

**STRICTLY CONFIDENTIAL**

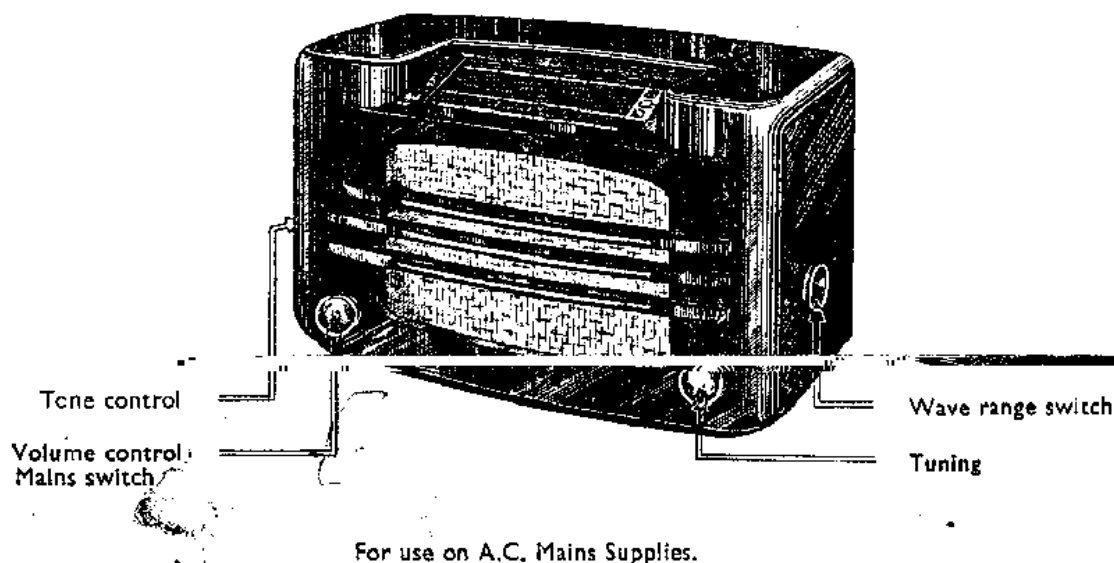
FOR USE OF PHILIPS SERVICE  
DEALERS ONLY

COPYRIGHT 1937

# PHILIPS

## SERVICE MANUAL

### FOR RECEIVER Type 727A

**GENERAL.**

This super heterodyne receiver is equipped with:—  
Seven tuned circuits.

Band-filter pre-selection.

Filter for signals at the image frequency.

Filter for interference at the intermediate frequency.

Delayed A.V.C.

Continuously variable tone control.

Permanent magnet dynamic loudspeaker, type 9636.

Terminals for extension speaker having low impedance speech coil.

Terminals for gramophone pick-up.

Tapping plate with automatic voltage indication on backplate, for voltages 103—253 volts A.C., and safety contact.

Wave ranges: 16.7—51 metres.

198—585 metres.

720—2000 metres.

Net weight, approximately 22 lb. (including valves).

Dimensions: height 12½ in., width 19½ in., depth 7½ in.

**DESCRIPTION OF THE CIRCUIT.**

**I.F. Filter Circuit.**—S5, C13, C37: acts as short-circuit across aerial and earth for I.F. signals.

**R.F. Pre-Selection.—Long Waves:** aerial coil (S6 & S7) inductively coupled to first band-filter coil (S8-S9), trimmer C7, tuning condenser C4. Second band-filter coil (S10-S11), trimmer C8, tuning condenser C5. Band-filter coupling condenser (C14-C15).

**Medium Waves:** aerial coil (S6) inductively coupled to first band-filter coil S8, trimmer C7, tuning condenser C4. Second band-filter coil S10, trimmer C8, tuning condenser C5. Band-filter coupling condenser C15. Band-filter coupling coils S27, S28.

Remark: C10 is the capacitive aerial coupling for long and medium waves.

**Short Waves:** aerial coil S12, inductively coupled to S13, tuning condenser C5, C46.

**Image Frequency Filter.**—C11 with first band-filter circuit.

**Frequency Changer.**—L1; R2 prevents parasitic oscillation; R4 is the grid leak.

**Oscillator Circuit.**—Long Waves : (S14 & S16), inductively coupled to (S15 & S17), trimmer C9, padding condenser (C18 & C19), tuning condenser C6, C41 shorted.

**Medium Waves :** S14 inductively coupled to S15, trimmer C12, padding C18, tuning condenser C6 ; C41 shorted.

**Short Waves :** S18 inductively coupled to S19, tuning condenser C6 ; C41 in circuit.

**I.F. Section** (128 kc/s).—First band-filter S20, S21, C21, C33, C22, C34. I.F. pentode L2. Second band-filter : S22, S23, S23a, C25, C35, C26, C36.

**Detector Circuit.**—First diode L3, S23a, R8, R21, R9 (volume control, also on pick-up), cathode, C29.

**A.V.C.**—Delayed A.V.C. on the control grids of L1 and L2 ; the I.F. voltage across S22, via C28 is rectified by the second diode of L3. When there is no signal on the diode anode, the latter is negative in respect of the cathode (R13, R15) ; on a weak signal there is no voltage across R16. On a sufficiently strong signal, however, the anode becomes positive and a voltage occurs across R16 which is applied to the grids via R14, C23 (for L1 also via R3).

**A.F. Section.**—A.F. valve L3, volume control, also on gramophone pick-up, R9 tone control, also on pick-up, R22, R24, C30. Coupling condenser : C30. Grid leak : R11. Resistance for delay voltage : R15. Grid bias : R13, C3. Coupling between L3 and L4 : R17, R18, C32. Resistance to prevent parasitic oscillation : R19. Negative A.F. back-coupling and grid bias L4 : R20. Speaker transformer S24, S25. Output valve L4. Speech coil S26.

**Gramophone Pick-up.**—When a pick-up is used, the first diode of L3 is quenched by R10 and there is, therefore, no risk of break-through of radio signals.

**Supply.**—Mains transformer S1, S2, S3, S4. Ripple condenser C49\*. Rectifier valve L5 (half-wave). Smoothing filter C1, C2, R1. Anode decoupling L1 : R12, C42. Screen grid decoupling L1, L2 : R5, R6, C20.

Grid bias L1 : R23, C16.

„ „ L2 : R7, C24.

„ „ L3 : R13, C3.

„ „ L4 : R20.

\*Not fitted in some receivers.

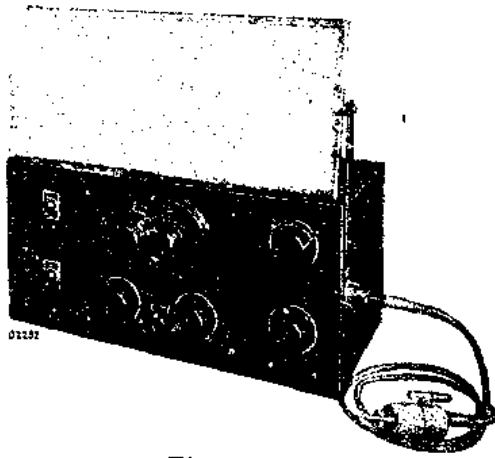


Fig. 1.

### TRIMMING INSTRUCTIONS.

The tuned circuits are provided with trimming condensers so that the sensitivity and selectivity may be adjusted to maximum values. If the receiver is completely out of balance, the **sequence** of the following trimming instructions must be carefully adhered to.

**Note.**—The bottom plate and chassis must be removed from the cabinet. See page 8.

#### Auxiliary Apparatus.

1. Philips' Service Oscillator, type GM2880, with artificial aerial (only the connection **without** the red spot to be used).
2. Output indicator, e.g., Universal Testboard, type 4256 or 7629.
3. 15° jig.
4. Insulated trimming screwdriver.
5. Insulated trimming key, 3 mm.
6. 32,000  $\mu\mu\text{F}$  condenser.
7. Trimming transformer.

#### Wire Trimmers.

Some of the trimmers in this receiver are somewhat different to the usual type, being constructed of a tube of insulating material with a sprayed layer of metal on the inside and covered on the outside with a winding of copper wire. The capacity is adjusted by removing turns of wire.

In trimming, turns are removed until the output indicator which has reached maximum value, drops back slightly. A couple of turns are then replaced and the surplus wire clipped off. The winding is held in place with wax.

#### Trimming.

- N.B. 1. Before commencing trimming melt off the wax on the trimmers concerned by means of a hot soldering iron. After trimming, re-melt the wax and allow to harden.
2. The **volume control** must be **left at maximum value**; volume must be varied by means of the service oscillator only.
  3. Use only the valves belonging to the receiver. If the octode becomes defective during trimming, the R.F. and oscillator circuits must be re-trimmed with the new octode in position.

4. Before trimming, wire trimmers must be replaced by new ones.
5. Connect the output indicator to the extension speaker sockets via trimming transformer.
6. The receiver must be properly earthed.

#### I.F. Bandfilters.

Switch receiver to long waves.

1. Apply a modulated signal of 128 kc/s to the control grid of L2, via 32,000  $\mu\mu\text{F}$  condenser.
2. Adjust C26 and then C25 for maximum output.
3. Apply 128 kc/s modulated signal to control grid (top cap) of L1 via 32,000  $\mu\mu\text{F}$  condenser.
4. Adjust C21 and then C22 for maximum output.

#### R.F. Bandfilter and Oscillator Circuits.

Switch receiver to medium waves.

1. Fit 15° jig (Fig. 2) and rotate the tuning condenser in the direction of 200 metres, until the jig is against the stop.

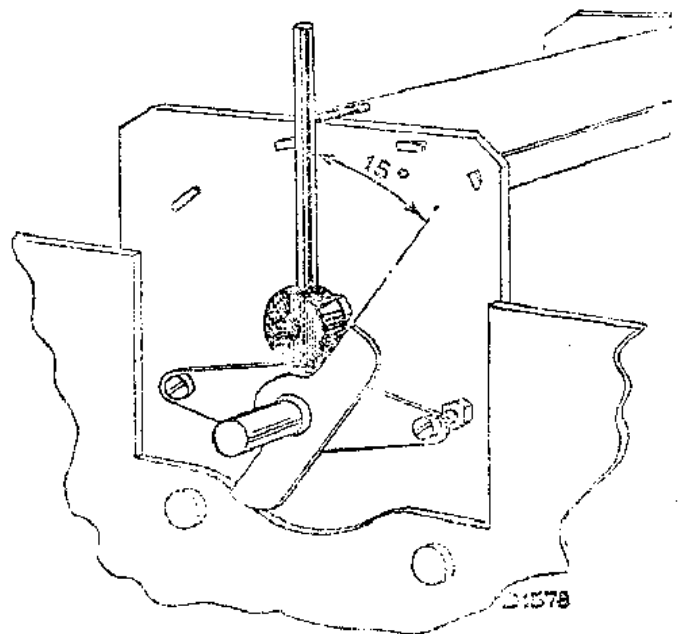


Fig. 2

2. Apply a weak, modulated signal of 1,442 kc/s to the aerial, via artificial aerial.
3. Trim C12, C7 and C8 for maximum output.
4. Repeat the adjustments at No. 3.

#### Switch to long waves.

1. Check that condenser is set to the jig.
2. Adjust service oscillator to 414 kc/s
3. Trim C9 for maximum output.

#### I.F. Filter Circuit.

Switch set to long waves.

1. Tune receiver to 2,000 metres.
2. Apply a strong, modulated signal of 128 kc/s to the aerial socket via artificial aerial.
3. Trim C37 for **minimum** output.

#### Calibration.

If the scale indications are not accurate, proceed as follows:—

Switch receiver to medium waves.

1. Apply 810 kc/s modulated signal via artificial aerial to aerial socket of receiver.
2. Accurately adjust the pointer to 310 metres, using the clamping screw on the driving cable.

## FAULT FINDING.

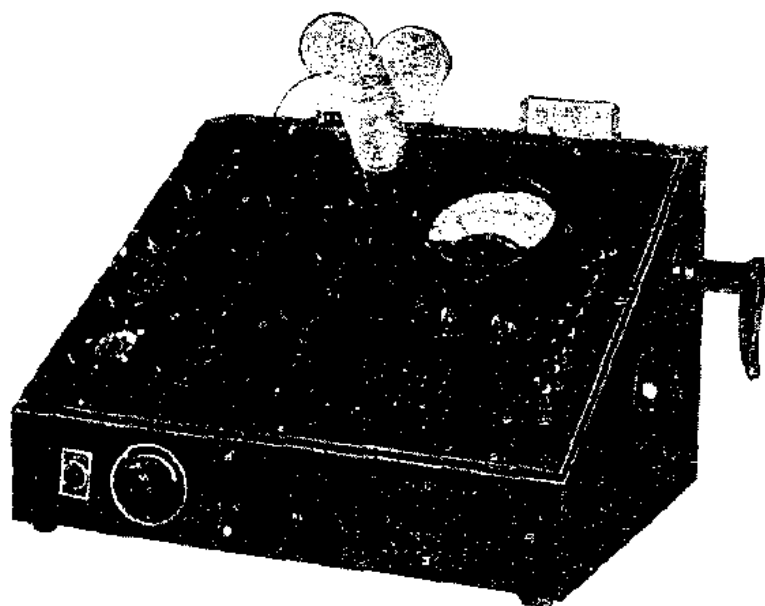


Fig. 3.

Fault finding is greatly facilitated by the use of the Universal Testboard, type 4256 or 7629 (Fig. 3). The type GM.4140 Capacity and Resistance Bridge will also be found useful.

In order to localise a fault, the chassis need not be removed from the cabinet, see page 8.

No leads should be unsoldered before the fault has been localised.

#### Sequence of Operations in Fault Finding.

- I. Place the receiver on the correct voltage and test with its own valves, using an outdoor aerial or service oscillator.
  - a. If the receiver works normally, leave it working for some time under observation.
  - b. If the set works badly or not at all, test as in §II.
- II. Test with a set of valves taken from a good receiver and, if necessary, with a different loudspeaker. Faults in the valves or loudspeaker are then eliminated or localised.
- III. See whether gramophone reproduction is possible.
  - a. If gramophone reproduction is obtained, first look for the fault in the I.F. or R.F. sections (see GENERAL TESTS, §C, D and E).
  - b. If gramophone reproduction is not possible or faulty, first look for the fault in the A.F. section (see GENERAL TESTS, §A and B).
- IV. General tests, i.e., currents and voltages, R.F. and I.F. whistle tests, etc.

#### General Tests.

A. Voltage across C2 abnormal (normal is approximately 230 volts).

1. Mains switch defective, or defective safety contact or tapping plate.
2. Mains transformer defective (measure secondary voltage without rectifier).
3. Open- or short-circuit in heater wiring.
4. Short-circuit between primary and secondary of speaker transformer.

5. Bad contact in valveholder of L5.
6. Short-circuit in, or in connection with, I.F. transformers.
7. C1, C2 short.
8. R1 open-circuit.

#### B. Voltage across C2 normal, but gramophone reproduction absent.

Note.—In every case look for short-circuiting screened leads.

L4 showing abnormal currents and voltages.

1. No anode current : S24, R20 open.
2. Anode current too high : C32 short.
3. R18, R19 open.

L3 showing abnormal currents and voltages.

1. No anode current : R13, R15, R17 open-circuit.
2. Anode current too high : C30, C3 short.
3. No anode current : C38 short.
4. R11 open.

L3 and L4 showing normal currents and voltages.

1. R9, C30, C32 open.
2. Speaker transformer, C29 or C40 short.

#### C. Gramophone but not Radio Reproduction.

L2 showing abnormal currents and voltages.

1. No anode current : S22, R7 open, C20 short.
2. Anode current too high : C24 short.
3. R5, R14, R16, S21 open.

L1 showing abnormal currents and voltages.

1. No anode current : S20, R12, R23 open, C42 short.
2. Anode current too high : C16 short. S15, S17, S19, R2, R3, R4, S10, S11 open.

#### D. All Normal, but no Gramophone Reproduction.

Note.—In each case inspect the contacts of the relative switch.

1. No reproduction of a modulated I.F. signal of 128 kc/s applied to grid of L2 : S22, S23, S23a, C25, C35, C26, C36, C29 short ; C30, R8 open.
2. No reproduction of a modulated, 128 kc/s I.F. signal applied to the control (fourth) grid of L1, but reproduction possible when applied to control grid of L2 : S20, S21, C21, C33, C22, C34 short.
3. No reproduction of modulated R.F. signal applied to fourth grid of L1, but reproduction of I.F. signal applied to this grid : one of the coils or condensers in the oscillator section of L1 open or short.
4. No reproduction of a modulated signal applied to the aerial contact, but reproduction from the fourth grid of L1 : open- or short-circuit in one of the coils or condensers in the aerial or fourth grid circuit of L1.

**E. Radio and Gramophone Reproduction, but with certain faults.**

- a. A.V.C. not working : C28 open.
- b. Receiver oscillating : one of the coupling condensers C2, C20, C42, C23 open.
- c. Receiver hums : C1, C2 open.
- d. Cabinet resonance : This is caused by loose parts, e.g., valve caps, strips or springs. When the resonating part has been located, it may be fixed by means of a piece of felt.
- e. Oscillator working badly or not at all between 17 and 18 metres : renew C20.
- f. Weak signals : out of balance ; re-trim.

## FAULT FINDING ACCORDING TO THE POINT-TO-POINT SYSTEM.

If a Universal Testboard, type 4256 or 6729, is available, fault finding may be greatly simplified by following the "Point-to-Point" system. The first principles of this method correspond to the system given on page —, §I and II, to which reference should be made; further:—

- III. General test in accordance with point-to-point system, i.e., measurement of resistance and capacity between valveholder contacts and connection sockets, both mutually and in respect of the chassis. In this manner the fault and also, with the aid of the theoretical circuit, the faulty component may be traced. If necessary, pages 4 and 5 should also be consulted.

### Point-to-Point Testing.

- a. Remove mains lead from the socket.
- b. Remove all valves and insert in the rectifier holder a valve base having all its contacts shorted.
- c. Connect the Universal Testboard, type 4256 or 7629, to the receiver, and set for resistance testing (position 12). Extend the positive test prod, so that the various valveholder contacts, etc., can be easily reached. Insert the other prod in the earth socket of the receiver.
- d. Measure the resistance between the points given in the "point-to-point" table and the chassis, by touching the points indicated with the positive prod. Compare the meter deflection with the value shown in the table.

Remark.—P indicates test between gramophone pick-up socket and earth, etc.  
11/12 indicates test between points 11 or 12 and earth.

- e. Set the Universal Testboard for capacity testing (position 2). Compare the meter deflections with the values in the table.
- f. Remove the shorting plug when testing the rectifier valveholder contacts.

### Important.

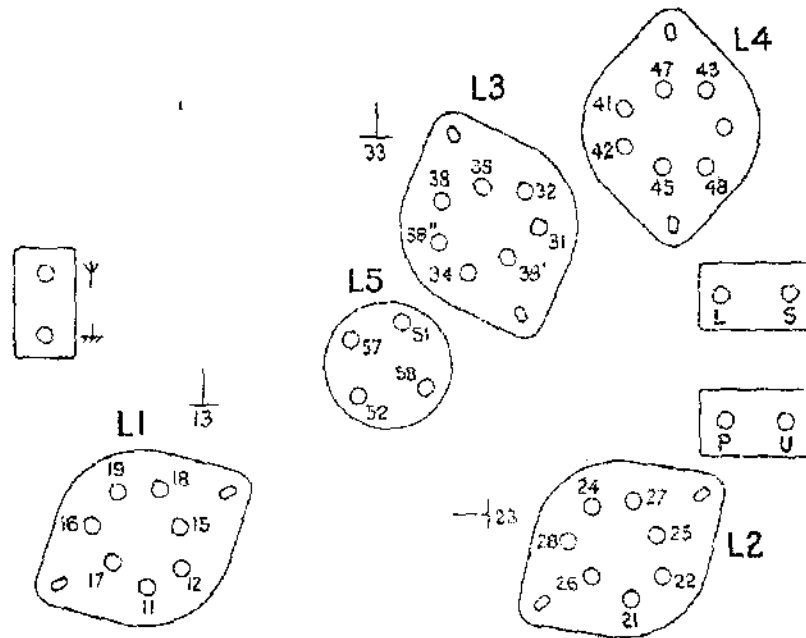
1. Differences of about 10 per cent. may be found between the values as measured and as given in the table, but this does not necessarily mean that the component concerned is defective.
2. When resistance values of electrolytic condensers are measured, it will be found that the leak current, and therefore also the meter deflection, drops back. The value as measured may also be found far too high, due to the condenser being defective, but at the same time a similar result is obtained if the receiver has not been in use for some time.

Care should, therefore, be exercised in judging the condition of electrolytic condensers.

### Numbering of Valveholder Contacts.

The first number of the code indicates the number of the valve in the theoretical circuit; the second figure indicates the following:—

- 1 & 2 = heaters.
- 3 = control grid.
- 4 = contact for metallising.
- 5 = cathode.
- 6 = extra grid (e.g., first octode grid or suppressor of pentode).
- 7 = screen grid.
- 8 = anode.
- 9 = extra grid (e.g., second octode grid).



## RESISTANCES.

12	3X Aerial			11 12	21 22	31 32	41 42	24 34	L	S	P						
	S 95	M 380	L 480	5	5	5	5	5	5	30	315						
11	15 310	13 S 100	25 285	28 455	26 285	45 190	48 400	47 455									
10	18 420	19 240	16 140	17 230	35 390	27 320											
9	13 LM 75	23 80	33 80	38 400	38" 200	38' 225	43 170	U 370									

## CAPACITIES.

12	4X 13			38	38"	43											
	S 500	M 450	L 370	350	125	250											
11	17 280	23 290	27 365														
10	48 330																
9	35 470	45 390	52 465														

## REPAIRING AND REPLACING COMPONENTS.

### General Instructions.

When repairs are being carried out, the following points should always be borne in mind :—

1. After the repairs, replace wiring and screening in original positions.
2. Uninsulated leads must be at least 3 mm. apart.
3. Washers, spring washers and insulating material must be replaced exactly as before the repairs.
4. Rivets may be replaced by screws and nuts.
5. Lubricate moving parts with a small quantity of pure vaseline.
6. Compounded components must not be soldered nearer to the compound than 2 cm.
7. Compounded condensers must be suspended free from other wiring.
8. Resistances must be suspended quite free on all sides (development of heat).
9. A number of condensers are shown in the theoretical circuit by means of one thick and one thin line: the thick line (outer electrode) corresponds to the connecting wire on the left-hand side of the value stamp. When condensers are renewed, the new condenser must be fitted in the same way as the old.

### UNCASING THE CHASSIS.

1. Remove the backplate. Remove the knobs by releasing the screws, access to which can be obtained through the small holes on the underside of the moulding.
2. Slightly loosen the right-hand guide wheel, slide the bracket to the left and lift off the driving cable.
3. Loosen the clamping screw on the pointer.
4. Lay the receiver on its back and remove the four screws holding the wooden board to the chassis.
5. Remove the screws holding the R.F. and A.F. chassis to the cabinet.
6. Unsolder the two earth connections on left- and right-hand chassis.

### COILS AND TRIMMERS.

These are replaced in the following manner :—

1. Unsolder the leads.
2. Bend up the lugs holding the component to the chassis.
3. Lift the coil or trimmer vertically from the chassis.
4. Fit the new component.
5. Press down the lugs with lever.
6. Resolder electrical connections. If the lugs on the chassis are broken off, the component may be mounted by means of repair clips obtainable from the Service Department.

### WAVE-CHANGE SWITCHES.

These consist of :—

1. One or more switch gangs.
2. Stop plate to determine the positions.
3. Spindles, springs and supports.

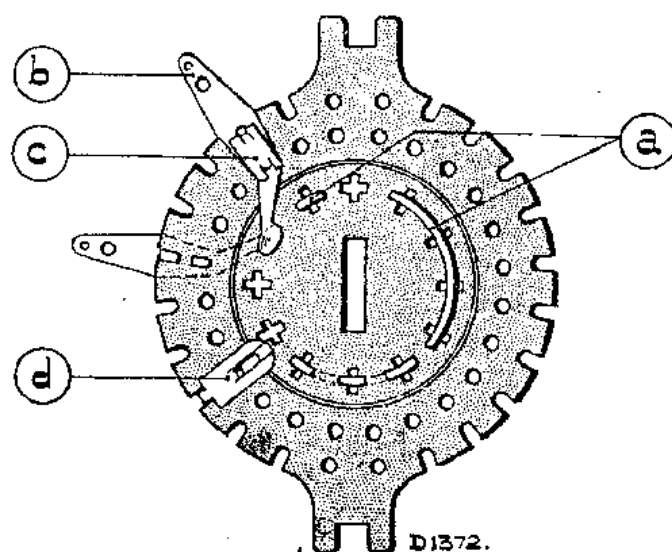


Fig. 4.

The switch gangs comprise a rotor and stator (Fig. 4).

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

### WAVE-CHANGE SWITCHES IN THE THEORETICAL CIRCUIT.

A circle represents a contact spring; open positions on the stator are shown by a black dot. The outside row of circles represents the contact springs on the same side of the switch as the stop plate, the inside row those on the side remote from the stop plate. Rotor contacts are shown by arcs of a circle and radial lines, full on the stop plate side and dotted on the remote side. The rotor contacts are provided with tags which fit into the rotor holes as a means of holding the contacts in position: the tags are pressed flat with a smooth-nosed pair of pliers.

### INDICATION OF ROTOR CONTACTS.

Rotor contacts are indicated by means of a figure code.

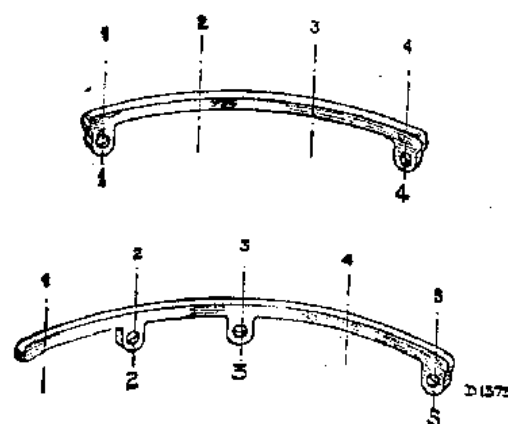


Fig. 5.



The first figure gives the number of holes covered and the following indicate the holes in which the tags appear, as seen from the centre of the arc with the tags downwards, from left to right.

The two contacts shown in Fig. 5 would thus be known as 4.1.4 and 5.2.3.5.

### LOUDSPEAKER.

Before undertaking repairs to the loudspeaker, make quite certain that the speaker is actually faulty (test with other speaker or transformer).

Rattle or resonance can be caused by :—

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

If repairs are found necessary, the following points should be observed :—

1. The bench must not be of iron and must be kept quite dust-free.
2. Never demount the top and bottom discs of the magnet.
3. Faults may be due to :
  - (a) dirt in the air-gap.
  - (b) distorted or jammed speech coil.
4. When repairs are completed, replace the dust cover immediately.

Four feeler gauges are required for centring the speech coil, should the cone require adjustment.

If the chassis required renewing or the core re-centring, a special centring jig is used.

### RENEWING THE STATION SCALE.

The scale can be removed from the cabinet by taking out the four screws holding the diffuser scale and also the screws at the ends of the scale bracket, inside the cabinet. The cursor rod and the clamping screw on the pointer driving cable must also be removed.

### CONTROL CABLES.

Inner cables are supplied in metre lengths, in two types :—

1. Thick (type A) for operating the wave-range indicator.
2. Thin (type B) for operating the pointer.

Before the cable is cut it should be tinned with the aid of acid-free soldering grease ; it is then clipped in the centre of the tinned part. **HANDLE THE CABLES WITH CARE ; EVEN A SMALL KINK WILL CAUSE HEAVY RUNNING AND BACK-LASH.**

Outer cable, also supplied in metre lengths, is cut by means of a pair of pliers, the burr being removed from **inside and outside with a file.**

# LIST OF COMPONENTS AND TOOLS.

When ordering always state :—

1. Code number.
2. Description.
3. Type number of the receiver.

Fig.	Item.	Description.	Code No.
	1	Cabinet (colour 040) ... ..	23.660.308
	2	Speaker silk ... ..	06.600.990
	3	Knob (colour 040) ... ..	23.610.652
	4	Tuning pointer ... ..	28.067.020
	5	Cursor with pointer for scale ... ..	28.896.502
	6	Back plate ... ..	28.400.300
	7	Flat spring for back plate ... ..	28.752.290
	8	Flat spring for back plate ... ..	28.283.480
	9	Flat spring for back plate ... ..	28.752.072
	11	Plug socket plate ... ..	28.873.030
	12	Plug pin plate ... ..	28.869.190
	13	Plate with pins for voltage switch ... ..	28.871.702
	14	Bush for chassis mounting ... ..	28.890.240
	15	Bush ... ..	25.655.951
	16	Tension spring ... ..	28.740.490
	17	Tension spring ... ..	28.740.580
	18	Rubber for fixing scale ... ..	28.451.140
	19	Pilot lamp holder ... ..	08.515.230
		Spindle assembly for potentiometer ... ..	28.880.110
		Spindle for wave-change switch ... ..	28.003.321
		Contact 1—1 ... ..	28.904.161
		Contact 2—2 ... ..	28.904.390
		Contact 3—2 ... ..	28.904.211
		Loudspeaker cone with coil ... ..	28.220.510
		Loudspeaker chassis ... ..	28.256.170
		Spinning ring ... ..	25.871.810
		Paper ring ... ..	28.451.540
		Valve cap ... ..	28.838.740
		Double pole plug ... ..	08.280.400
		Spring for driving drum ... ..	28.942.631
		Plug socket plate ... ..	28.873.710
		Station scale ... ..	28.710.211

Fig.	Item.	Description.	Code No.
		<b>TOOLS, TESTING INSTRUMENTS, ETC.</b>	
		Oscillator type GM.2880F ... ..	CM.2880F
		Universal testboard, type 4256 ... ..	4256
		Universal testboard, type 7629 ... ..	7629
		15° Jig ... ..	09.991.741
		Insulated box spanner ... ..	09.992.210
		Insulated screwdriver ... ..	09.991.501
		Trimming transformer ... ..	—
		Feeler gauges ... ..	09.990.840
		Centring jig ... ..	09.991.530

## COILS.

Designation.	Resistance in Ohms.	Code No.
S1 } S2 } S3 } S4 }	Mains Transformer	28.534.59
S5 } S6 } S7 }	120 Ohm 35 Ohm 100 Ohm	28.587.88
S8 } S9 }	4.5 Ohm 48 Ohm	28.571.59
C7 } S10 }	2.5—30 $\mu\mu\text{F}$ 4.5 Ohm	
S11 } S12 }	48 Ohm 2.2 Ohm	28.571.79
S13 } C8 }	0.05 Ohm 2.5—30 $\mu\mu\text{F}$	
S14 } S15 }	19 Ohm 3.3 Ohm	
S16 } S17 }	40 Ohm 7 Ohm	28.572.54
S18 } S19 }	0.95 Ohm 40 Ohm	
C12 } S20 }	2.5—30 $\mu\mu\text{F}$ 130 Ohm	
S21 } S22 }	130 Ohm 130 Ohm	28.572.06
S23 } S23A }	30 Ohm 109 Ohm	28.571.78
S24 } S25 }	606 Ohm 0.8 Ohm	28.533.72
S27 } S28 }	1.0 Ohm 1.0 Ohm	28.587.69
S26 }	3.6 Ohm	28.860.40

## VALVE VOLTAGES AND CURRENTS.

	L1 (FC4)	L2 (VP4B)	L3 (TDD4)	L4 (PENA4)	
Va	200	200	100	210	Volts
Vgl*	2	1.5	9.5	4.0	Volts
Vg235	70	140	—	200	Volts
Ia	1.8	5	1.0	32	mA.
Ig2	1.2	0.8	—	3	mA.
Ig35	3.2	—	—	—	mA.

Volts across C2 = 200.

\* From cathode to E.

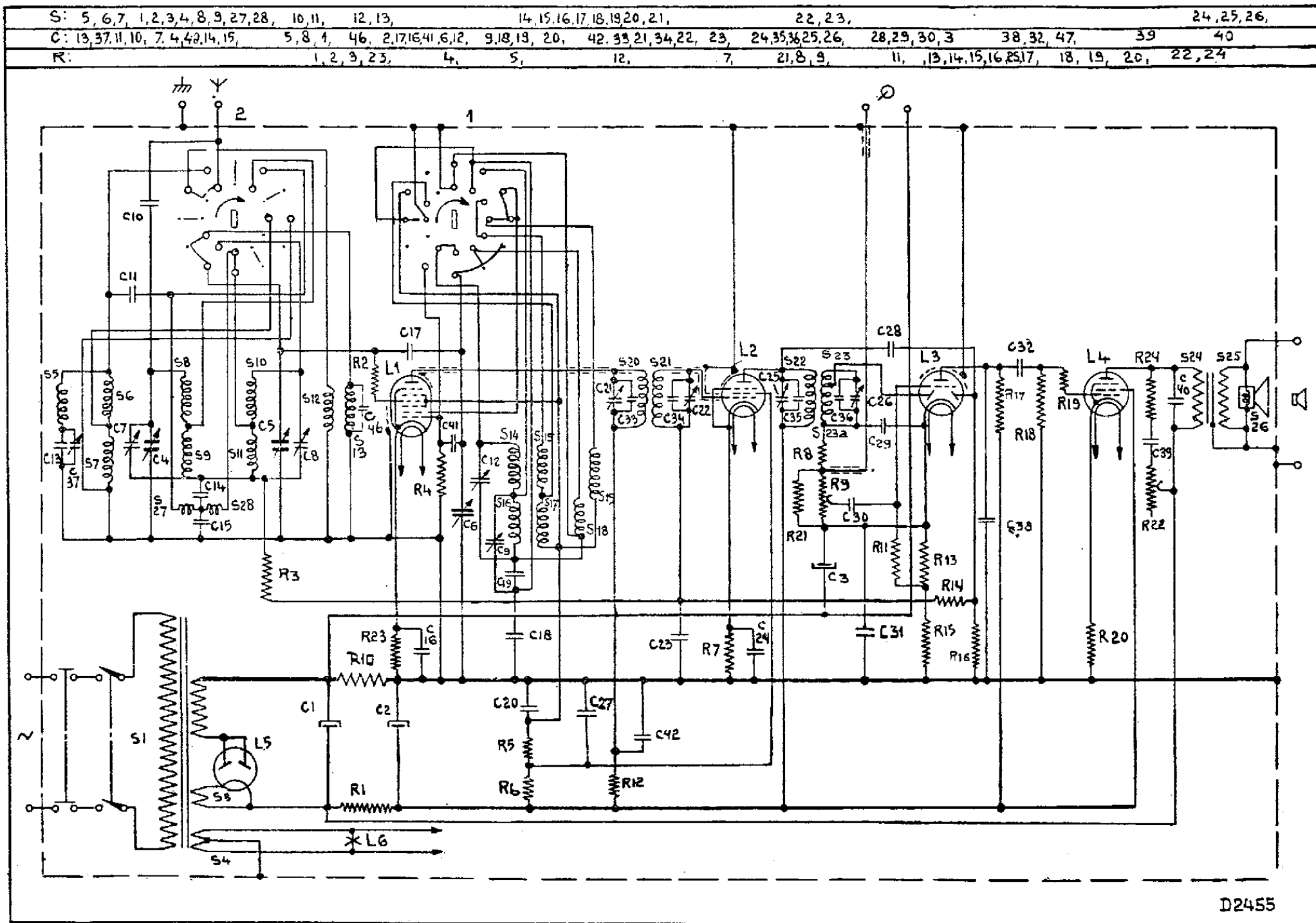


Fig. 6.

RESISTANCES.		
Designa- tion.	Condensers.	Code No.
R15	6400 Ohm	28.773.78
R16	0.5 M. Ohm	28.773.97
R17	0.1 M. Ohm	28.773.90
R18	0.8 M. Ohm	28.773.99
R19	1000 Ohm	28.773.70
R20	125 Ohm	28.770.16
R21	0.16 M. Ohm	28.773.92
R22	50000 Ohm	28.812.50
R23	320 Ohm	28.773.65
R24	100 Ohm	28.773.60
R5	* { 20000 Ohm 32000 Ohm	28.771.03 28.770.40

\* In parallel = 12,300 Ohms.

CONDENSERS.		
Designa- tion.	Condensers.	Code No.
C1	32 $\mu$ F	28.182.40
C2	32 $\mu$ F	28.182.40
C3	25 $\mu$ F	28.182.24
C4	11—490 $\mu$ $\mu$ F	28.212.19
C5	11—490 $\mu$ $\mu$ F	
C6	11—490 $\mu$ $\mu$ F	
C7	2.5—30 $\mu$ $\mu$ F	
C8	2.5—30 $\mu$ $\mu$ F	see coils
C9	8 $\mu$ $\mu$ F	
C10	20 $\mu$ $\mu$ F	28.212.05
C11	50 $\mu$ $\mu$ F	28.206.37
C12	2.5—30 $\mu$ $\mu$ F	28.206.24
C13	64 $\mu$ $\mu$ F	see coils
C14	16000 $\mu$ $\mu$ F	28.192.41
C15	25000 $\mu$ $\mu$ F	28.201.10
C16	50000 $\mu$ $\mu$ F	28.201.12
C17	2 $\mu$ $\mu$ F	28.201.15
C18	1400 $\mu$ $\mu$ F	28.205.88
C19	670 $\mu$ $\mu$ F	28.191.87
C20	0.1 $\mu$ F	28.195.35
C21	30 $\mu$ $\mu$ F	28.199.09
C22	30 $\mu$ $\mu$ F	28.212.06
C23	0.1 $\mu$ F	28.212.06
C24	0.1 $\mu$ F	28.201.18
C25	30 $\mu$ $\mu$ F	28.201.18
C26	30 $\mu$ $\mu$ F	28.212.06
C27	50000 $\mu$ $\mu$ F	28.212.06
C28	20 $\mu$ $\mu$ F	28.199.06
C29	100 $\mu$ $\mu$ F	28.206.37
C30	10000 $\mu$ $\mu$ F	28.206.27
C31	0.1 $\mu$ F	28.201.08
C32	10000 $\mu$ $\mu$ F	28.201.18
C33	50 $\mu$ $\mu$ F	28.198.99
C34	50 $\mu$ $\mu$ F	28.192.40
C35	50 $\mu$ $\mu$ F	28.192.40
C36	50 $\mu$ $\mu$ F	28.192.40
C37	64 $\mu$ $\mu$ F	28.192.41
C38	30 $\mu$ $\mu$ F	28.192.41
C39	250 $\mu$ $\mu$ F	28.212.06
C40	50000 $\mu$ $\mu$ F	28.192.47
C41	2000 $\mu$ $\mu$ F	28.201.64
C42	100 $\mu$ $\mu$ F	28.201.48
C43	0.1 $\mu$ F	28.206.27
C44	10 $\mu$ $\mu$ F	28.199.09
C45	10 $\mu$ $\mu$ F	28.206.34
RESISTANCES.		
R1	2000 Ohm	28.802.66
R2	50 Ohm	28.773.57
R3	0.1 M. Ohm	28.773.90
R4	50000 Ohm	28.773.87
R6	8000 Ohm	28.773.99
R7	250 Ohm	28.773.64
R8	0.4 M. Ohm	28.773.96
R9	0.5 M. Ohm	28.814.55
R11	1.6 M. Ohm	28.770.57
R12	2000 Ohm	28.773.73
R13	2500 Ohm	28.773.74
R14	1.6 M. Ohm	28.770.57

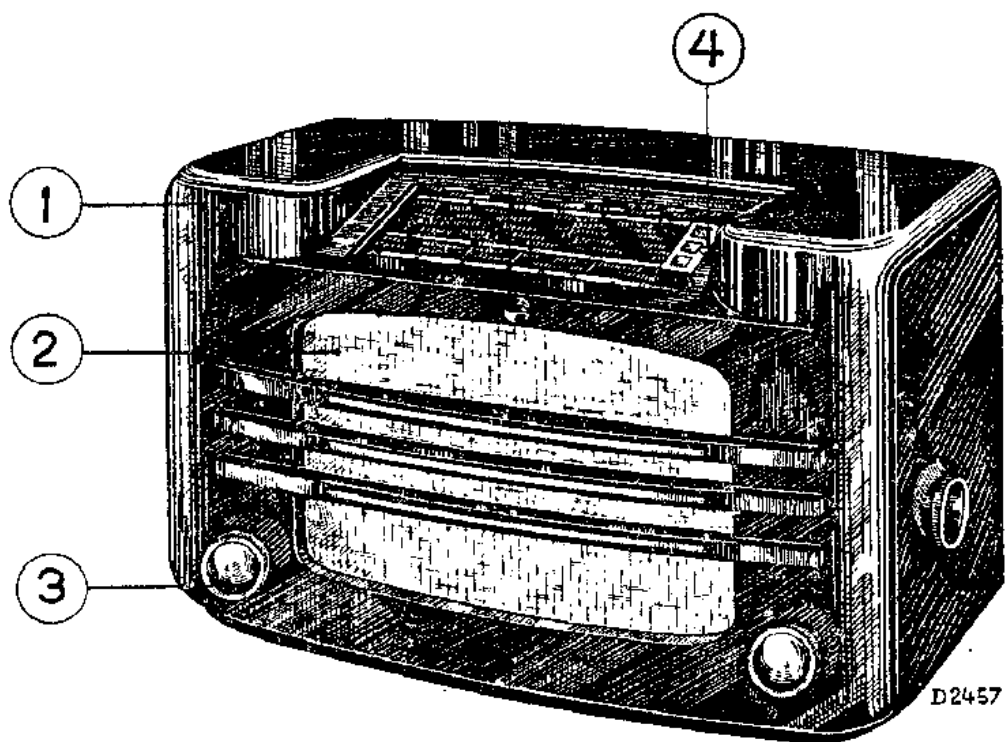


Fig. 8.

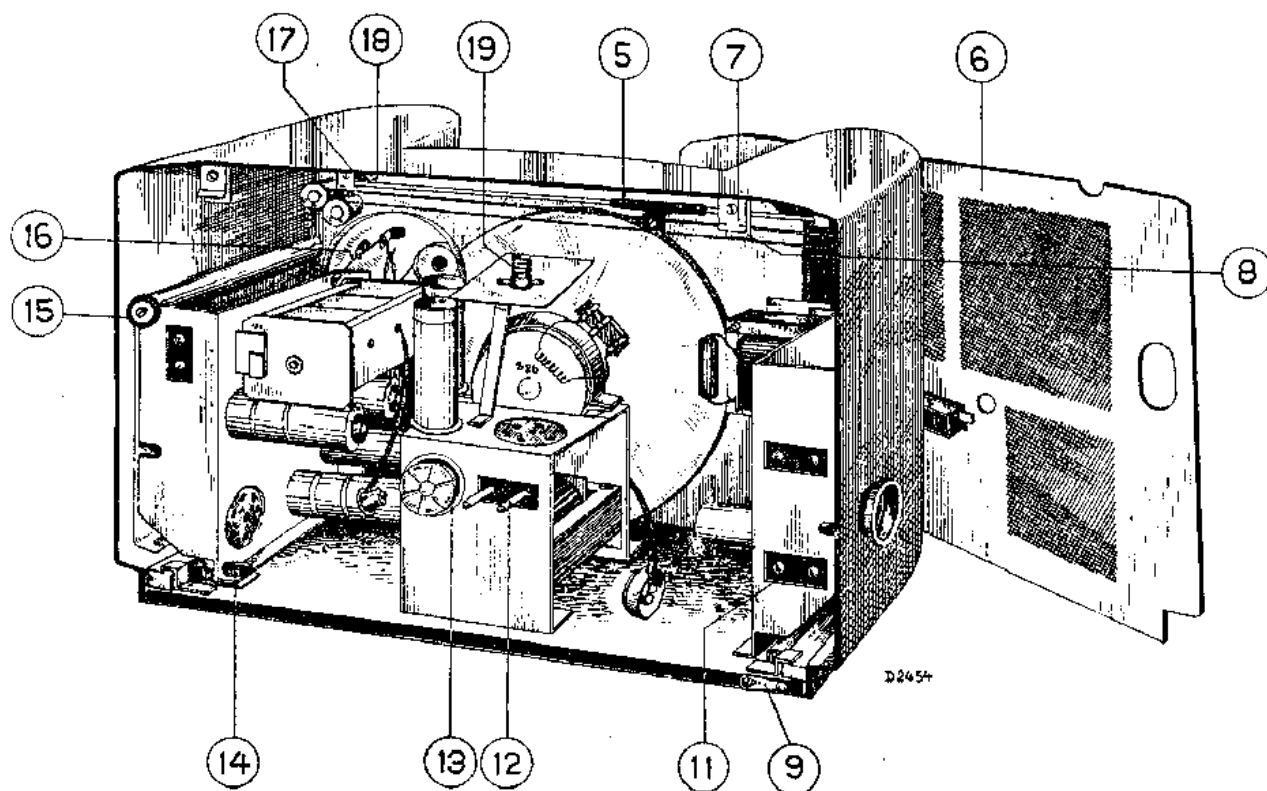


Fig. 9.

C: 27.	30, 32, 3.	39, 38.	28, 36, 29, 26.	24, 25, 31
R: 15, 18, 19.	6, 11, 13, 24, 20	17.	14.	22.
S:	16.			
	18, 9, 21, 8, 7			
	23, 23a, 22			

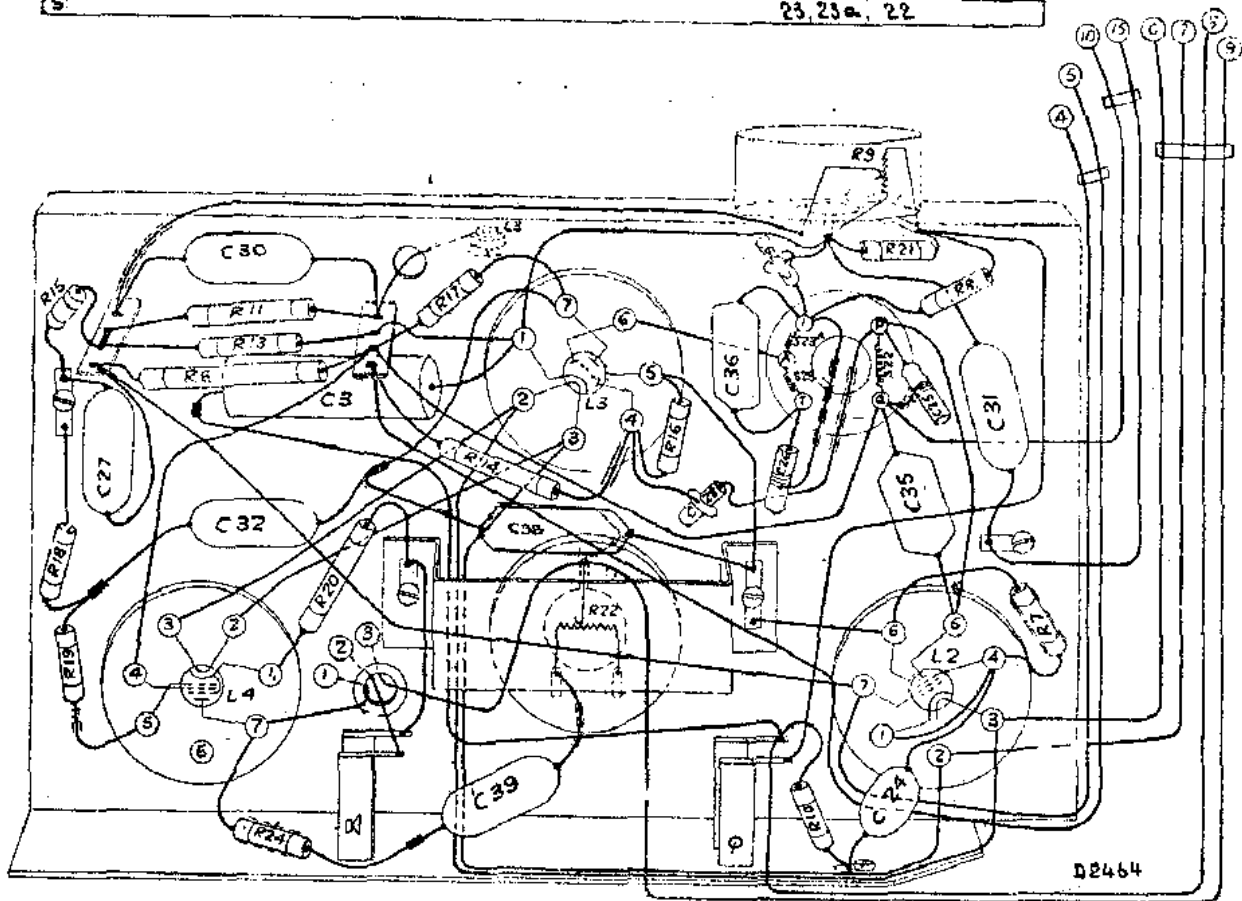


Fig. 10.

C: 16, 9, 12, 42,	33, 19, 18,	20, 21, 22, 34	41, 7, 23,	8, 14, 10, 46, 13, 37, 11, 6, 5, 4, 15,	17
R: 5, 23,	1	4, 12,	3,		
S:	17, 15, 13, 14, 16, 18,		20, 21,	13, 12, 11, 10, 7, 6, 9, 8, 28, 27, 5	

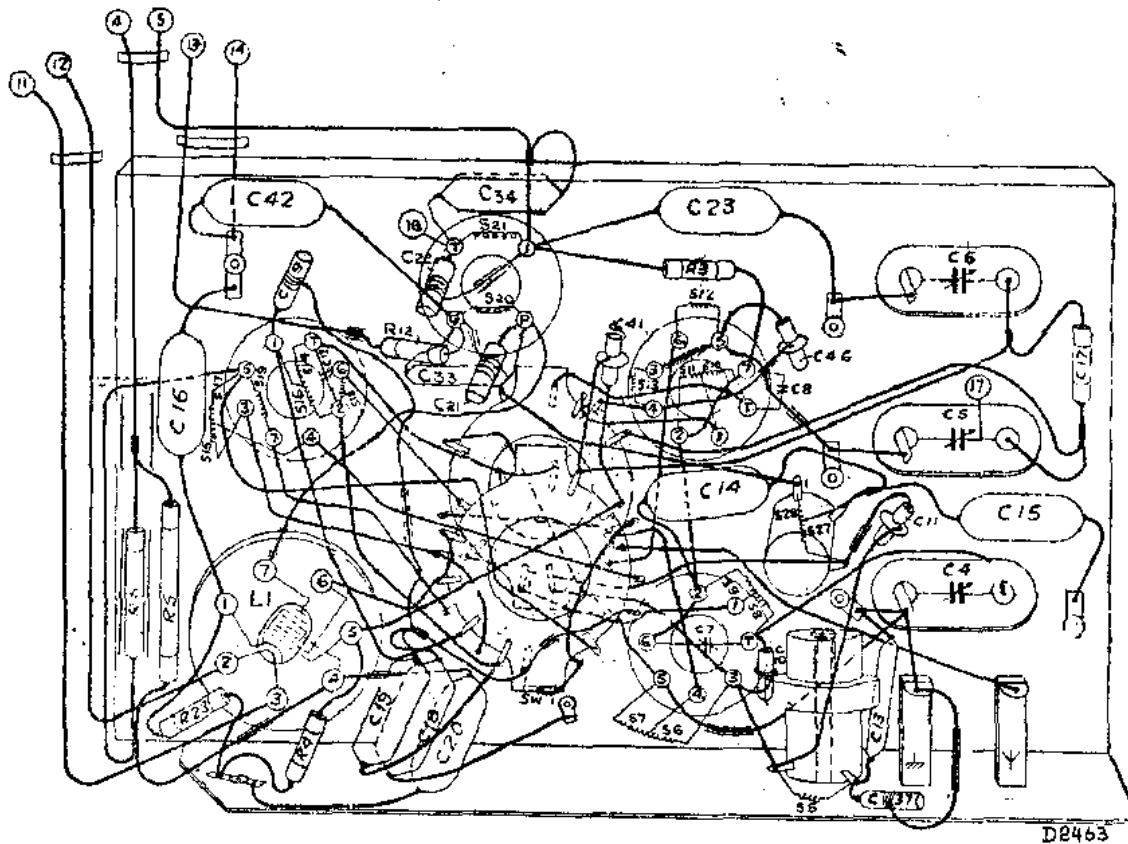


Fig. 11.

