STRICTLY CONFIDENTIAL

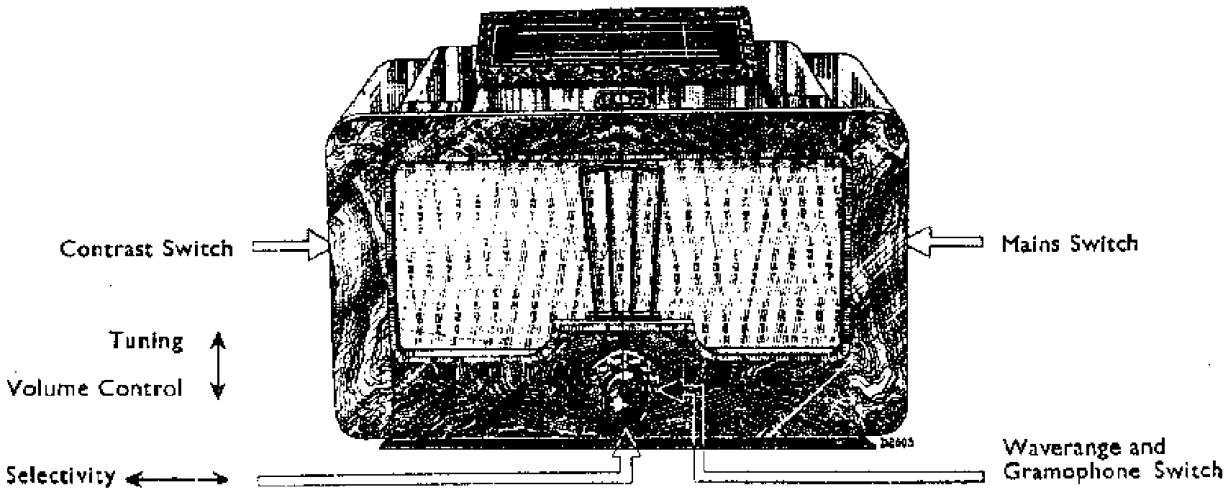
FOR PHILIPS SERVICE DEALERS ONLY

PHILIPS

SERVICE MANUAL

FOR RECEIVER

787AX



For use with A.C. mains.

See note re D.C. mains supply.

GENERAL.

The receiver is of the superheterodyne type, and is equipped with :—

Seven tuned circuits.

Band filter pre-selection.

Triode hexode mixing valve.

Filter to by-pass signals at the image frequency.

Filter to suppress interference at the intermediate frequency.

Audio-frequency whistle filter.

Delayed automatic volume control.

Quality correction (A.F. feed-back), combined with contract expansion.

Monoknob, for the operation of :—

Tuning, rough and vernier adjustment.

Volume control.

Selectivity control, combined with variable tone filter.

Wave range and gramophone switch.

Rising scale, embodying indirectly lighted station scale and pointer.

Wave range and gramophone indicator with lighted arrows.

Visual tuning with tell-tale light which, when scale is closed, indicates whether the set is switched on or off.

Output stage ; 2–9 watt valves in parallel.

Permanent dynamic concert-type loudspeaker with anti-directional cone.

Mains aerial.

Connection for extension loudspeaker ; for low impedance matching.

Connection for gramophone pick-up.

Station corrector.

Safety contact for breaking the current when the backplate is removed.

Tapping plate with automatic voltage indicator on the backplate for voltages 110–245 v., A.C.

Wave ranges :—

Ultra short wave (Television band) : 6—12 m. (50—25 M.C.).

Short waves : 16.5—51 m. (18.2—5.89 M.C.).

Medium waves : 198—585 m. (1,515—513 K.C.).

Long waves : 725—1,975 m. (417—152 K.C.).

Weight : 49 lb.

Dimensions : width, 605 mm. ; height, 400 mm. ; depth, 275 mm.

DESCRIPTION OF CIRCUIT.

Ultra Short Waves.

Dipole coupling coils : S41, S42.

Grid circuit of L1—S40, S41, C6.

Oscillator grid circuit : S21—C7.

Oscillator anode circuit : S20.

Short Waves.

Aerial circuit : S37 inductively coupled with S38.

Grid circuit of L1 : S38–C6, C22.

Oscillator grid circuit : S39–S21–C7, C15 (trimmer).

Oscillator anode circuit : S20.

Medium Waves.

Aerial circuit : S9 coupled inductively and capacitively (C23) to S11.

Bandfilter : 1st circuit : S11–S33–C27–C5, C9 (trimmer), and

2nd circuit : S13–S34–C27–C6, C10 (trimmer).

Oscillator grid circuit : S16-C7, C11 (trimmer), C14–C32 (padding), R7.

Oscillator anode circuit : S18, damping resistance R8.

Long Waves.

Aerial circuit : S9–S10 coupled inductively and capacitively (C23) to S11–S12.

Bandfilter : 1st circuit : S11–S12–C26–C27–C5, C9 (trimmer), and

2nd circuit : S13–S14–C26–C27–C6, C10 (trimmer).

Oscillator grid circuit : S16–S17–C7, C11–C12 (trimmers), C13–C31–C14–C32 (padding).

Oscillator anode circuit : S19, R8.

Remark.—L1 is a triode-hexode. The triode section works as an oscillator and the hexode part as a mixer. C28 is the grid condenser and R7 the grid leak of the oscillator. R57 prevents parasitic oscillation of the hexode the same as R49 in the case of the triode section.

I.F. aerial filter : S8–C21.

Image frequency filter : C24, C8 with the first coil of the bandfilter.

I.F. CIRCUITS.

First Bandfilter.—S22–C16–S23–C17 ; coupling between S22 and S23 is variable

Second Bandfilter.—S24–C18–S35–S25–C19.

Detector Circuit.

First diode-anode of L3, cathode, R13, R12, R11, S35, diode-anode of L3. R14–C38 provide tone compensation for the volume control. The A.F. voltage across R12–R13 is applied to the **A.F. amplifier** via (C60), C42, R16 and the tone filter R17, C43, R18, C49 to the grid of L4 ; the amplified A.F. voltage across R26 is applied via C50, R31 and R30–R52 to the grids of L5 and L11. The anodes of these two valves are coupled to the loudspeaker via S29 and S30. R30–R52 and R35–R55 prevent parasitic oscillation in L5 and L11.

Gramophone Reproduction.

The voltage of the gramophone pick-up is fed direct to the grid of L3 and the amplified A.F. voltage across R47 is applied to R12–R13 via C58 ; see also " A.F. amplifier."

Visual Tuning Lamp.

When the receiver is tuned, the direct voltage, across R28 of the potentiometer R21–R28, is impressed upon the triode section of L6. In this way the anode current (current across R4), i.e., the voltage drop across R4, decreases. The deflector plates in the tuning indicator, which are connected to this anode, then receive a higher voltage, thus reducing the screen action and causing the light bands to increase in size.

Automatic Volume Control.

Automatic volume control is supplied by the diode portion of the valve L4. The second diode-anode receives I.F. voltage via C46, thus producing across R29 a direct voltage which is in proportion to the signal strength. The first diode provides the delay in the control voltage. R27 and the internal resistance of the first diode of L4, form a potentiometer in parallel with R29. The direct voltage across the internal resistance is the control voltage of the first two valves. Without signals the first diode-anode is positive by reason of R25 ; on a small signal this voltage is reduced by part of the voltage across R29 (via R27). This reduction is very small, however, as, when the diode-anode is positive, the anode to cathode resistance is very small in respect of R27, but on a large signal the drop is so great that the first diode anode of L4 becomes negative in respect of its cathode. The anode to cathode resistance is then high as compared with R27 and practically the whole of the control voltage across R29 is fed via R10–C37 and R5 to the grid of L1 and also via R3–C35 to the grid of L2. In the ultra short waves the automatic volume control operates only on valve L2.

Quality Correction and Contrast Expansion.

A part of the A.F. voltage across S30 is fed via R56, R54, R22, S28 back to the grid of L4, this produces so-called A.F. reaction, which enables the A.F. amplifier to deliver more power with less distortion. As the bias resistance for L3, R44 is not by-passed by a condenser, A.F. feed-back, that is, quality improvement, is also obtained in gramophone reproduction. By pulling forward the switch knob on

the left-hand side of the receiver, L12 is switched in instead of R56, whereby the degree of feed-back becomes inversely proportional to the A.F. signal strength, thus amplifying the contrast between the louder and softer passages.

C57, S43, C67, R46 form the whistle filter.

Switches on the Back.

When the switch in the upper right-hand corner is moved to the right, the speaker is in circuit; when operated to the left the speaker is switched off and R58 placed in circuit. This resistance is required to ensure that the output stage is not left without load if the extension speaker is not used and the set speaker is switched off.

The lower right-hand switch is the station corrector. Normally the switch lever points upwards, that is to say, C60 is short-circuited. Should a station produce a troublesome hum or if the reproduction of speech is dull, this is corrected by depressing the switch, thus coupling C60 in series with C42 and reducing amplification of the lower frequencies. The mains aerial switch is in the left-hand bottom corner. When the switch is pointing downwards the receiver is set for use on ordinary outdoor aerial, whilst when the switch is turned up the aerial terminal is connected to the mains via C41, the aerial socket being simultaneously closed.

Note.—When a Philips Converter Unit is fitted—Type 7860 C., 110—145 v., or Type 7861 C., 200—245 v.—the receiver will be suitable for operation on D.C. supplies.

Power Supply.

Mains transformer: S1, S2, S3, S4.

Ripple condenser: C59.

Rectifier valve: L9.

Smoothing filter: C1, S6, C2.

De-coupling of anode of hexode part of L1: R50, C61.

De-coupling screen grids L1: R1, R37, R51, C63.

De-coupling anode of triode portion of L1: R1, R37, C34 (for ultra short waves, also C65).

De-coupling screen grid L2: anode L4 and anode of L3 when on gramophone; R1, C53.

Feeding of anodes L2, L5, L6, L11 and screen grids of L5 and L11 direct from C2.

Grid bias L1: R35, R42, C30 and specially for ultra short waves, C66.

Grid bias L2: R9, C36.

Grid bias L3: (on gramophone only), R44.

Grid bias L4: R46, R22, S28, R23, C3.

Grid bias L5: R32, C4.

Grid bias L6: R53, C64.

TRIMMING THE RECEIVER.

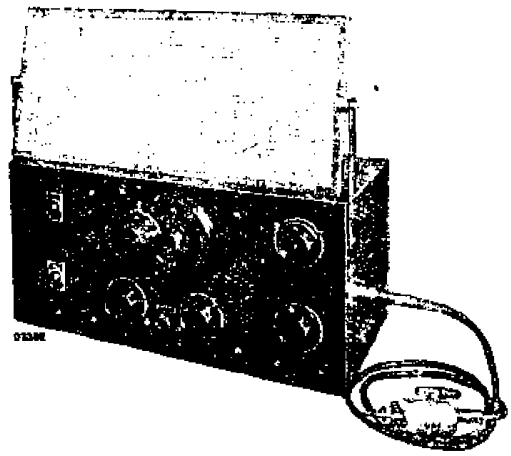


Fig. 1.

The chassis need not be taken from the cabinet for trimming; by placing the cabinet on its left-hand side upon a piece of felt (watch contrast switch moulding), and removing back and bottom plates, all the trimming points are rendered accessible.

The set must be re-trimmed—

1. When the coils or condensers in the I.F. or R.F. sections are changed.
2. If the receiver is not sufficiently sensitive or selective (see page 8).

The following equipment is required for trimming—

1. Service oscillator GM2880F (Fig. 1).
2. Output indicator: universal testboard 4256 or 7629.
3. Aperiodic amplifier GM2404 or an auxiliary receiver.
4. 15° jig for alignment of the condenser setting with the scale.
5. Insulated trimming keys 6 mm.
6. Insulated trimming keys 8 mm.
7. Insulated screwdriver.
8. Wax for locking trimmers.
9. 25 $\mu\mu$F condenser.
10. 25,000 ohms resistance.
11. 32,000 $\mu\mu$F condenser.
12. 0.1 μF condenser.
13. Trimming transformer.

The following artificial aerials are used :—

1. For I.F.; 32,000 $\mu\mu$F condenser.
2. For medium waves or long waves: standard artificial aerial (supplied with oscillator).
3. For short waves: short wave artificial aerial, i.e., standard artificial aerial, with red spot (supplied with oscillator).

ALWAYS TRIM RECEIVER WITH ITS OWN VALVES. AVOID SHORT CIRCUIT BETWEEN ANODE OF L1 OR L2 AND CHASSIS, AS THIS RESULTS IN BURNING OUT OF S22 OR S24. Before trimming, soften the wax of the trimmers (e.g., with soldering iron).

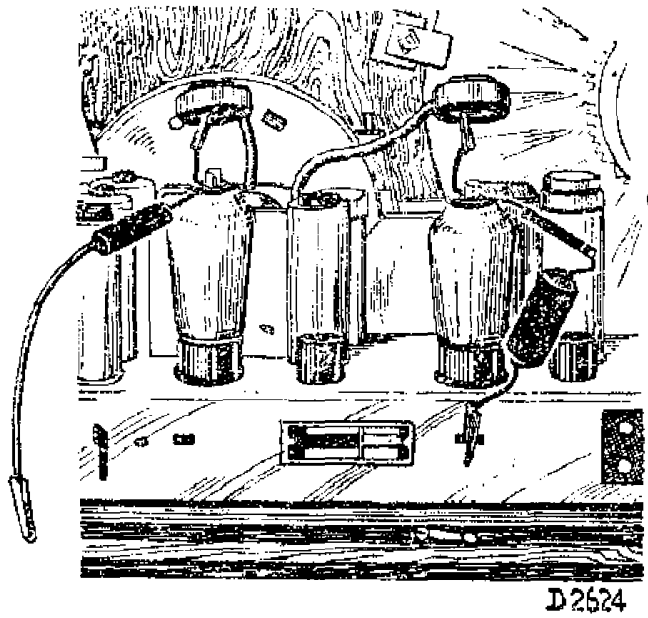


Fig. 2.

A. I.F. Circuits.

1. Earth the receiver.
2. Set wavelength switch to long waves. } 725 m.
3. Set variable condenser to minimum. } approx.
4. Volume control at maximum. } Monoknob. ↗
5. Selectivity at minimum. }
6. Render A.V.C. inoperative by short-circuiting C35 and C37 (see Fig. 3).
7. Connect output indicator to the extension speaker sockets through a trimming transformer.
8. Remove the screen cap from the second I.F. transformer.
9. Shunt S24 with 25,000 ohms resistance (see Fig. 3).

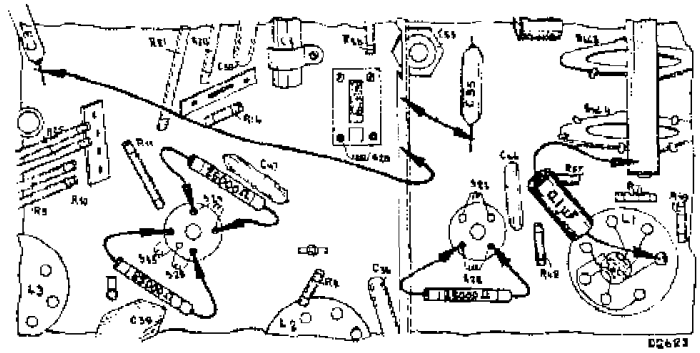


Fig. 3.

10. Apply modulated 128 K.C. signal through 32,000 $\mu\mu$F to the first grid of L1 (Fig. 2).
11. Trim C19 for maximum output (see Fig. 4).
12. Remove damping resistance from S24.
13. Shunt S25–S35 with 25,000 ohms resistance (see Fig. 3).

14. Trim C18 for maximum output.
15. Remove damping resistance from S25-S35.
16. Shunt S24 with 25,000 ohms resistance (see Fig. 3).
17. Trim C19 for maximum output.
18. Remove damping resistance from S24.
19. Shunt S22 with 25,000 ohms resistance (see Fig. 3).
20. Trim C17 for maximum output.
21. Remove damping resistance from S22.
22. Damp S23 by means of a 25,000 ohms resistance in series with 0.1 μF condenser coupled between the first grid of L2 and chassis (see Fig. 2).
23. Trim C16 for maximum output.
24. Remove damping resistance and condenser from grid of L2.
25. Shunt S22 with 25,000 ohms resistance (see Fig. 3).
26. Trim C17 for maximum output.
27. Remove damping resistance from S22.
28. Transfer modulated 128 K.C. signal to aerial-earth socket (not via 32,000 $\mu\mu$F, but through standard artificial aerial).
29. Set variable condenser to maximum (about 2,000 metres).
30. Trim C21 for **minimum** output (make signal very strong).
31. Lock C21, C16, C17, C18 and C19 with wax.
32. Remove short-circuit from C35 and C37.

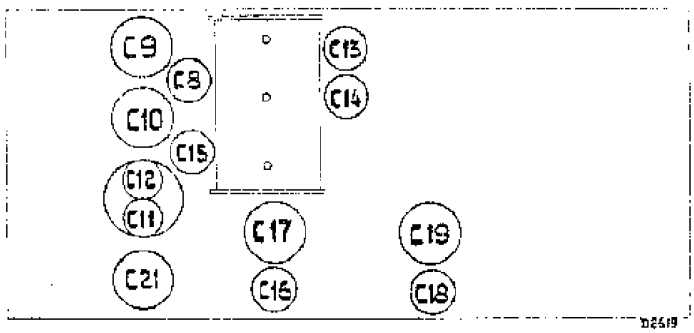


Fig. 4.

B. R.F. and Oscillator Circuits.

I. Medium Wave.

1. Switch receiver to medium waves.
2. Volume control at maximum.
3. Selectivity at maximum.

} Monoknob. ↖

4. Fit 15° jig and set variable condenser to the jig (Fig. 5) (minimum capacity).
5. Apply modulated 1442 K.C. (208 m.) signal via standard artificial aerial to aerial and earth sockets.
6. Trim C9, C10, C11 in that order for maximum output. Lock C9 and C10 and see that output does not alter while wax is setting ; correct if necessary.
7. Earth grid of the triode part of L1 through an 0.1 μF condenser (Fig. 3), and tune on service oscillator to 550 K.C. (545 m.).
8. Connect auxiliary receiver or aperiodic amplifier through 25 $\mu\mu$F condenser to the anode of L1 (through hole in chassis) ; connect output indicator to the auxiliary apparatus and tune the latter to 550 K.C. (545 m.).

Tune variable condenser of the receiver on test to maximum output (centring). This is done in the following manner :—

Set variable condenser as accurately as possible for maximum output, mark the position of the condenser and make a note of the output (setting 1). Rotate the condenser to the left until output is one-third of the value for setting 1, and again mark the condenser setting (setting 2). Turn condenser back (to the right) until output is again one-third of the value for setting 1 and once more mark the setting (setting 3). The correct position is then exactly midway between settings 2 and 3.

9. Disconnect auxiliary apparatus and short-circuiting condenser from the grid of the triode part of L1 and connect output indicator to the receiver to be trimmed.
10. Trim C14 for maximum output.
11. Re-set the service oscillator at 1,442 K.C. and place the variable condenser against 15° jig. Lock C14 and C11 and while wax is setting, re-adjust C11 for maximum output.

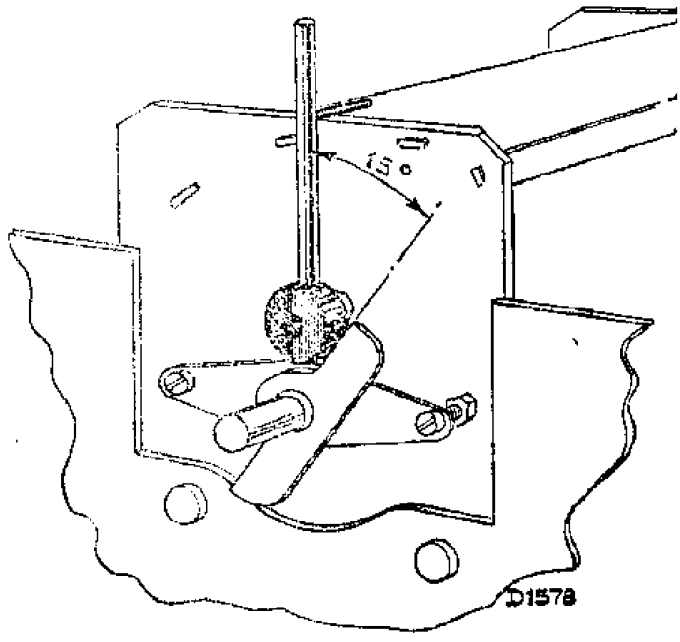


Fig. 5.

II. Long Waves.

1. Switch receiver to long waves.
2. Volume control at maximum.
3. Selectivity at maximum.

} Monoknob. ↖

4. Earth the grid of the triode section of L1 through 0.1 μF condenser (see Fig. 3).
5. Set service oscillator for 395 K.C.
6. Connect auxiliary apparatus via 25 $\mu\mu$F condenser to the anode of L1 ; connect output indicator to the auxiliary apparatus and tune the latter to 395 K.C. (760 m.).

7. Tune the variable condenser of the receiver to be trimmed to maximum output (centring, see above).
8. Disconnect auxiliary receiver and earthing condenser from the grid of the triode part of L1, and reconnect output meter to the receiver being trimmed.
9. Trim C12 for maximum output.
10. Lock C12 and, if necessary, re-adjust while wax is setting.
11. See paragraph 4.
12. Set service oscillator to 160 K.C.
13. As paragraph 6, but adjust auxiliary receiver to 160 K.C. (1,875 m.).
14. Set variable condenser to maximum and then turn it back to the second point for maximum output.
15. See paragraph 8.
16. Trim C13 for maximum output.
17. Lock C13 and, if necessary, re-adjust while wax is setting.

III. Short Waves.

1. Switch receiver to short waves.
2. Set variable condenser to the 15° jig.
3. Set service oscillator to 17.05 M.C.
4. Adjust artificial aerial for short waves (red spot).
5. Tune C15 up to the first point where maximum output is obtained.
6. Lock C15.

Image Frequency Filter.

1. Switch receiver to medium waves.
2. Set service oscillator to 1,000 K.C.
3. Make signal very strong.
4. Adjust receiver to 403 m.; tune for maximum output.
5. Trim C8 for **minimum** output.
6. Lock C8.

D. I.F. Aerial Filter.

1. Switch receiver to long waves.
2. Tune variable condenser to maximum.
3. Adjust service oscillator to 128 K.C.
4. Adjust S8 for **minimum** output (see Fig. 4).
5. Lock S8.

E. Calibration.

The scale is readjusted in the following manner:— Adjust selectivity to maximum; apply signal of 240 m. (1,250 K.C.) through standard artificial aerial and tune receiver to this wavelength.

Set pointer to 240 m. and fix.

Apply 340 m. signal (882 K.C.) and tune to this. Note error.

Apply 510 m. (588 K.C.) signal and tune. Note error.

Adjust the driving bracket in accordance with the attached table, loosening the screws A and B (see Fig. 6) each time.

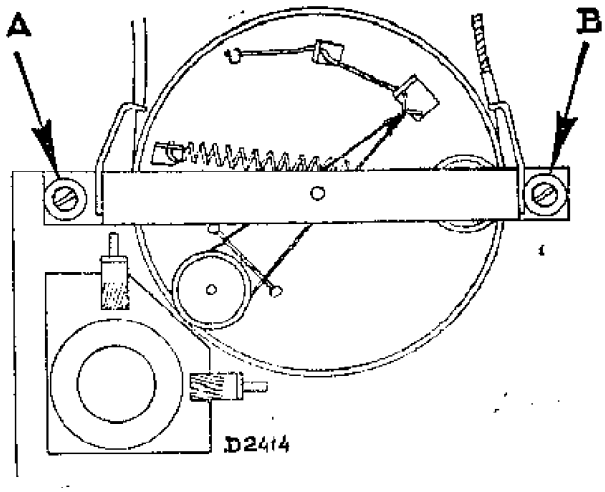
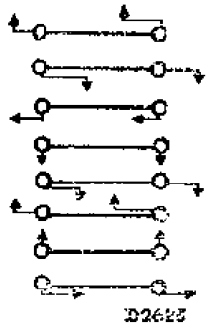


Fig. 6.

After each adjustment tune to 208 m. and, if necessary, re-set the pointer.

In many cases it will be sufficient merely to correct the setting of the pointer, in which case it is not necessary to remove the chassis from the cabinet.



G. Contrast Expansion.

In order to check the action of the contrast expansion, proceed as follows:—

1. Apply a modulated signal (e.g., 300 m.) through the standard artificial aerial and tune to the latter with output meter connected to the set; bandwidth set to minimum (contrast expansion off).
2. Set bandwidth control to maximum and volume control roughly to normal output.
3. Switch in the contrast expansion; the output then becomes smaller.
4. As paragraph 2, but with large output.
5. When the contrast expansion is switched in the output must now increase.
6. If the above results are not obtained, see "fault finding."

FAULT-FINDING.

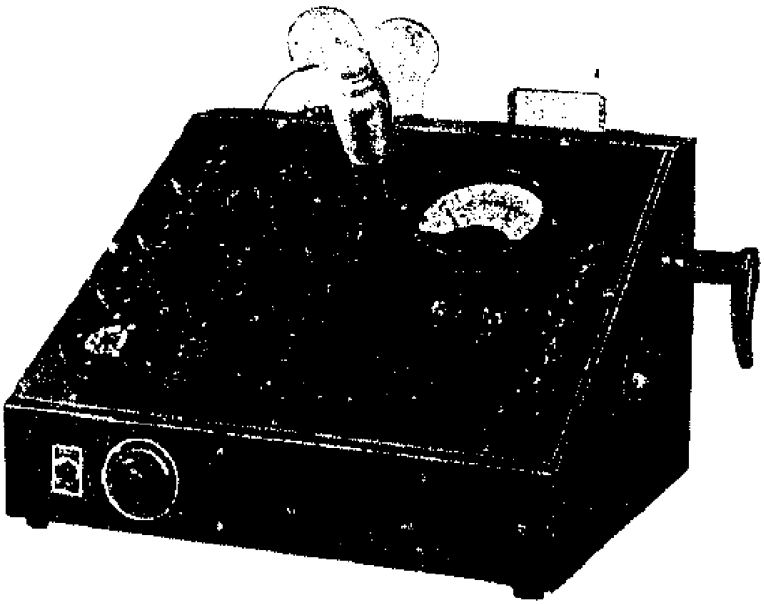


Fig. 7.

For efficient fault-finding it is necessary to use a good measuring instrument, and for this purpose the universal testboard type 4256 or 7629 should be used. It is not necessary to remove the chassis from the receiver in order to localise faults, as all the components are accessible upon placing the receiver on its left-hand side on a piece of felt (remember the contrast switch moulding), and remove the bottom and backplates. No connections must be unsoldered before the fault has been localised by means of measurements on the receiver while working.

Normal values for currents and voltages, as measured with the test apparatus 4265 and 7629, are given in the currents and voltages table on sheet S1.

I. Connect receiver to the correct voltage and test with receivers own valves on an outdoor aerial or service oscillator :—

(a) If the receiver works normally leave it working under observation.

(b) If the receiver works badly or not at all :—

II. Test with a set of valves taken from a good receiver and, if necessary, also with a new speaker.
Defects in the valves or loudspeaker are thus eliminated or localised.

III. Test for gramophone reproduction.

(a) Reproduction satisfactory; defect to be sought in the I.F. or A.F. section (see under V.).

(b) No reproduction; defect in the feed or A.F. section (see under IV).

IV. No radio or gramophone reproduction.

(a) Abnormal voltage across C2 (260 v.).

1. Safety contact, mains switch or tapping plate faulty; measure voltage across S1 (245 v.).
2. S3 defect; measure the voltage at the heater terminals of L7 (4 v.).
3. S2 defective or C59 shorted; measure voltage across both halves of S2 (2 × 280 v.).
4. C1 shorted.
5. S6 open circuit; measure resistance of this coil with receiver switched off.
6. C2 shorted.
7. Short circuit to chassis in the screen box of S24; if this is the case, the D.C. resistance across C2 is very small (no polarity).
8. L4, L5 or L11 giving abnormal currents and voltages (see below).
9. S29 short circuit to chassis or S30.

(b) L5 or L11 giving abnormal currents and voltages.

1. S29, R53, R32, R33, R55 open circuit; C50 short; no anode current or current too low.
2. C4, C64 short; anode current too high.
3. R30, R52, R31 open.

(c) L4 giving abnormal currents and voltages.

1. R1, R26, R46, R22 +S28, R23 open; C53, C56 short; no anode current.
2. C3 short; anode current too high.
3. R18, R17, R16 open.

(d) L3 giving abnormal currents and voltages (gramophone setting only).

1. R47, R44 open; C51 short; no anode current.
2. R43 open, bad contact on switch 4.

(e) L3, L4, L5 and L11 giving normal currents and voltages but no gramophone reproduction.

1. Short circuit in screen grid lead of L3 and L4.
2. Shorted turns in S29 or S30; test by connecting output meter between anode and screen grid of L5.
3. C43, C49, C52 short.
4. R12, R13 open.

V. Gramophone reproduction, but no radio reception.

(a) L2 giving abnormal currents and voltages.

1. S24, R9 open, no anode current.
2. R2, R36, R39, R3, R29 open; C36 short; anode current too high.
3. S23 open.

(b) L1 giving abnormal currents and voltages.

1. S22, R35, R42, R57 open; C34, C37 short. No anode current or current too low.
2. C30 short; anode current too high.
3. R16, R5, R10, R27, R7, R8 open.

(c) L1 and L2 giving normal currents and voltages.

1. No reproduction of 128 K.C. modulated signal applied to the control grid of L2. S25, S35 open. C18, C19; C39 short.
2. No reproduction of modulated 128 K.C. signal applied to the control grid of L1 (first grid of hexode portion). C16, C17 short.
3. Signal as in paragraph 2 received but not an R.F. signal. One of the coils or condensers in the oscillator section short or open. Switch 3 or 4 making bad contact.
4. Reception of modulated R.F. signal as applied to control grid of L1, but not when applied to the aerial socket. One of the coils or condensers in the R.F. bandfilter or aerial circuit short or open. Switch 1 and/or 2 making bad contact.

VI. Quality of radio and gramophone reproduction not good.

(a) A.V.C. not working.

1. R25, R27 open.
2. C35, C37 short.

(b) Visual tuning not working properly.

1. Light bands remain small; R4, R21 open, C47 short.
2. Light bands not wide enough on weaker stations. R25 open.
3. Bands merging; R28 open.

(c) Loud background noise.

Circuits out of alignment; re-trim.

(d) Oscillation.

Screened grid leads on L1, L2, L3 and L4 not making proper contact with chassis; C53, C34 open.

(e) Hum.

1. Various screening not making proper contact with chassis.
2. S6 turns shorting.
3. C1 and/or C2 open.

(f) Distorted reproduction.

Feed-back open-circuited. R22 and S28, R54, R56 of L12 open.

(g) Receiver not selective.

1. Circuits out of alignment; re-trim.
2. I.F. coils shorted; measure resistance.

(h) Microphony.

Retaining screws in the chassis not loosened (unscrew until tight).

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

If a Test Board, type 4256 or 7629, is available, faults can be easily located by following the "point to point" method.

Initially this method corresponds with the instructions given on pages 7 and 8, and a commencement may be made in accordance with paragraphs 1 and 2. Then proceed as follows :—

1. Remove all valves from the receiver. Connect the Universal Test Board and set the latter for resistance testing (position 12). The positive prod on the test lead is extended so that the various contacts of the valveholders can be reached easily, while the other prod is inserted in the earth socket of the receiver.

2. The contacts of valve L7 must be short circuited ; this also protects the meter, as otherwise the smoothing condensers might become charged during testing and the meter would be in danger of burning out.

3. The various resistances between the points indicated in the attached table, and the chassis are measured by touching the contacts in question with the positive prod. The meter deflection is compared with the value given in the table. P indicates that the test must be made between the gramophone pick-up socket and earth. 11/12 signifies that the measurement must be made between points 11 and 12. Differences of 10 per cent. may be met with, but this does not necessarily indicate that the component is faulty.

4. When the resistances have all been measured, the test board is switched over for capacity testing, the various capacities being measured in accordance with the table.

As every circuit in the receiver is tested in this manner, the fault will be ultimately located and the component concerned can then be identified by means of the wiring diagram.

If this fails to reveal the defect it is advisable to repeat the tests mentioned on pages 7 and 8. The valve-holder contacts are numbered systemmatically as follows :—

The first figure indicates the valveholder, the second figure having the following meaning :—

1 & 2 = heaters.
3 = control grid.
4 = contact for metallising (if used).
5 = cathode.
6 = an extra grid.
7 = screen grid.
8 = anode.
9 = extra electrode (e.g., anode of the triode section of the mixing valve).

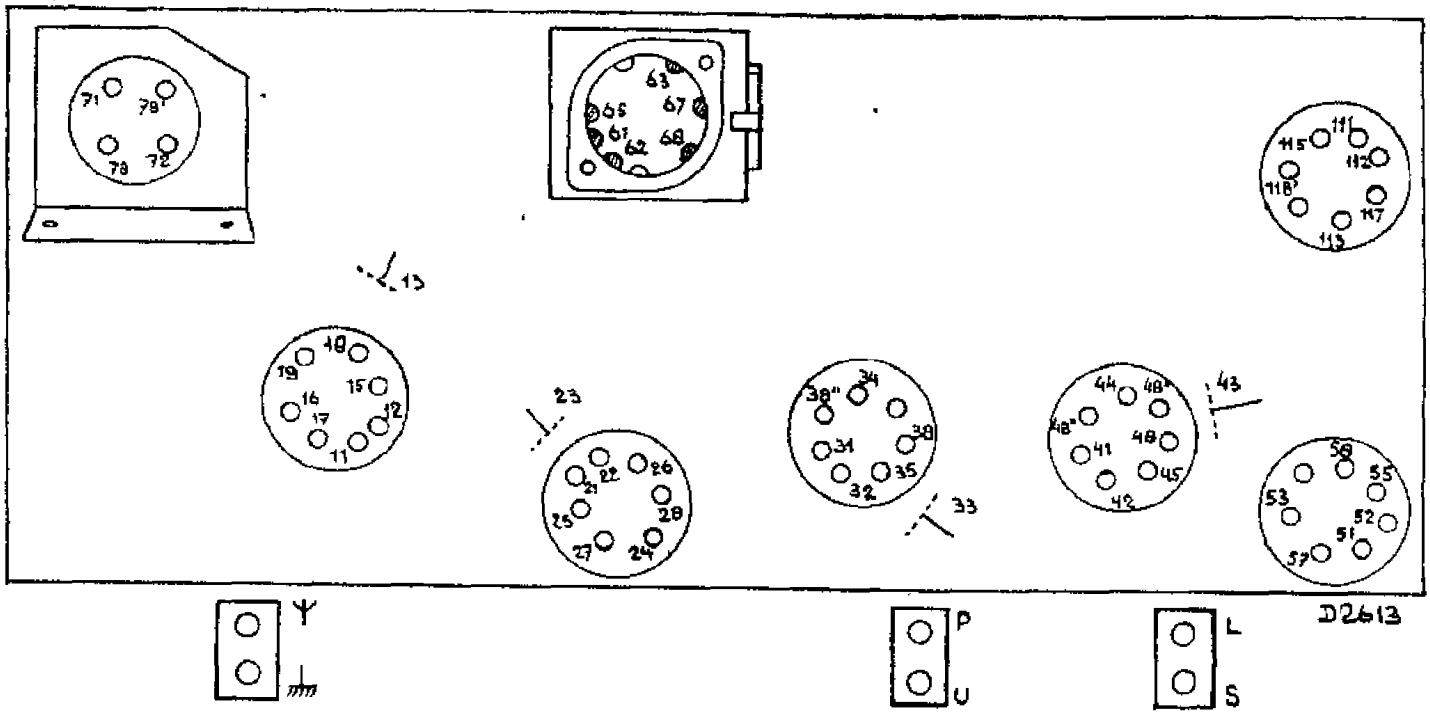
It will be clearly seen from the table that the numbers are grouped according to the value of the resistance (capacity), all grid circuits, 13, 23, 33, etc., being measured in position 9, while all heater and cathode circuits having very low resistance values are measured in position 12.

For several measurements it is necessary to operate the wavelength switch and this is indicated in the test table as :—

A X.
5.

In testing electrolytic condensers it will be found that, due to the drop in leak current, the deflection falls back to a certain value. It may occur that a value obtained is much too high due to the condenser in question being defective, but this may also be due to the receiver having been laid up for some time. When judging the condition of electrolytic condensers, therefore, a certain amount of care must be exercised.

F2



RESISTANCES.

12	11/12	to	111/112		13*	24	34	44	E	A X5				P
	5	5	5		10	5	5	5	5	US 5	S 120	M 370	L 465	G 500	5
11	15*	15†	58	57	55	115	18	25	26	28	45	117	118	78	67
	220	320	370	350	180	180	480	350	360	360	470	360	370	160	320
10	16	17	19	19	27*	35†	35‡	L/S							
	150	410	US.S 400	MLG 420	440	480	420	470							
9	*13‡	13†	23	33	38‡	38″	43	48	48′	48″	53	113	63	68	U‡
	500	70	70	350	350	200	140	390	110	230	250	240	120	85	340

CAPACITIES.

12	48	53												
	360	340												
11	17	23	16	27										
	420	230	120	260										
10	18													
	230													
9	71													
	460													

* U.S.W. † S.M. & L. ‡ Gram.

REPAIRING AND RENEWING COMPONENTS.

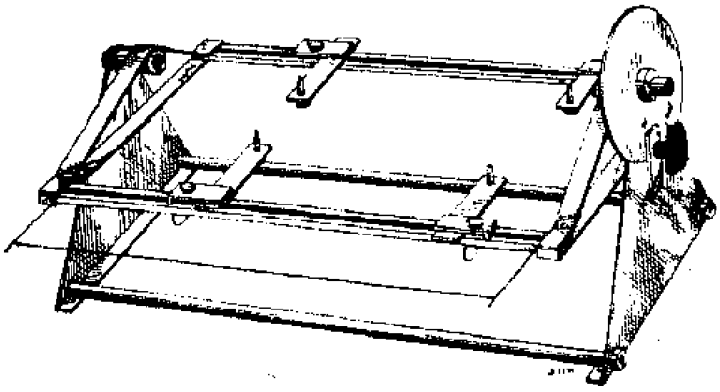


Fig. 8.

When repairs are effected the following must be borne in mind :—

1. After the repairs return all wiring and screening to their original positions.
2. Washers, spring washers and insulating material must be fitted exactly as before repairs.
3. Rivets may be replaced by screws and nuts.
4. Moving parts to be lubricated with a little pure vaseline if necessary.
5. Condensers moulded in compound must be soldered at least 1 cm. from the compound.
6. Compounded condensers must be suspended free from all other wiring.
7. Resistances must always hang free (development of heat).
8. Condensers of which the outer plate is indicated by a thick line in the theoretical circuit, must always be fitted in the same manner as the condensers which they are to replace. The outer plate is always connected to the lead on the left of the printing, and (in the case of mica condensers) on the same side as the printing. These condensrs are marked in the index with a *. See Sheet S1.

For most repairs it is not necessary to uncase the chassis. If the cabinet is placed upside down on a piece of felt and the four screws loosened, the bottom plate can be removed. Should it be necessary to remove the chassis from the receiver, use should be made of the universal cradle, shown in Fig. 8, by means of which it is possible to rotate the chassis along its axis and to fix it in any position.

UNCASING.

NEVER LIFT UP THE CHASSIS BY THE COILS.

1. Remove back and bottom plates.
2. Loosen main switch and contrast switch by taking out the two screws on the outside of the moulding.
3. Unscrew speaker switch.
4. Loosen the lead from the centre speaker terminal to the scale by taking out the wood screw.
5. Unsolder the following leads :—
   (a) The lead to the centre contact of the speaker.
   (b) The lead of the contrast lamp which runs to the speaker switch.
   (c) The leads from the heater terminals of the visual tuning lamp to the pilot light.
6. Remove the bottom screening from the chassis.
7. Take out the visual tuning lamp and place this on the chassis.
8. Remove all valves from the receiver.
9. Remove bottom screws with a box spanner.
10. Slide the chassis forward as far as possible.
11. Detach monoknob (by means of two screws).
12. Place the receiver on two blocks and pull the chassis half way out of the cabinet so that the front of the chassis is accessible through the bottom aperture.
13. Disengage the two cables for the pointer drive and wavelength indicator from the drums.
14. Take the chassis from the cabinet and fix it in the universal cradle.
15. When recasing the chassis, reverse the order of operations.

REMARK.

Never loosen the wood screws H (Fig. 14) to remove the coverstrip from the cabinet as this leaves an unsightly white line at the top of the cabinet.

RENEWING SCALE.

1. Loosen four screws (Fig. 16) at the side of the scale holder (take care not to damage the cabinet) ; in order to remove the short screws from the holes, a magnetic screwdriver should be used (pass the screwdriver two or three times across the speaker magnet), and remove backplate.
2. Close the scale holder and raise the backplate.
3. Loosen the four screws by the glass plate.
4. Slide the glass scale to the left and then take out.

Re-assemble in the reverse order.

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

RENEWING POINTER.

1. The Points 1—4 of " Renewing Scale."
2. Remove damaged pointer and fix a new one in its place.
3. Replace the glass scale (quite straight) and straighten pointer (must pass through 1,050 and 300 m.)
4. Allow glue to dry and then replace the backplate.

RENEWING THE PILOT LIGHTS.

1. As points 1 and 2 of " Renewing Scale."
   All lamps are now easily accessible.

WAVE RANGE INDICATOR SLIDE.
GLASS ROD FOR LIGHTING THE LATTER.
MOULDED ROLLER.
Renewing. (Fig. 16).

1. As paragraph 1 of " Renewing Scale.".
2. Loosen two springs B on the indicator strip and lift up this end of the strip so that the roller and glass rod become accessible.
3. Loosen three screws and take out screw nearest bowden wire.
4. Renew strip, roller or glass rod (check that the indication is correct).

Re-assemble in the reverse order.

(Indicator strip; felt blocks against the screen box; glass plate with plain side towards the screen box.)

RENEWING MOULDED ESCUTCHEON.

1. Remove the switch ring from the monoknob (two screws).
2. Remove bottom and backplates.
3. Take out the bottom screws, place the receiver on two blocks and pull the chassis half out of the cabinet, so that the front of the chassis is accessible through the bottom opening.
4. Disengage the two pointer cables from the drum.
5. Return the chassis to its correct position in the cabinet and temporarily replace two of the bottom screws.
6. Loosen the four screws (Fig. 16) at the side of the moulded scale holder and remove backplate.
7. Dislodge the spring washer E (Fig. 16) with a small screwdriver.
8. Unsolder the leads from the trade mark lamp to the pilot lamp holders and place these in the escutcheon.
9. Loosen the cable of the wavelength indicator and place it in the cabinet.
10. Loosen the pointer driving cable from the pointer; open the eye at one end and pull the whole cable from the escutcheon.
11. Loosen the two bolts F (Fig. 14) on both sides and remove the bushes which serve as hinges.

    The spring lies between two presspahn washers, and the escutcheon is kept in position by a metal ring (G in Fig. 16).
12. Remove the whole assembly from the moulded scale holder and renew the latter.

Re-assemble in the reverse order.

RENEWING THE SCREEN BOX ON THE SCALE.

1. As paragraphs 1 to 11 on " Renewing Moulded Escutcheon."
2. Remove screen box assembly, take off all accessories and renew.

Re-assemble in the reverse order.

VERNIER UNIT NOT WORKING.

A. Brake lining too smooth—reverse the fibre bands.
B. Springs slipped from the drum.
C. Steel springs not offering sufficient pressure—carefully bend springs straight.

In order to do this, it is necessary to remove the monoknob :—

1. Loosen driving cable.
2. Loosen volume and bandwidth control cables.
3. Detach driving cord and make it fast to the knob.
4. Loosen screws in the switch spindle.
5. Take off the four long screws for the fixing of the knob.
6. Remove the knob.

If, due to rough handling, the monoknob is jammed and cannot be pushed back, this is due to the steel ball having left its holder. To repair, pull the chassis half out of the cabinet and bend the ball slightly towards the chassis with a pair of small-nosed pliers.

CONTROL CABLES.

These are supplied per metre.

There are two types of inner cable :—

1. Thick cable (A) for driving potentiometer and coil.
2. Thin cable (B) for driving the pointer.

Before cutting the inner cable, tin the cable with acid-free soldering grease, and then cut in the centre of the tinned part. This prevents unravelling.

Clip outer cable with cutting pliers and trim with file; remove burr from inside. Control cables must always be handled very carefully; even light kinks cause heavy running and backlash.

The arrangement of the cables are shown in Fig. 9.

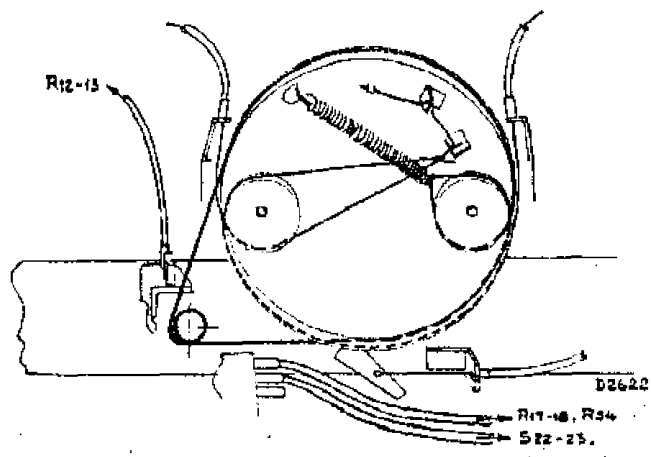


Fig. 9.

RENEWING COILS AND TRIMMERS.

1. Unsolder leads.
2. Slightly open lugs holding the component to the chassis.
3. Lift the coil box vertically from the chassis.
4. Place new coil in position.

5. Press down lugs with lever.
6. Re-solder electrical connections.

If the chassis lugs are broken off, coils can be fixed by means of a repair clip.

DESCRIPTION OF WAVELENGTH SWITCH.

Wavelength switch consists of :—

1. One or more switch units.
2. Stop plate to determine positions.
3. Spindles—springs and supports.

Switch unit comprises (see Fig. 10) :—

Stator.
Rotor.

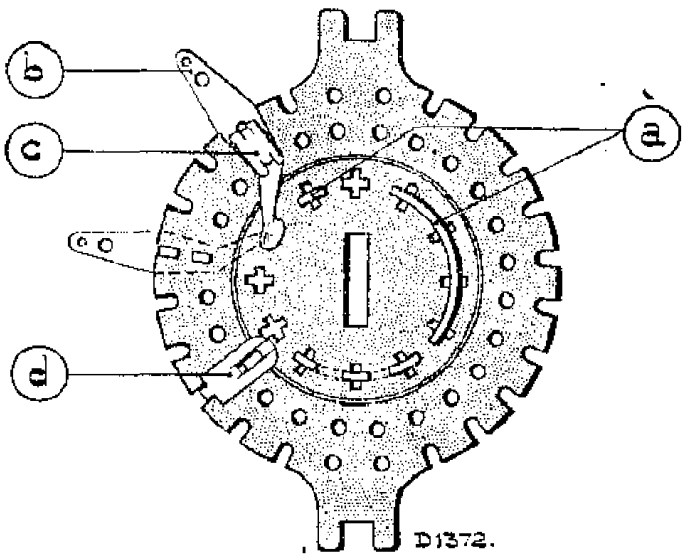


Fig. 10.

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

WAVECHANGE SWITCH IN THE THEORETICAL DIAGRAM.

Contact springs are represented by circles ; open positions on the switch by black dots. The outer ring of circles represent the contact springs on the same side as the stop plate, while the inner circles are the contacts on that side which is remote from the stop plate.

Rotor contacts are indicated by arcs and radial lines —full lines on that side which is towards the stop-plate—dotted lines on the remote side.

The rotor contacts are provided with lugs (which fit into the holes in the rotor), and are fixed to the rotor by pressing the lugs down flat with a pair of smooth-nosed pliers.

CODING OF ROTOR CONTACTS.

Rotor contacts are indicated in accordance with a figure code.

The first figure gives the number of holes covered, while subsequent figures give the numbers of the holes in which the lugs are located, as seen from the centre of the arc, with the lugs downwards, reading from left to right.

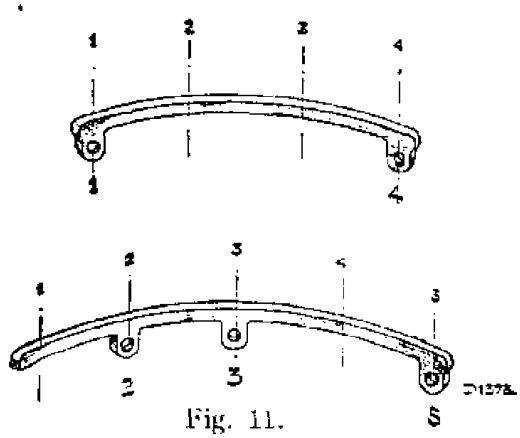


Fig. 11.

The two contacts shown in Fig. 11 are thus indicated by 4.1.4. and 5.2.3.5.

LOUDSPEAKER.

Type 9634.

Before repairs to the loudspeaker are undertaken, it should be definitely ascertained that the speaker is actually at fault (try out with fresh speaker and transformer).

Rattle and resonance may be caused by :—

1. Loose components in the cabinet.
2. Leeds too slack.
3. Leads too taut.

The following should be borne in mind when repairs are carried out :—

1. The bench must be quite dust free.
2. Never remove the front and backplate from the magnet.
3. The fault may be due to :—
   A. Dirt in the air gap.
   B. Speech coil distorted or jammed.
4. Replace the dust cover immediately after repairs.

For centring the speech coil in the air gap, four feeler gauges are used.

If the loudspeaker chassis is to be renewed or the core of the magnet recentred in the air gap, the centring jig (Fig. 12) is used.

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

MICROPHONY AND TRANSPORT SCREWS.

When putting the receiver in to commission care should be taken that the screws which are accessible through

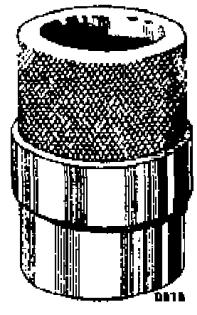


Fig. 12.

the mounting bushes in the bottom of the cabinet, are rotated to the left until tight. This ensures resilient mounting of the chassis and prevents microphony. If the receiver is to be transported, however, these screws must be tightened down.

INCORRECT WAVERANGE INDICATION.

If the arrows on the scale are partly covered up when the switch is rotated from one waverange to another, the control cable should be inspected for kinks.

SAFETY CONTACT.

The safety contact must always be pressed on to the pins **very carefully** and only when it has been ascertained that the pins are exactly in line with the holes in the contact block, as the copper pins are very easily damaged. Should these pins have become bent through rough handling, they may be straightened by a pair of flat pliers (do not bend too much or pins will break off).

LIST OF COMPONENTS AND TOOLS—continued.

Fig.	Pos. (Item).	Description.	Code No.
16	52	Screen box assembly	25.872.340
16	E.	Spring washer	28.451.950
16	53	Cover plate assembly painted moulded colour	28.873.610
16	54	Tension spring for driving drum	28.740.490
15	55	Wire spring for driving drum	28.942.631
11		Contact piece 4-1-4	28.904.182
		Contact piece 1-1	28.904.161
		Contact piece 4-2-4	28.904.290
		Contact piece 5-1-5	28.904.240
		Contact piece 3-2	28.904.211
		Contact piece 2-2	28.904.390
		Contact piece 3-2-3	28.904.400
		Speaker chassis	28.256.080
		Clamping ring for speaker	28.446.750
		Paper ring for loudspeaker	28.445.880
		Anti-directional cone for speaker	23.666.600
		Backplate for rise and fall scale holder	28.873.610

TOOLS.

1		Service oscillator	GM.2880F
		Aperiodic amplifier	GM.2404
7		Universal testboard	7629
8		Universal cradle	09.991.380
		Test prod—universal	23.685.570
		Lever for fixing coils	09.991.560
		Box spanner for electrolytic condenser	09.991.540
		Trimming key, 8 mm.	09.991.810
		Trimming key, 6 mm.	09.992.040
		Trimming transformer	09.992.220
		Trimming screwdriver	09.991.501
5		15° jig	09.991.741
12		Centring jig	09.991.530
		Pertinex feeler gauges	09.990.840
		Box spanner, 12 mm. (for bottom screws)	09.992.110
		Clip for fixing coils	28.080.870
		Condenser 32,000 $\mu\mu$F	28.199.800
		Condenser 0.1 μF	28.199.090
		Condenser 25 $\mu\mu$F	28.190.070
		Resistance 25,000 ohm	28.770.390
		Wax S 413	02.851.360

Components not listed above will be found in the "General Part List."

RESISTANCES.		
Designation.	Value.	Code No.
R1	3,300 †	28.771.000
	‡	28.770.990
R2	2,500 Ohm	28.770.290
R3	1.6 M. Ohm	28.770.570
R4	2 M. Ohm	28.771.230
R5	0.1 M. Ohm	28.773.900
R7	50,000 Ohm	28.773.870
R8	1,000 Ohm	28.773.700
R9	500 Ohm	28.773.670
R10	1 M. Ohm	28.770.550
R11	0.2 M. Ohm	28.770.480
R12	0.28 M. Ohm *	28.818.260
R13	0.07 M. Ohm *	
R14	25,000 Ohm or	28.773.840
	16,000 Ohm	28.773.82
R16	1 M. Ohm	28.770.550
R17	0.3 M. Ohm	28.818.270
R18	1.2 M. Ohm	
R21	5 M. Ohm	28.771.270
R22	10 Ohm	28.773.500
R23	3,200 Ohm	28.773.750
R25	2 × 5 M. Ohm	28.771.270
R26	0.1 M. Ohm	28.770.450
R27	1.25 M. Ohm	28.770.560
R28	1.6 M. Ohm	28.770.570
R29	0.5 M. Ohm	28.773.970
R30	1,000 Ohm	28.773.700

† 2 × 10,000 Ohm.

‡ 8,000 Ohm.

* R13 may have resistance 12,500 ohms (R60) 28.773.810 in parallel.

RESISTANCES.		
Designation.	Value.	Code No.
R31	0.4 M. Ohm	28.770.510
R32	125 Ohm	28.773.610
R33	100 Ohm	28.773.600
R35	160 Ohm	28.773.620
R36	250 Ohm	28.773.640
R37	4,900 Ohm §	28.771.020
	‖	28.771.010
R39	5,000 Ohm	28.770.970
R42	200 Ohm	28.773.630
R43	0.16 M. Ohm	28.770.470
R44	4,000 Ohm	28.770.310
R46	80 Ohm	28.773.590
R47	0.16 M. Ohm	28.770.920
R49	32 Ohm	28.773.550
R50	4,000 Ohm	28.773.760
R51	1,000 Ohm	28.770.250
R52	1,000 Ohm	28.773.700
R53	125 Ohm	28.773.610
R54	3,500 Ohm	28.818.300
R55	100 Ohm	28.773.600
R56	80 Ohm	28.773.590
R57	10 Ohm	28.773.500
R58	10 Ohm (64/3)	28.770.080
R59	5 Ohm (10/2)	28.773.500
R60	12,500 Ohm	28.773.810

§ 2 × 16,000. ‖ 1 × 12,500.

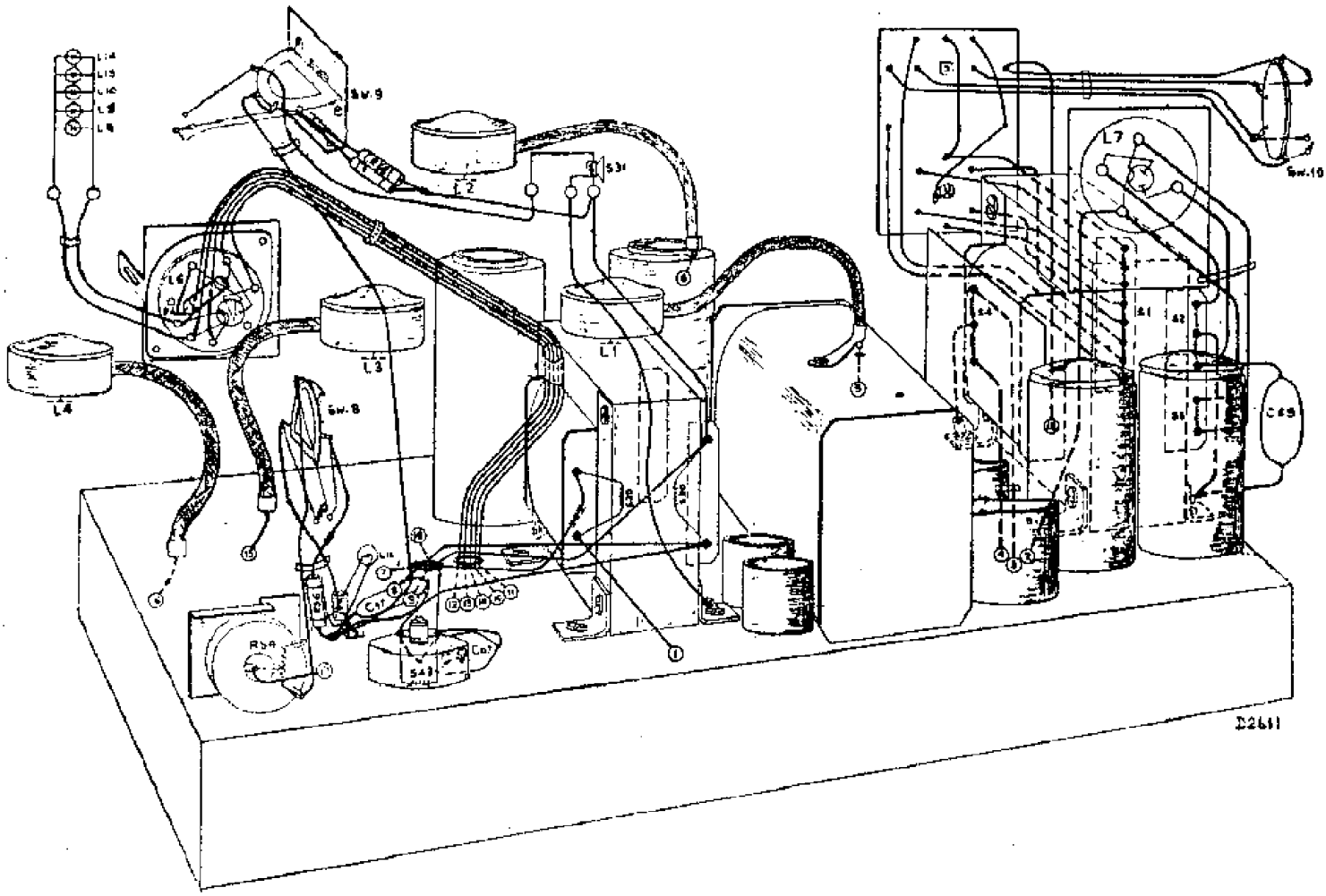
COILS.

Designation.	D.C. Resistance.	Code No.
S1, S2, S3, S4	Mains Transformer	28.535.040
S6	290 Ohm	28.546.061
S8	125 Ohm	28.570.481
C21	12.170 $\mu\mu$F	
S9	27 Ohm	
S10	110 Ohm	
S11	6 Ohm	28.571.590
S12	23 Ohm	
C9	2.5—30 $\mu\mu$F	
S13	4.1 Ohm	
S14	40 Ohm	28.571.600
C10	2.5—30 $\mu\mu$F	
S16	6.5 Ohm	
S17	23 Ohm	
S18	9 Ohm	28.572.160
S19	15 Ohm	
C11	2.5—30 $\mu\mu$F	
C12	2.5—30 $\mu\mu$F	
S20	0.05 Ohm	
S21	.01 Ohm	28.588.020
S39	.01 Ohm	
S22	130 Ohm	
S23	130 Ohm	28.570.834
C17	12.170 $\mu\mu$F	
S24	130 Ohm	
S25	90 Ohm	28.570.720
S35	40 Ohm	
C19	12.170 $\mu\mu$F	
S28	2.0 Ohm	28.546.530
S29	220 Ohm	28.534.320
S30	1.0 Ohm	
S31	4.5 Ohm	28.220.610
S33	1.5 Ohm	28.587.710
S34	1.5 Ohm	
S37	3 Ohm	28.588.330
S38	.05 Ohm	
S40, S41, S42	Very small Resistance	28.588.360
S43	15 Ohm	28.587.141

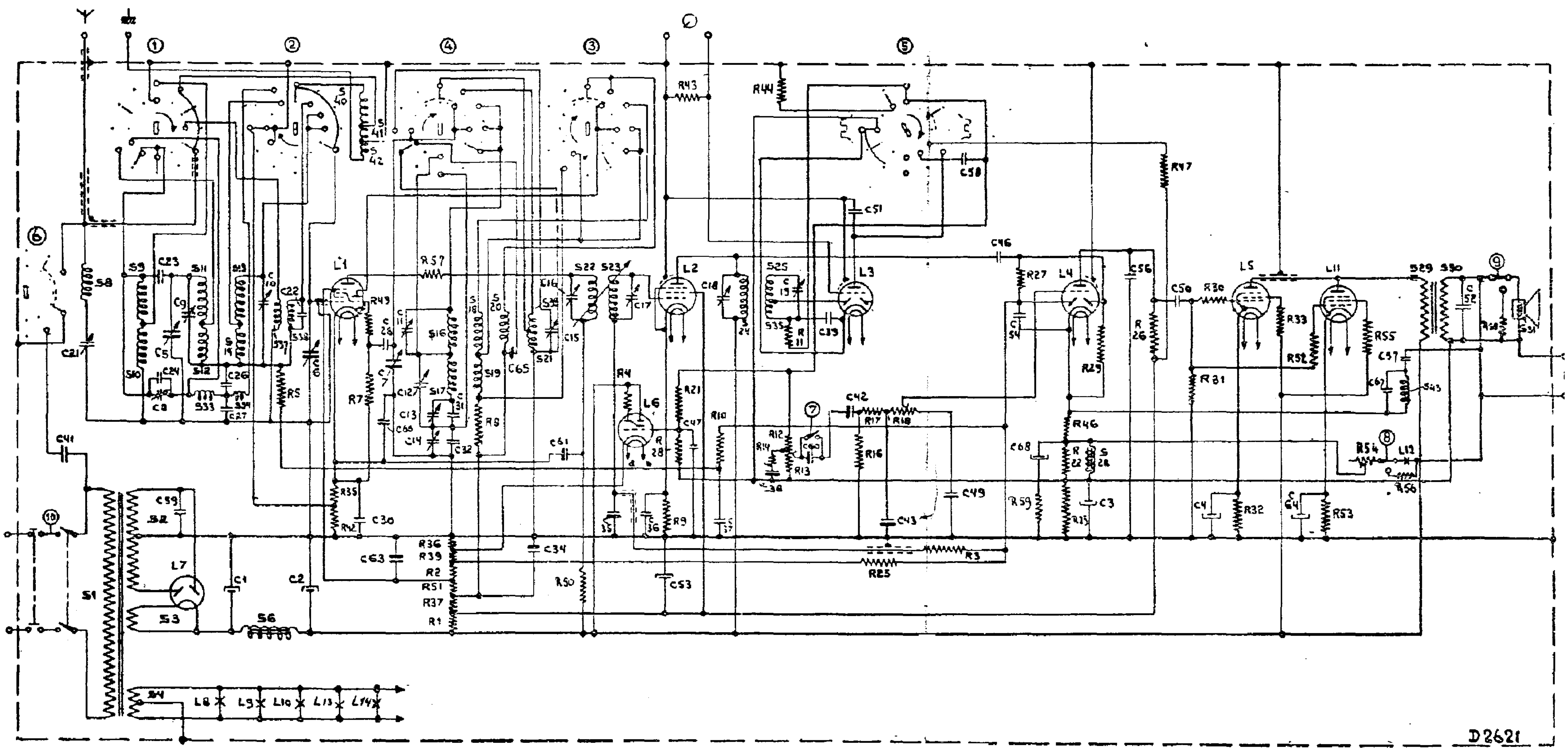
CONDENSERS.

Designation.	Value.	Code No.
C1	32 μF	28.182.400
C2	32 μF	28.182.400
C3	50 μF	28.182.320
C4	12.5 μF	28.182.520
C5	11—490 $\mu\mu$F	
C6	11—490 $\mu\mu$F	28.212.010
C7	11—490 $\mu\mu$F	
C8	2.5—30 $\mu\mu$F	28.211.320
C9 to C12	See Coils	—
C13	12—170 $\mu\mu$F	28.211.310
C14	12—170 $\mu\mu$F	28.211.310
C15	2.5—30 $\mu\mu$F	28.211.320
C16	12—170 $\mu\mu$F	28.211.310
C17	See Coils	—
C18	12—170 $\mu\mu$F	28.211.310
C19	See Coils	—
C21	See Coils	—
C22	10 $\mu\mu$F	28.206.340
C23	10 $\mu\mu$F	28.206.340
C24	20 $\mu\mu$F	28.206.370
C26	12,500 $\mu\mu$F	28.201.090
C27	40,000 $\mu\mu$F	28.201.140
C28	50 $\mu\mu$F	28.206.240
C30	50,000 $\mu\mu$F	28.201.150
C31	650 $\mu\mu$F	28.192.250
C32	1,440 $\mu\mu$F	28.195.060
C34*	50,000 $\mu\mu$F	28.199.060
C35*	0.1 μF	28.201.180
C36	0.1 μF	28.201.180
C37	0.1 μF	28.201.180
C38*	50,000 $\mu\mu$F	28.201.150
C39	100 $\mu\mu$F	28.192.430
C41	500 $\mu\mu$F	28.192.500
C42*	4,000 $\mu\mu$F	28.198.950
C43*	400 $\mu\mu$F	28.190.190
C46	20 $\mu\mu$F	28.206.370
C47	0.1 μF	28.201.180
C49*	100 μF	28.192.430
C50	50,000 μF	28.199.060
C51	200 μF	28.190.160
C52	50,000 μF	28.201.150
C53	32 μF	28.182.400
C54	40,000 $\mu\mu$F	28.199.050
C56	3,200 $\mu\mu$F	28.194.020
C58	20,000 $\mu\mu$F	28.199.020
C59	20,000 $\mu\mu$F	28.201.650
C60*	400 $\mu\mu$F	28.190.190
C61*	50,000 $\mu\mu$F	28.199.060
C63*	50,000 $\mu\mu$F	28.199.060
C64	12.5 μF	28.182.520
C65*	800 $\mu\mu$F	28.190.220
C57	25,000 $\mu\mu$F	28.202.010
C66	800 $\mu\mu$F	28.190.220
C67	8,000 $\mu\mu$F	28.195.750
C68	12.5 μF	28.182.890

* See page 11.


L7
L1
L2
L3
L4
L6
SW.9
SW.8
SW.10
D2611

S:	8, 1.2.3.4. 9.10. 11.12.33.13.14.34.6. 37.38. 40,41,42. 16.17.18.19. 20. 21.39. 22.23. 24.25.35. 28. 43, 29,30. 31.
C:	41.21. 69. 24.8.9.23.5. 26.27.1. 10. 22.6.2.63.30.65.29.7.11.12 13.14.31.32 65. 34.15.16.61. 35. 17.36.53.47.37.18. 38.19.60. 39. 51. 42. 43. 49.58.46. 54. 68. 3. 56. 50. 4. 64. 67. 57 52.
R:	5. 35.42.7.57.49. 36.39.2.51.37.1.8. 50. 4.43. 9.21.28. 10. 44.14.11.12.13. 16.17.25.18. 3. 46. 27. 59. 22.23. 29. 26.47. 31. 30. 32. 33 52. 53. 54. 55. 56. 58.



VALVE VOLTAGES AND CURRENTS.

	L1	L2	L3	L4	L5	L11	
Va	220	220	70	70	220	220	Volts
Vg1	2.5	3.2	2.0	2.0	5.0	5.0	Volts
Vg2	70	160	—	—	210	210	Volts
Voa	75	—	—	—	—	—	Volts
Ia	0.8	5.0	0.5	0.5	45	45	Milliamps.
Ig2	3.3	1.5	—	—	7	7	Milliamps.
Ioa	3.4	—	—	—	—	—	Milliamps.

Readings taken on M.W. band.

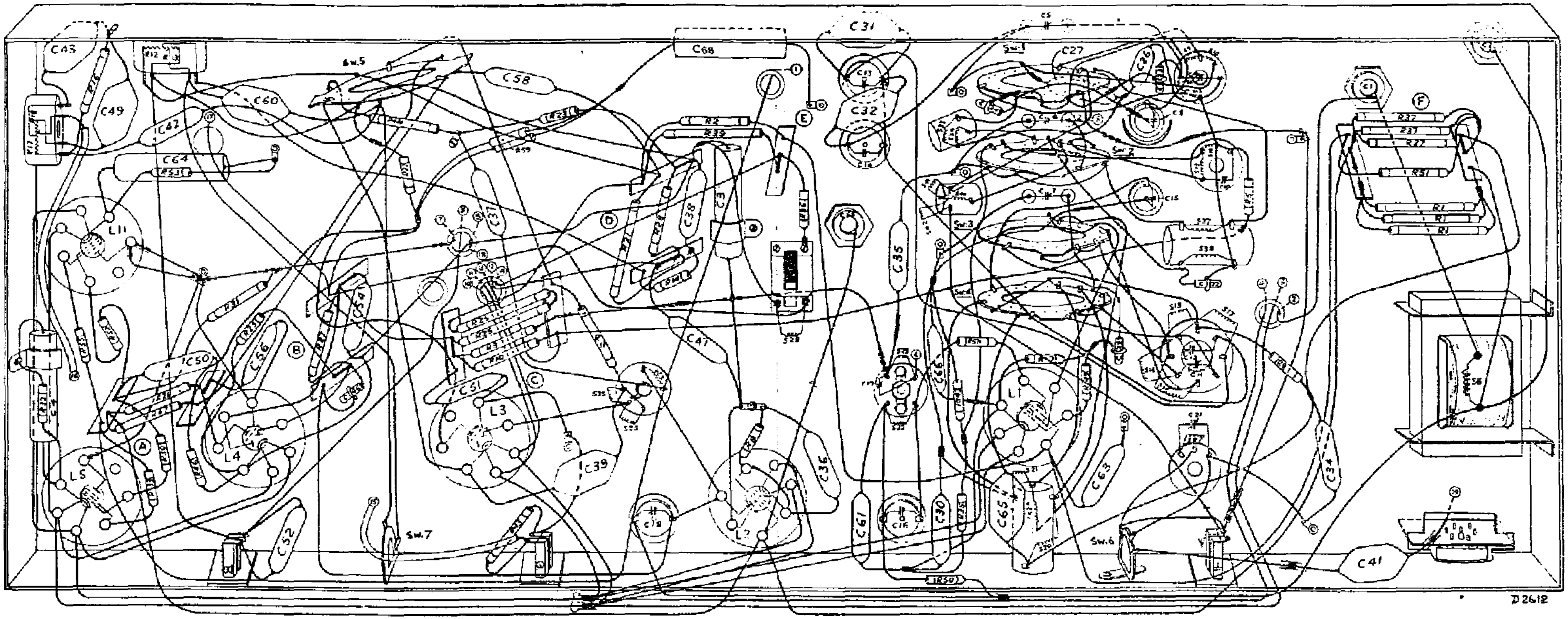
VALVES AND LAMPS.

L1	L2	L3	L4	L5	L6	L7
TH4A	VP4B	TDD4	TDD4	PENA4	TV4	1561
L8 Orange	L9 Orange	L10 Arrow	L11	L12 Contrast Lamp	L13 Pointer	L14 Emblem
8042/37	8042/37	8042/07	PEN A4	7199D	8042/07	8041/07

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 are the mean of several measurements, therefore some readings obtained may differ appreciably, particularly as variations may arise due to the tolerance 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.

S:	24, 25, 35, 28, 22.23, 33, 34, 41, 42, 40, 39, 20, 16, 18, 19, 38, 37, 11, 12, 9, 13, 10, 14, 17, 8, 6.
C:	4, 43, 49, 42, 64, 50, 60, 56, 52, 46, 54, 51, 37, 58, 39, 18, 19, 38, 47, 3, 68, 36, 31, 13, 32, 14, 53, 35, 61, 17, 16, 30, 66, 24, 65, 5, 6, 7, 27, 63, 28, 26, 23, 8, 15, 9, 22, 10, 12, 11, 21, 34, 1, 41, 2
R:	17, 18, 32, 55, 16, 52, 35, 12, 13, 30, 53, 26, 47, 46, 31, 29, 27, 44, 22, 25, 3, 10, 43, 59, 23, 11, 21, 28, 14, 2, 39, 9, 36, 50, 42, 35, 57, 7, 49, 5, 8, 37, 51, 1



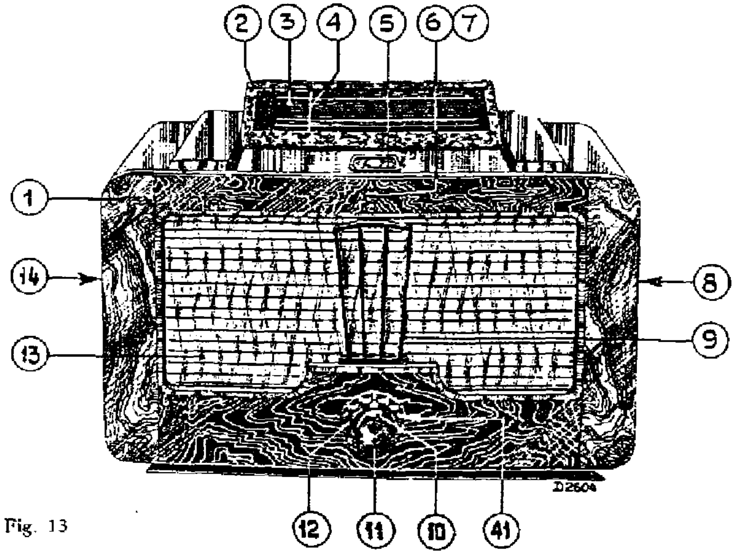


Fig. 13

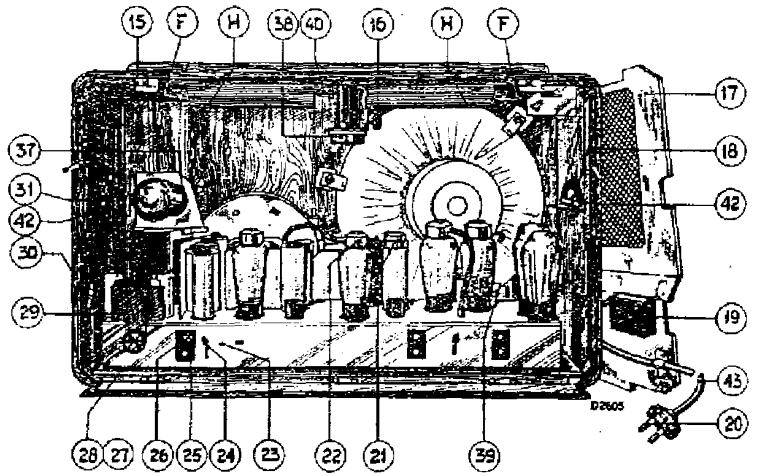


Fig. 14

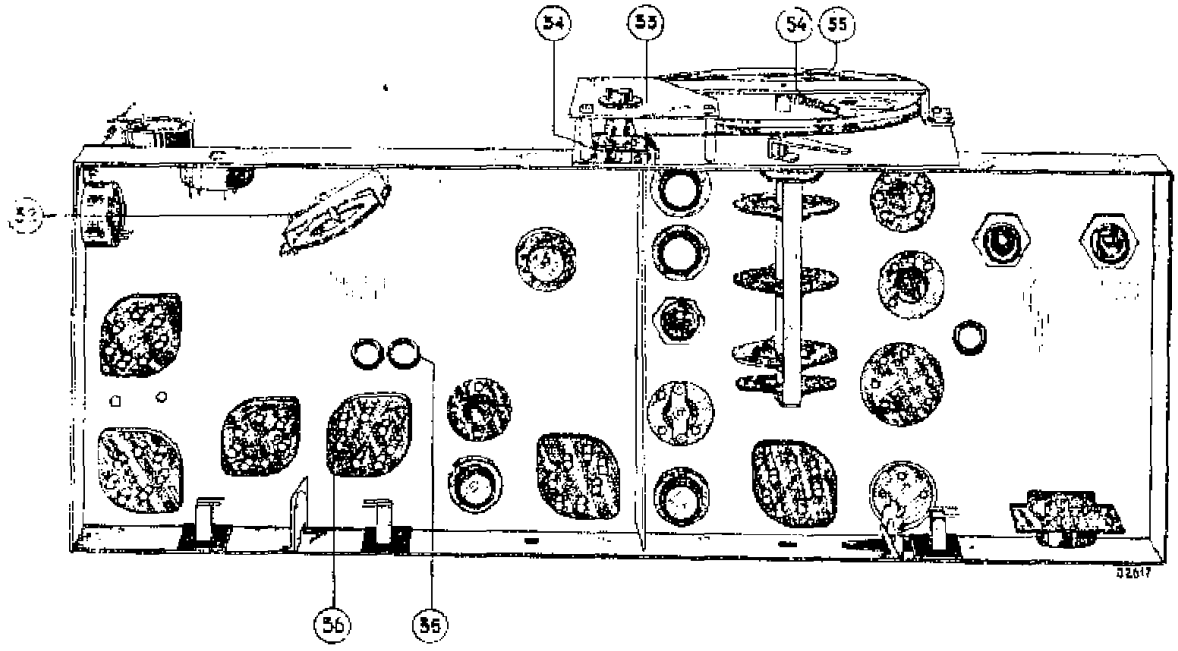


Fig. 15.

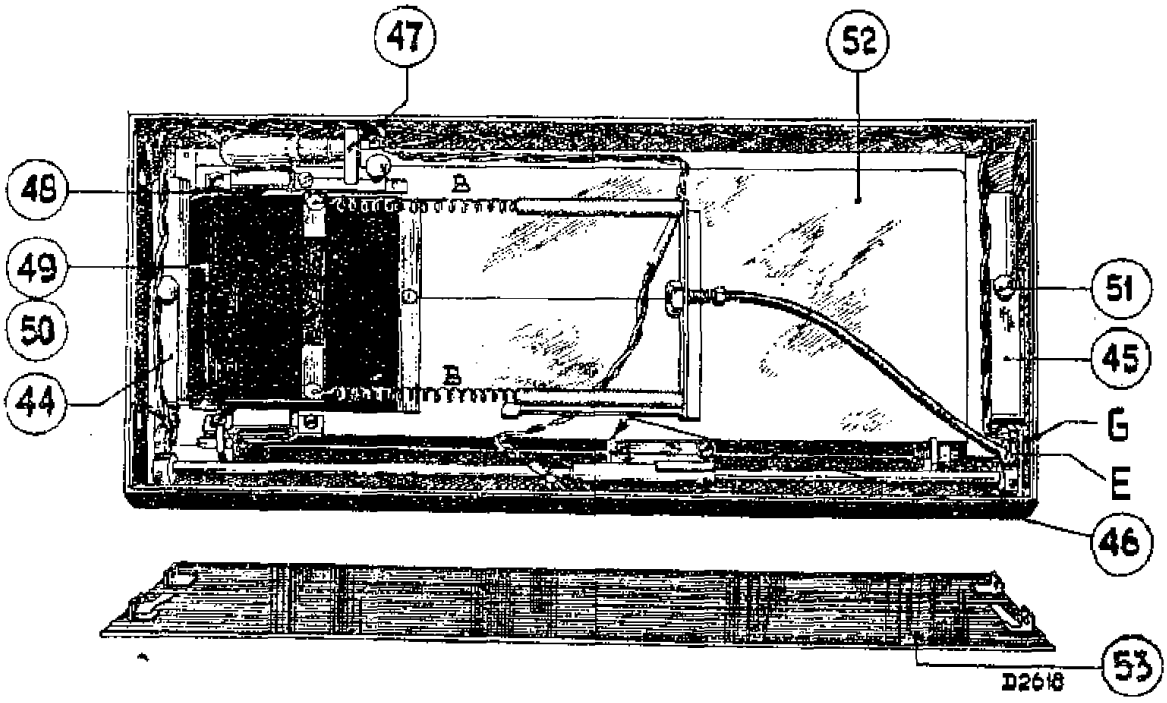


Fig. 16.