly increase signal strength.

4. Adjust receiver to 403 metres.
5. Trim C14 for **MINIMUM** output.
6. Lock C14.

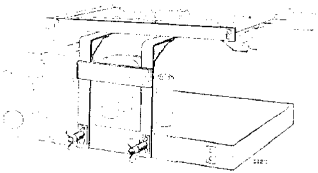


Fig. 7.

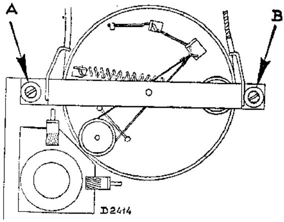


Fig. 7A.

D. I.F. Aerial Filter.

1. Switch receiver to long waves.
2. Turn variable condenser to maximum.
3. Adjust service oscillator to 128 K.C.
4. Trim S6 (or C12) for **MINIMUM** output (Fig. 6).
5. Lock S6 (or C12).

E. Calibration.

If readjustment of the scale is necessary, this is done in the following manner :

Apply 208-metre (1,442 K.C.) signal via standard artificial aerial and tune the receiver to this signal.

Adjust the pointer to 208 metres and fix. Apply a signal of 350 metres (857 K.C.) and tune to this.

Note the error in the indication. Apply a signal of 549.5 metres (546 K.C.) and tune receiver to this.

Note error.

Adjust driving plate with driving spindle of variable condenser in accordance with the following :—

(The screws A and B, Fig. 7A, can be released for this adjustment).

350 metres	549.5 metres	
Correct ...	Too high ...	↑ or ↖
Correct ...	Too low ...	↙
Too high ...	Too high ...	←
Too low ...	Too low ...	→
Too high ...	Too low ...	↓
Too high ...	Correct ...	↓
Too low ...	Too high ...	↑
Too low ...	Correct ...	↑

After each adjustment tune to 208 metres, and if necessary, correct the pointer. A special bracket for holding the scale is recommended for use during this operation (see Fig. 7).

In the majority of cases it will be sufficient to correct the position of the pointer, rendering removal of the chassis from the cabinet unnecessary.

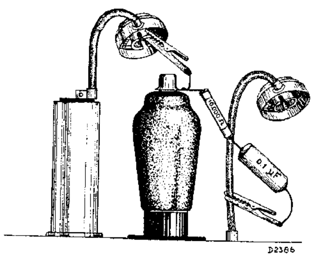


Fig. 2A.

FAULT-FINDING.

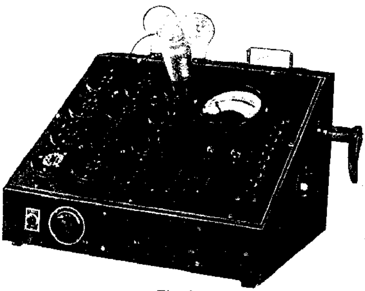


Fig. 8.

In order to trace faults efficiently it is necessary to use a good test instrument; therefore attention is drawn to the universal test box Type 4256 and Type 7629, Fig 8. It is not necessary to remove the chassis from the cabinet in order to localise a fault, as all components are accessible upon placing the receiver on its left-hand side on a piece of felt and removing the bottom and back plates.

Connections should not be unsoldered before the fault has been localised by means of measurements taken whilst the receiver is running under working conditions. Normal values for currents and tensions are in each case indicated in brackets. These values were obtained with the Universal Test Board type 4256.

I. Connect the receiver to the correct voltage and test on outdoor aerial with the receiver's valves.
   (a) If the performance of the receiver is normal, leave it working under observation.
   (b) If the receiver does not work properly:

II. Take a set of valves from a receiver which is in good working order, place them in the set and, if necessary try out with a different speaker. Faults in either valves or speaker are thus localised.

III. Test for reproduction of gramophone music.
   (a) If reproduction is in order, the fault will be found in the I.F. or R.F. section (see § V).
   (b) If there is no reproduction the fault is in the feed or A.F. section (see § IV).

IV. No radio or gramophone reproduction.

Voltage across C2 abnormal (260 v.).

1. R1 defective } Voltage exists across C1.
2. S5 defective }
3. C2 short.
4. C1 short.
5. C51 short (measure alternating voltage between anodes of L5).
6. S1, S2 or S3 defective.
7. Mains switch defective (measure voltage across primary winding).
8. Mains tapping plate wrongly set.
9. Short circuit to chassis in one of the screening boxes of the I.F. transformers.
10. C5, C4 short.
11. Short circuited speaker transformer.

Normal voltage at C2 but no gramophone reproduction.

(a) Abnormal currents and voltages at L4 (Pen4DD) (Va = 250 v.; Vg2 = 260 v.; — Vg = 0 v.; Ia = 32 ma.; Ig2 = 4.5 ma.).
   1. S26 open: no anode current.
   2. C8, C45 short; R1 short; short circuit in screened control grid circuit; anode current too high.
   3. R10, R29, R30 open.

(b) Abnormal currents and voltages at L3 (TDD4) (Va = 75 v.; —Vg = 2.2 v.; Ia = 0.7 ma.).
   1. R27, R4, R23 open; C46 short; no anode current.
   2. C3 short: anode current too high.
   3. R21, R22, R20 open.

(c) Normal voltages for L3 and L4, but no gramophone reproduction.
   1. Bad contact in switch 4.
   2. Short circuit in speaker transformer (primary or secondary).
   3. R19 open.
   4. C44 short.

V. Gramophone reproduction but no radio reception.

(a) Abnormal currents and voltages at L2 (VP4B) (Va = 260 v.; Vg2 = 150 v.; —Vg = 3.0 v.; Ia = 8.5 ma.; Ig2 = 3.0 ma.).
   1. S22, R12 open; no anode current.
   2. C37 short; R2, R3, R4, R6 open; anode current too high.
   3. S21, R13, R25 open.

(b) Abnormal currents and voltages at L1 (FC4) (Va = 260 v.; Vg2 = 55 v.; Vg3.5 = 55 v.; —Vg = 1.2 v.; Ia = 1.0 ma.; Ig2 = 1.0 ma.; Ig3.5 = 1.2 ma.).
   1. S20, R7 open: no anode current.
   2. C32 short: anode current too high.
   3. R5, R37, R28, R9 open: switch making bad contact (test 4 positions).

(c) Normal currents and voltages for L1 and L2, but no radio reception.
   1. No reproduction of modulated 128 K.C. signal applied to control grid of L2. S23, S24, R17 open or C23, C24, C40 short.
   2. No reproduction of modulated 128 K.C. signal applied to control grid of L1. C21, C22 short.
   3. Reproduction of modulated I.F. signal applied to the grid of L1, but no reproduction of R.F. signal. Defective coil or condensers in the oscillator section; switch 3 making bad contact.
   4. Reproduction of modulated R.F. signal applied to the control grid of L1, but not to an R.F. signal applied to the aerial socket. Defective coil or condensers in the R.F. band filter; bad contact in switch 1 or 2.

VI. Bad quality radio and gramophone reproduction.

(a) A.V.C. not working.
  1. R33 open.
  2. C49, C36 short.

(b) Visual tuning not working properly.
  1. Cross remains small on weak and strong stations. C39 short, R15 open.
  2. Valve not giving full indication; R33 open.
  3. Arms of light merging: R16 open.
  4. No cross: R14 open.

(c) Loud background noise.
Receiver is de-trimmed. Re-trim.

(d) Oscillating.
One of the decoupling condensers open: C2, C5, C4, C48, C46.

(e) Hum.
Screens not making contact with chassis.
  1. S5 short.
  2. C1, C2 open.

(f) Distorted reproduction. Feed-back R34, S25 open; R24, S31, C47 short.

(g) Unselective.
Receiver de-trimmed. Re-trim. C22, C23, C24 short: measure resistance of I.F. coils.

(h) Weak reproduction.
R34 open; S28, C24 short.

(j) Microphony.
This may be caused by the omission to release the screws accessible through the tapped bushes upon which the chassis is mounted.

For mechanical faults, see pages 11—13.

FAULT-FINDING IN ACCORDANCE WITH THE "POINT TO POINT" SYSTEM.

When either Universal Test Board type 4256 or 7629 is available, faults may be easily localised by following the "point to point" system.

In the first stages this method corresponds with the system described under "Fault Finding," so that a commencement may be made with the operations mentioned in §I and II of those sheets.

Further, the operations are as follows :—

1. All valves are removed from the receiver. The Universal Test Apparatus is connected and set for resistance testing (Position 12). The positive pin on the test lead is so extended that the various contacts of the valveholders can be reached easily, the other pin being inserted in the earth socket of the receiver.

2. The contacts of valveholder L5 must be short circuited ; this also protects the meter, as otherwise the smoothing condensers may become charged during testing, and this might involve burning out the meter.

3. The various resistances between the points indicated in the accompanying table and the chassis are measured by touching the points indicated with the positive pin. The deflection of the meter is compared with the values given in the table. P or U indicates that a test must be made between gramophone pick-up socket and earth, etc. 11/12 means that the test is made between points 11 and 12. Differences of 10% may be met with, but this does not necessarily indicate that the relative component is faulty.

4. When the resistance tests have been completed the testboard is switched over for capacity testing, the values given in the corresponding table being checked.

All the different circuits of the receiver are covered by these measurements, and the particular component concerned is then ascertained with the aid of the theoretical circuit. Should the fault not be located, however, it is advisable to repeat the investigations suggested under "Fault-Finding."

The contacts of the valveholders are numbered systematically as follows :—

The first figure indicates the valveholder, the second as follows :—

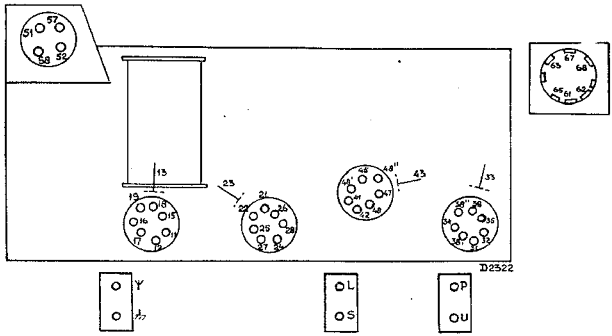
1 & 2 = filament (heaters).
3 = control grid.
4 = metallising (if connected to separate contact).
5 = cathode.
6 = extra grid.
7 = screen grid.
8 = anode.
9 = extra grid (e.g., of octode).

It will be seen from the test table that the numbers are grouped according to the resistance or capacity values, e.g., all grid circuits 13, 23, 33, etc., are tested in position 9 ; on the other hand all filament and cathode connections having very low resistance are tested in Position 12. It is necessary for various tests to change the position of the wavelength switch, and this is indicated in the table in the following manner :—

2 X
13.

In testing electrolytic condensers (resistance tests) it will be found that the deflection drops back to a certain value by reason of the fall in the leak current. It may happen that the value found is very much too high, due to the condenser in question being defective ; this may also be due to the receiver not having been used for some time, so that a certain amount of care should be exercised when testing electrolytic condensers.

F 2



RESISTANCES.

12	11 / 12	21″ / 22	31 / 32	41 / 42	2X 13		24	45	34	4X Aerial				U	S	L	P
	5	5	5	5	S 390	G 390	5	5	5	S 130	M 370	L 465	G 500	5	5	35	SML 5
11	18	4X 15		26	28	25	47	48	38′	35							
	390	SML 270	G 460	270	390	270	390	410	460	460							
10	17	16	19	27													
	240	145	240	460													
9	23	48′	48″	43	33	38″	38	P / G									
	70	210	120	170	145	220	390	210									

CAPACITIES.

12	27	18	26	28	25	47	35										
	470	350	300	350	300	420	480										
11	48	15															
	300	310															
10	17	16															
	280	120															
9																	

REPAIRING AND REPLACING COMPONENTS.

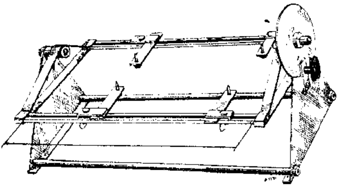


Fig. 9.

During repairs the following points should always be strictly observed :—

1. When completing repairs always restore the wiring and screening to their original positions.
2. Leads must always be at least 3 mm. apart.
3. Washers, spring washers, and insulating material must be replaced exactly as they were before the repairs.
4. Rivets may be replaced by nuts and bolts.
5. If necessary lubricate moving parts with a little pure vaseline.
6. Compounded condensers must always be soldered at least 1 cm. from the compound.
7. Compounded condensers must be suspended free from all other wiring.
8. Resistances must always hang free on account of the heat developed.
9. Condensers of which the outer plate is indicated in the theoretical circuit by a thick line must always be replaced in the same manner. The outer or screened plate is connected to the lead on the **LEFT OF THE PRINTING,** and is situated (in the case of mica condensers) on the **SAME SIDE AS THE PRINTING.** These condensers are marked with a * in the condenser lists.

For most repairs it is not necessary to take the chassis out of the cabinet. The bottom plate can be removed by standing the receiver on its head upon a piece of felt and removing the four screws.
Should it be found necessary to remove the chassis from the cabinet, use can be made of the universal cradle (Fig. 9), a bracket (Fig. 7) being fixed to the chassis over the scale. This enables the chassis to be rotated in the length and to be clamped in any position.

UNCASING.

NEVER LIFT UP THE CHASSIS BY THE COILS.

1. Remove the mains switch by loosening the two screws on the outside of the switch.
2. Unsolder the leads to the speaker.
3. Loosen the bottom screws with a box spanner.
4. Tilt the chassis forward.
5. Remove switch ring from mono-knob (loosen two screws).
6. Loosen the two screws holding the scale to the moulded cap.
7. Take out the six wood screws holding the scale to the cabinet.
8. Remove chassis and scale from cabinet.
9. Hook the scale bracket on to the chassis and push up the scale.
10. Clamp the chassis to the universal cradle.

CHANGING THE SCALE.

Uncasing of the chassis is not necessary.

1. Loosen the two screws holding the scale to the moulded cap.
2. Remove the cap.
3. Loosen the four screws by the glass plate.
4. Slide the glass plate to the left and remove.

When fitting a new glass scale take special care that the rubber bands are fixed in the correct position.

VERNIER UNIT OUT OF ORDER.

A. Brake lining too smooth—reverse the fibre bands.
B. Springs slipped off the fibre bands. In order to prevent this two brackets should be fitted over the springs.
C. Tension of steel springs too low—carefully straighten the springs.

In order to do this it is necessary to :—

REMOVE MONO-KNOB.

1. Loosen scale drive cable.
2. Loosen cables on volume and bandwidth controls.
3. Disengage the condenser driving cord and attach this loosely to the knob.
4. Loosen the screw in the switch spindle.
5. Remove the four long bolts by which the knob is fixed.
6. Dismount the knob.

If, owing to rough usage, the mono-knob lies over to one side and cannot be moved back, this is due to the ball-lever having become disengaged from its holder. In order to repair this the chassis must be uncased and the ball in question bent over slightly towards the chassis, by means of a pair of long-nosed pliers.

BOWDEN CABLES.

These are supplied per metre.

Inner cable is supplied in two types :—

1. Thick (A) for operating potentiometers and coils, and
2. Thin (B) for the pointer drive.

Before cutting the inner cable, tin the cable using acid-free soldering grease and clip in the centre of the tinned part. This prevents unravelling of the wire. Outer cable is cut with a pair of cutting pliers and finished with a file, all burr being removed from the inside.

The Bowden cables must always be handled very carefully, as even a small kink will produce heavy action and backlash.

For the location of the cables, see Fig. 10.

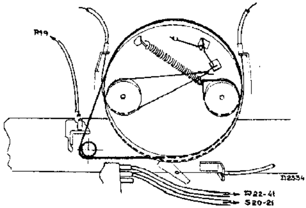


Fig. 10.

COILS AND TRIMMERS.

These are renewed in the following manner :—

1. Unsolder the leads.
2. Slightly bend up the lugs holding the component to the chassis.
3. Lift the coil box perpendicularly from the chassis.
4. Place the new component in position.
5. Press down the lugs with a lever.
6. Solder the electrical connections.

If the chassis lugs are broken off, the coils can be fixed by means of a special repair clamp obtainable from the Service Department.

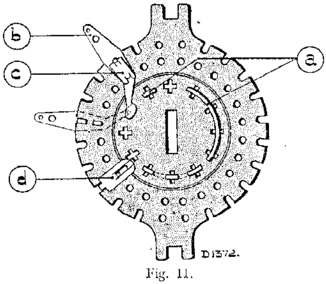


Fig. 11.

DESCRIPTION OF WAVELENGTH SWITCH.

This consists of :—

1. One or more switch units.
2. A stop-plate to determine the positions.
3. Spindles—springs—supports.

The switch unit consists of (see Fig. 11) :
Stator.
Rotor.

(a) Rotor contacts.
(b) Contact springs.
(c) Clips for fixing springs to stator.
(d) Guide plates.

WAVELENGTH SWITCH AS INDICATED IN THE THEORETICAL CIRCUIT.

Contact springs are indicated by circles, open positions on the switch by dots. The outer circles are made up of the contact springs towards the same side as the stop-plate, the inner circles representing the contact springs on the far side of the stop-plate. The rotor contacts are indicated by arcs and radial lines—full lines on the same side as the stop-plate—dotted lines on the remote side. The rotor contacts are provided with lugs which fit into the holes in the rotor, a special pair of pliers with smooth jaws being used to clench the lugs flat.

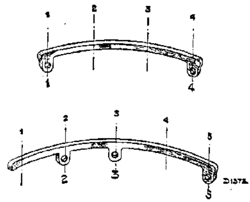


Fig. 12.

INDICATING THE CONTACTS.

Contacts are indicated by means of a code of figures. The first figure gives the number of holes covered, while the following figures indicate the numbers of the holes in which the lugs are located, as seen from the centre of the circle with the lugs pointing downwards and reading from left to right.

The two contacts shown in Fig. 12 would thus be shown by 4.1.4. and 5.2.3.5.

LOUDSPEAKER.

Type 9602.

Before commencing upon loudspeaker repairs it should be definitely established that the fault actually lies in the speaker (try out with other speaker or transformer).

Rattle and resonances can be caused by :—

1. Loose components in the cabinet.
2. Slack leads.
3. Leads too tight.

If repairs are resorted to the following should be observed :—

1. The bench should be quite dust-free.
2. Never dismantle the front and back plates of the magnet.
3. The fault may be caused by :—
A. Dirt in the air-gap.

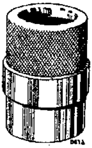


Fig. 13.

B. Distorted or jamming speech coil.

4. As soon as repairs are completed, replace the dust cover.

Four feeler gauges are used for centring the speech coil in the air-gap.

If the speaker chassis or the core of the magnet requires re-centring, use is made of a centring jig (Fig. 13).

When the cone is moved up and down, and held close to the ear, no sound must be audible.

BOTTOM BUSHES.

When the receiver is put into use it should be seen that the screws which are accessible through the fixing bushes at the bottom of the set are loosened one turn. This ensures resilient mounting of the chassis in the cabinet and excludes the possibility of microphonic effect.

During transport, however, these screws must be tight.

INCORRECT WAVELENGTH INDICATION.

If the illuminated arrows on the scale become partially obscure when the switch is rotated from one position to another, the Bowden cable should be inspected for kinks.

LIST OF COMPONENTS AND TOOLS.

When ordering any of these spare parts please state:—

1. Code number of spare part.
2. Type and serial number of receiver.
3. Description of spare parts.

Fig.	Item.	Description.	Code No.
16	1	Cabinet	28.244.310
16	2	Speaker silk	06.600.990
16	3	Escutcheon...	23.684.272
16	4	Station scale	28.709.411
16	5	Trade mark plate ...	28.936.530
16	6	Pointer Assembly ...	25.871.070
16	7	Switch cap ...	28.856.450
16	8	Wavelength switch knob with felt rings	25.871.090
16	9	Monoknob cap assembly ...	25.871.080
16	10	Tuning knob	23.610.830
17	11	Housing for brake...	23.660.271
17	12	Pad for brake	28.478.932
17	13	Four-pin valve holder	28.838.850
17	14	Mains switch	28.650.250
17	15	Voltage plate	28.873.200
17	16	Cap for voltage switch	23.610.210
17	17	Bottom bush	28.725.372
17	18	Threaded bush for fixing chassis	28.146.401
17	19	Cheese-head screw...	28.646.531
17	20	Cover plate for aerial socket	28.313.421
17	21	Lever for Mains aerial switch	28.243.891
18	22	Pin for Mains aerial switch (Hinge)	28.619.621
17	23	Coil cap	28.244.080
17	24	Mains plug ...	08.280.350
17	25	Mains lead ...	33.981.080
17	26	Knurled screw (for contact on backplate)	28.856.570
		Washer (for contact on backplate)	28.924.090
		Screw (for contact on backplate)	28.936.540
		Contact housing assembly (for contact on backplate)	25.871.820
17	27	Valve cap ...	28.838.740
17	28	Backplate ...	28.400.630
17	29	Knurled screw	07.742.000
17	30	Screen box assembly	25.871.830
17	31	Indicator plate with pin and felt strips...	25.871.060
17	32	Pilot lampholder ...	08.515.210
17	33	Plush band (brown)	06.602.770
18	34	Tension spring	28.740.483
18	35	Seven-pin valve holder	28.838.860
18	36	Plug socket plate	28.873.030
	37	Screw for FC4	28.826.400
18	38	Vernier unit	28.882.420
18	39	Flat spring for vernier unit	28.751.811
		Contact 1-1	28.904.161
		Contact 3-2	28.904.211
		Contact 4-2-4	28.904.290
		Contact 4-1-4	28.904.182
		Contact 2-1-2	28.904.142
		Contact 3-2-3 P.U.	28.904.470
		Spring for fixing backplate	28.752.072
		Plate	28.400.400
		Contact spring	28.942.460
		LOUDSPEAKER.	
		Screen cap (chassis)	28.255.330
		Spinning ring	28.445.821
		Paper ring	28.445.390

TABLE OF VOLTAGES AND CURRENTS.

	L1 (FC4)	L2 (VP4B)	L3 (TDD4)	L4 (PEN4DD)	
Va	260	260	75	250	Volts
Vg′	55	150	...	260	Volts
Vg′ 2.3.5	55	—	—	—	Volts
Ia	1—0	8.5	0.7	32.0	Milliamps.
Ig′	g2 = 1.0 ma. g3.5 = 1.2 ma.	3.0	—	4.5	Milliamps.

L7, L8 Dial Lamps ... = 8042.37 Rectifier Valve, type 1821.
L9 Dial Lamp ... ... = 8042.07
Tuning Indicator ... = TV4.
Voltage across C2 ... = 260 v.
Primary Current at 245 v. = 275 ma.

The voltages are measured with voltmeters having a resistance of 2,000 ohms per volt. Moving-coil voltmeters give readings which depend upon the resistance in circuit and the current consumption of the meter itself. The values given above are the mean of several measurements, therefore some readings obtained may differ appreciably, particularly as variations may arise due to the tolerances of the components as well as the valves. Before finally deciding that a valve is defective, it is recommended that a replacement test with the same type of valve is made.

COILS.

Designation.	Resistance in Ohms.	Code No.
S1		
S2		28.534.030
S3		
S4		
S5	300—400 Ohm	28.546.081
S6	125 Ohm	28.570.480
C12	12—170 μμF	
S7	27 Ohm	
S8	110 Ohm	
C13	2, 5—30 μμF	28.571.590
S9	6 Ohm	
S10	23 Ohm	
S11	6 Ohm	
S12	23 Ohm	28.571.600
C15	2, 5—30 μμF	
S14	11 Ohm	
S15	30 Ohm	
C16	2, 5—30 μμF	
C17	2, 5—30 μμF	28.570.500
S16	3.5 Ohm	
S17	8.0 Ohm	
S18	0.75 Ohm	
S19	—	28.587.960
S20	130 Ohm	
S21	130 Ohm	
C22	12—170 μμF	28.570.832
S22	130 Ohm	
S23	90 Ohm	
S24	90 Ohm	28.570.720
C24	12—170 μμF	
S25	150 Ohm	28.587.930
S26	400 Ohm	
S27	0, 6 Ohm	28.530.950
S28		28.220.230
S29	1.5 Ohm	
S30	1.5 Ohm	28.587.710
S31	2.2—2.7 Ohm	28.546.510
S32	3.0 Ohm	
S33	—	28.587.970

CONDENSERS.		
Designation.	Value.	Code No.
C1	32 μF	28.182.40
C2	32 μF	28.182.40 or 28.180.13
C3	50 μF	28.182.32
C4	0.1 μF	28.199.09
C5	32 μF	28.182.40
C6	2 μμF	28.205.88
C8	0.1 μμF	28.201.18*
C9	11—490 μμF	28.212.01
C10	11—490 μμF	
C11	11—490 μμF	
C12	100 μμF	See sh. 12
C13	2.5—30 μμF	See sh. 12
C14	2.5—30 μμF	28.211.32
C15	2.5—30 μμF	See sh. 12
C16	2.5—30 μμF	See sh. 12
C17	2.5—30 μμF	See sh. 12
C18	12—170 μμF	28.211.31
C19	12—170 μμF	28.211.31
C20	2.5—30 μμF	28.211.32
C21	12—170 μμF	28.211.31
C22	12—170 μμF	See sh. 12
C23	12—170 μμF	28.211.31
C24	12—170 μμF	See sh. 12
C25	500 μμF	28.192.50
C26	20 μμF	28.206.37
C27	10 μμF	28.206.34
C28	4 μμF	28.206.53
C29	16,000 μμF	28.201.10
C30	25,000 μμF	28.201.12*
C31	100 μμF	28.206.27
C32	50,000 μμF	28.201.15
C33	500 μμF	28.190.20*
C34	650 μμF	28.192.25
C35	1,375 μμF	28.192.30
C36	0.1 μF	28.201.18
C37	0.1 μF	28.201.18
C38	20 μμF	28.206.37
C39	50,000 μμF	28.201.15
C40	50 μμF	28.206.24
C41	4,000 μμF	28.198.95*
C42	400 μμF	28.190.19*
C43	400 μμF	28.190.19*
C44	100 μμF	28.192.43*
C45	8,000 μμF	28.198.98*
C46	400 μμF	28.190.19
C47	50,000 μμF	28.201.15
C48	2,000 μμF	28.201.48*
C49	50,000 μμF	28.201.15
C51	20,000 μμF	28.201.65

* See page 11.

RESISTANCES.					
Designa-tion.	Value.	Code No.	Designa-tion.	Value.	Code No.
R1	125 Ohm	28.770.81	R20	0.8 M. Ohm	28.773.99
R2	32,000 Ohm	28.773.85	R21	0.16 M. Ohm	28.773.92
R3	25,000 Ohm	28.770.39	R22	0.32 M. Ohm	28.818.21
R4	12,500 Ohm	28.771.01	R23	3,200 Ohm	28.773.75
R5	0.1 M. Ohm	28.773.90	R24	20 Ohm	28.773.53
R6	50,000 Ohm	28.773.87	R25	0.5 M. Ohm	28.773.97
R7	250 Ohm	28.773.64	R27	0.1 M. Ohm	28.773.90
R8	2,500 Ohm	28.773.74	R28	1 M. Ohm	28.770.55
R9	50,000 Ohm	28.773.87	R29	0.4 M. Ohm	28.773.96
R10	0.32 M. Ohm	28.773.95	R30	1,000 Ohm	28.773.70
R12	250 Ohm	28.773.64	R32	50 Ohm	28.773.57
R13	2 M. Ohm	28.771.23	R33	9 M. Ohm	28.771.27
R14	2 M. Ohm	28.771.23			28.771.26
R15	5 M. Ohm	28.771.27	R34	800 Ohm	28.773.69
R16	1.6 M. Ohm	28.770.57	R37	32 Ohm	28.773.55
R17	0.25 M. Ohm	28.773.94	R38	10,000 Ohm	28.773.80
R19	0.35 M. Ohm	28.818.29	R41	200 Ohm	28.818.28
			R42	10,000 Ohm	28.773.80

R42 may be fitted across S17.

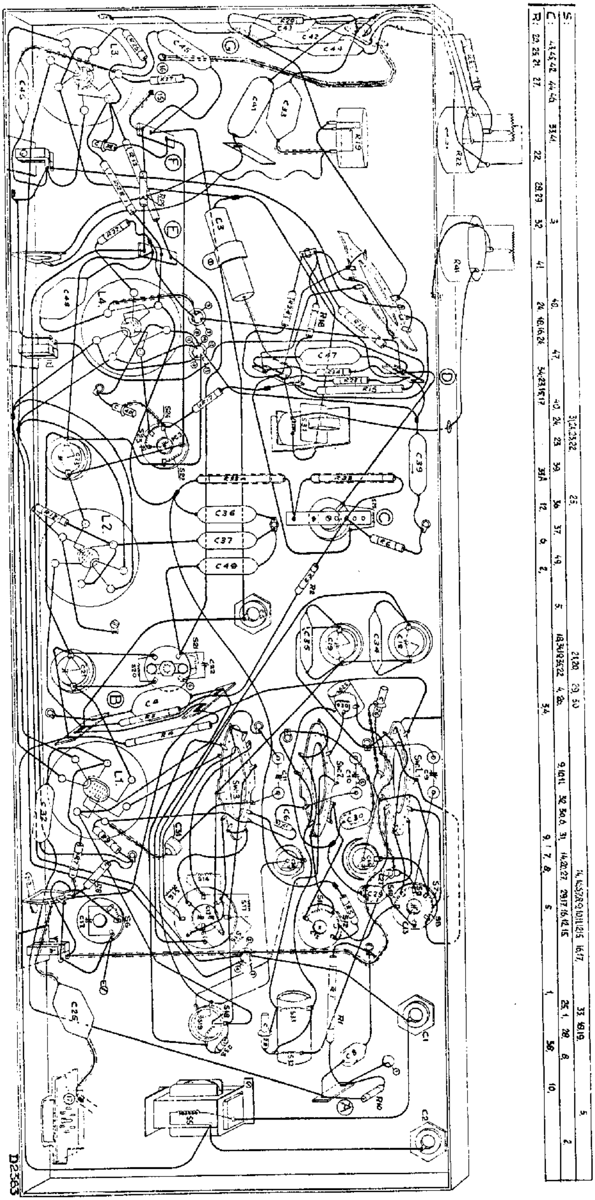


Fig. 14.

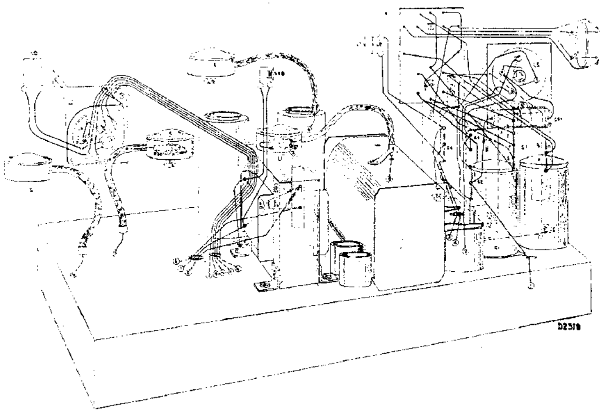


Fig. 15.

TOOLS, TESTING INSTRUMENTS, ETC.

Fig.	Description.	Code No.
1	Service oscillator	G.M.2880F
	Aperiodic amplifier	G.M.2404
5	Universal test prod for connecting auxiliary apparatus	09.991.622
8	Universal testboard	42.56
	Universal and valve testboard	76.29
9	Universal chassis cradle	09.991.380
7	Bracket for fixing scale	09.992.130
	Box spanner for electrolytic condensers	09.991.540
	Box spanner for trimming 8 mm.	09.991.810
	Box spanner for trimming 6 mm.	09.992.040
	Lever for fixing coils	09.991.560
	Trimming screwdriver	09.991.501
4	15° jig	09.991.741
13	Centring jig	09.991.530
	Pertinax feeler gauges	09.990.840
	Box spanner 12 mm. (for bottom screws)...	09.992.110
	Clamp for fixing coils	28.080.870
	Condenser 3,200 $\mu\mu$F	28.199.800
	Resistance 10,000 ohms	28.770.350
	Resistance 25,000 ohms	28.770.390
	Condenser 0.1 μF	28.199.090
	Condenser 25 $\mu\mu$F	28.190.070
	Coil wax S413	02.851.360
	Trimmer Transformer	09.992.220

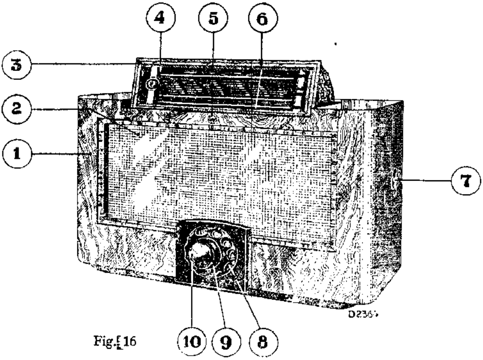


Fig. 16

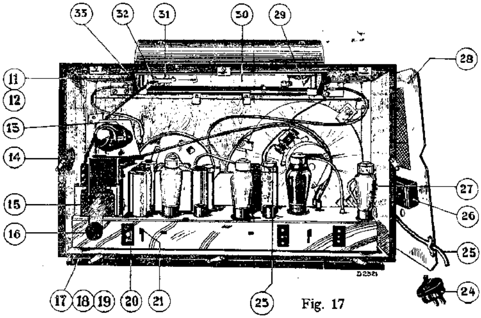


Fig. 17

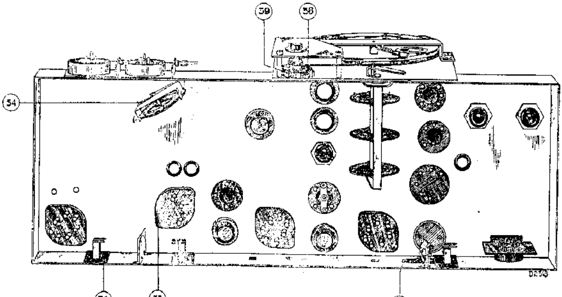


Fig. 18