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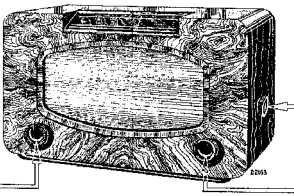
FOR PHILIPS SERVICE DEALERS ONLY

PHILIPS
SERVICE MANUAL

FOR BATTERY RECEIVER TYPE
716 B



GENERAL.

This is a superheterodyne receiver equipped with :—
Seven tuned circuits.
Separate oscillator valve, for more constant frequency.
Band filter pre-selection.
Filter to suppress signals at the image frequency.
Filter to suppress signals on the intermediate frequency.
Automatic volume control.

Wave ranges :—
Short waves. (19–51 metres).
Medium waves. (200–585 metres).
Long waves. (725–2000 metres).

Dimensions : Width 49 cm., height 35 cm., depth 21 cm. (exclusive knobs).
Weight : 22½ lb.

DESCRIPTION OF CIRCUIT.

Short Waves.

Aerial circuit : C19, S9.

Grid circuit of L1 : S9, C20.

Oscillator grid circuit : S15, R5. Coupled via C23 to the third grid of L1.

Oscillator anode circuit : S15, C26, tuning condenser C4, C22.

Medium Waves.

Aerial circuit : S2, coupled inductively (and via C15 capacitively) with S4.

Bandfilter : 1st circuit : S4, coupling condenser C18, tuning condenser C2 and trimmer condenser C6.

Second circuit : S6, coupling condenser C18, tuning condenser C3 and trimming condenser C8.

Oscillator grid circuit : S12 (C23 short circuited).

Oscillator anode circuit : S10, parallel padding condenser C9, series padding condenser C25, tuning condenser C4, C22.

Long Waves.

Aerial circuit : S2, S3 coupled inductively (and via C15 capacitively) to S4, S5.

Bandfilter : 1st circuit : S4, S5, coupling condensers C17, C18, tuning condenser C2.

2nd circuit : S6, S7, coupling condensers C17, C18, tuning condenser C3.

Oscillator grid circuit : S12, S13.

Oscillator anode circuit : S10, S11, parallel padding condensers C10 (C9), series padding condensers C24–C25, tuning condensers C4, C22.

Remark.—In all three wave ranges C27 is a grid condenser, R6 a grid leak, while R7 prevents parasitic oscillation of the oscillator valve.

I.F. aerial filter : S1, C5. This filter short circuits signals at the intermediate frequency, thus suppressing whistles.

Image frequency filter : The two condensers C7–C16 together with the first bandfilter coil, form a filter circuit for signals at a frequency which is higher than that to which the bandfilter is tuned by twice the intermediate frequency (image frequency). In this manner interference by signals at that frequency are eliminated.

I.F. CIRCUITS.

First Bandfilter.—S16, C11, S17, C12, tuned to the I.F.

Second Bandfilter.—S18, S19, C13, S20, C14, also tuned to the I.F.

Detector and A.F. Amplification.

The modulated I.F. voltage across S20 is rectified by the first anode of L4 ; the A.F. signal across R11 being applied to the grid of L5 through C33, R18, R19.

R18, C34 and R19 comprises a filter for the suppression of any residual I.F. voltage ; C35 fulfils the same function. The amplified I.F. voltages are passed to the loudspeaker via S21, S22 speaker transformer.

Automatic Volume Control.

The I.F. voltage across S19 via C32 is rectified by the second anode of L4, setting up a control voltage across potentiometer R12, R14. The latter is passed in full to L1 through R8, C37, R1, in part through L3, via R12, C28, S17.

As the second anode of L4 carries a negative voltage through R13, R14, the automatic volume control is delayed.

Feed.

The filament voltage is supplied by a 2 v. accumulator ; anode voltage and grid bias by a dry battery of 135 v.

TRIMMING THE RECEIVER.

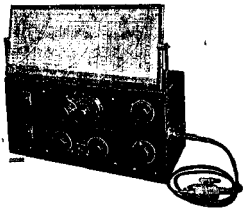


Fig. 1.

For trimming purposes only, the chassis need not be taken out of the cabinet, but if it is necessary to remove the chassis for repairs, it is preferable to trim the latter before replacing it in the cabinet.

The receiver requires retrimming—

1. After changing any coils or condensers in the I.F. or R.F. section.
2. If the receiver is not sufficiently sensitive or selective (see page 5).

For trimming the following apparatus is required—

1. Service oscillator G.M. 2880 F. (Fig. 1).
2. Output indicator: universal testboard 4256 or 7629.
3. A 15° jig for determining the relation between condenser setting and scale (Fig. 5).
4. Insulated box spanner 6 mm.
5. Insulated box spanner 8 mm.
6. Wax for locking trimmers.
7. 0.1 μF condenser.
8. 32,000 $\mu\mu$F condenser.
9. Trimming transformer.
10. 25,000 ohms resistance.

The following artificial aerials are used—

1. For the I.F.; a condenser of 32,000 $\mu\mu$F.
2. For medium and long waves: a standard artificial aerial (supplied with oscillator GM2880 F).

ALWAYS USE CUSTOMERS' OWN VALVES FOR TRIMMING.

If the mixer valve is found to be defective during trimming, the receiver must be retrimmed. Before trimming is commenced, the wax of the trimmers must be softened, e.g., with a soldering iron.

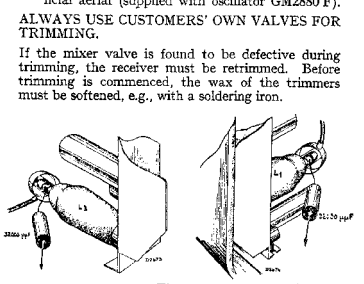


Fig. 2.

A. The I.F. Circuits.

Earth the receiver.

1. Switch receiver to long waves and set the variable condenser to minimum (800 m.).
2. Set the volume control to maximum; always adjust the volume by means of the output control of the service oscillator.
3. Connect output meter through trimming transformer to the loudspeaker terminals.
4. Apply modulated 128 K.C. signal through a 32,000 $\mu\mu$F (Fig. 2) to the control grid of L3.
5. Trim C13 and then C14 (Fig. 4) for maximum output.
6. De-tune the first I.F. circuit by connecting 25,000 ohms and 0.1 μF between the anode of L1 and chassis. (Fig. 3.)
7. Apply modulated signal of 128 K.C. via 32,000 $\mu\mu$F to grid 1 of L1 (Fig. 2) and trim C12 (Fig. 4) for maximum output.
8. Remove condenser from first I.F. circuit and de-tune the second I.F. circuit by means of 25,000 ohms and 0.1 μF connected between control grid of L3 and chassis. (Fig. 3.)
9. Trim C11 for maximum output.
10. Remove detuning and artificial aerial and lock trimmers C11, C12, C13 and C14 with wax.

B. The R.F. and Oscillator Circuits.

I. Medium Waves.

1. Switch receiver to medium waves: set volume control to maximum.
2. Fit 15° jig (Fig. 5) and set condenser to jig. (Minimum capacity.)
3. Detune first I.F. circuit by connecting 25,000 ohms + 0.1 μF between anode L1 and chassis. (Fig. 3.)
4. Apply modulated signal of 1,442 K.C. (208 m.) via standard artificial aerial to aerial socket.
5. Trim C9, C8, C6, C8, C9 (Fig. 4) for maximum output.

II. Long Waves.

1. Switch receiver to long waves with volume control at maximum.
2. Fit 15° jig and set variable condenser to it (minimum capacity).
3. Detune first I.F. circuit by 25,000 ohms + 0.1 μF connected between the anode of L1 and chassis.
4. Apply modulated signal of 395 K.C. (760 m.) via standard artificial aerial to aerial socket.
5. Trim C10 for maximum output.
6. Remove detuning and lock trimmers C6, C8, C9 and C10 with wax.

III. I.F. Aerial Filter.

1. Switch receiver to long waves: set variable condenser and volume control to maximum.
2. Apply a strong modulated signal of 128 K.C. via standard artificial aerial to the aerial contact.
3. Trim C5 for minimum output.
4. Lock C5 with wax.

C2

IV. **Image Frequency Filter.**

1. Switch receiver to medium waves with volume control at maximum.
2. Apply strong modulated signal of 1,000 K.C. (300 m.) via normal artificial aerial to aerial socket.
3. Tune the receiver to the image (approx. 403 m.) at maximum output.
4. Trim C7 for **minimum** output.
5. Remove artificial aerial output meter and trimming transformer and lock the trimmers.

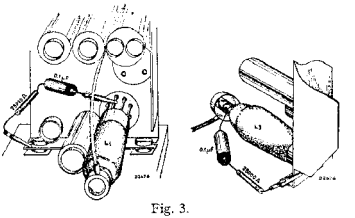


Fig. 3.

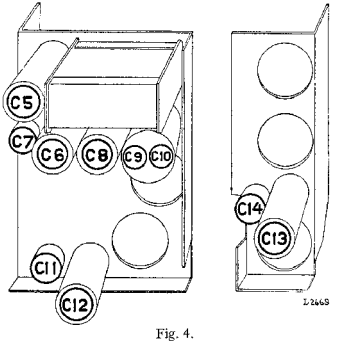


Fig. 4.

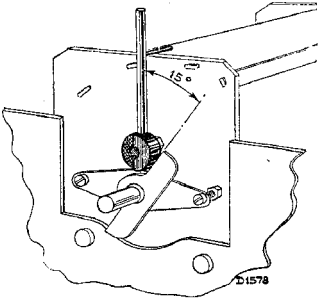


Fig. 5.

FAULT-FINDING.

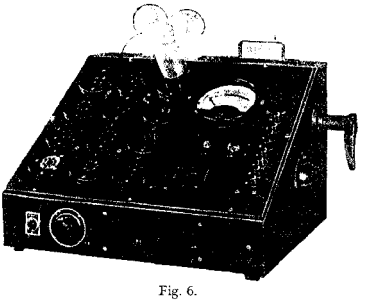


Fig. 6.

For efficient fault-finding it is necessary to have a good test instrument, and for this reason the universal testboard type 4256 or 7629 should always be used. No leads should be unsoldered until the fault has been localised by means of measurements on the receiver whilst working. The normal values of currents and voltages as measured with testboard 4256 are given in the currents and voltages table on page 15.

I. Connect the receiver to the appropriate voltages and test with its own valves on an outside aerial or with service oscillator.
   (a) If the receiver works normally, leave 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 another speaker.
Faults in the loudspeaker or valves are thus eliminated or localised.

III. Apply modulated I.F. signal (via 32,000 $\mu\mu$F) (Fig. 3) to grid 1 of L1.
   (a) Reproduction : fault in R.F. or oscillator section (see VII).
   (b) No reproduction : fault in I.F. or A.F. section (see IV).

IV. No reproduction of modulated I.F. signal applied to first anode of L4.
   (a) L5 giving abnormal currents and voltages.
      1. S21, R20 open ; C35, C1 short ; no anode current or current too low.
      2. R15 open ; C34 short ; anode current too high.
      3. R17, R18, R19, R21 open.
   (b) L5 giving normal currents and voltages.
      1. R11, C33, S22, S23 open.
      2. C31, C36, S21, S22, S23 short.

V. No reproduction of modulated signal applied to control grid of L3.
   (a) L3 giving abnormal currents and voltages.
      1. R10, S18, S19, R9 open ; C30, C29 short ; no anode current or too low.
      2. C28 short ; R13 open ; anode current too high.
      3. R14 open ; bad contact in grid bias switch.
   (b) L3 giving normal currents and voltages.
      1. S20 open ; C13, C14 short.

VI. No reproduction of modulated I.F. signal applied to grid 1 of L1.
   (a) L1 giving abnormal currents and voltages.
      1. S16, R2 open ; C21 short ; no anode current or too low.
      2. R1, R8, R12 open ; C37, C20 short.
   (b) L1 giving normal currents and voltages.
      1. C11, C12 short.

VII. Reproduction of modulated I.F. signal applied to grid 1 of L1, but no reproduction of R.F. signal.
   (a) In all wave ranges.
      1. R7 open ; C4 short.
      2. Bad contact of switch 1.
   (b) In one range only.
      1. Short or open circuit of condenser or coil in the oscillator section of that range.
      2. Bad contact switch 1.

VIII. Reproduction of modulated R.F. signal applied to grid 1 of L1, but not when applied to aerial socket.
   1. Short or open circuit of condenser or coil in the R.F. section.
   2. Bad contact switch 2.

IX. Radio reception possible but not of good quality.
   (a) Loud background noise.
   Receiver detrimmed. Retrim.
   (b) Oscillating.
      1. One of the coupling condensers C37, C26, C28, C29, C30, C36, C34, C35, C1 open circuited.
      2. Screening not making contact with chassis.
   (c) Distorted reproduction.
      1. C31, R15, R16 open.
      2. S21, S22, S23 shorted wiring (test resistance).
   (d) A.V.C. not working.
      1. R13, R14, R12, R8, R1, C32 open.
      2. C28, C37 short.
   (e) Reproduction weak.
      1. S16, S17, S18, S19, S20 shorted wiring (test resistance).
      2. C33 open.

For mechanical faults see pages 8 and 9.

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

If a test instrument, 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 in page 5, so that a commencement may be made with the operations mentioned in Sections I and II of those sheets.

After having done this, proceed 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 the battery cords must be connected together ; this also protects the meter, as otherwise the smoothing condenser might load up during testing, and this might involve burning out of 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. 13 indicates that a test must be made between contact 13 and earth, etc. 11/12 means that the test is made between points 11 and 12. Differences of 10 per cent. 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 test apparatus is switched over for capacity testing, the values given in the corresponding table being checked.

By testing all the different circuits of the receiver in this manner the fault must ultimately come to light 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 in page 5.

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

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

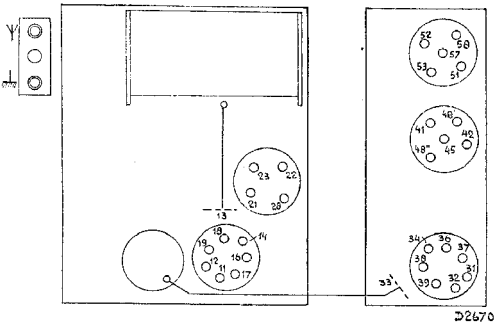
1 & 2 = Filament (heaters).
3 = control grid.
4 = metallising (if connected to separate contact).
5 = cathode.
6 = extra grid.
7 = screen grid.
8 = anode.
9 = extra grid (e.g., of octode).

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 :

3X.

19.

In testing an electrolytic condenser (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 the receiver not having been used for some time, so that a certain amount of care should be exercised when testing electrolytic condensers.



RESISTANCES.

12	11 to 51			12 to 52			14	3 x 19			34	39	57						
	5	5	5	5	5	5	5	S 500	M 160	L 285	5	5	5						
11	3 x Aerial			18	58														
	S 500	M 60	L 200	190	455														
10	23	2 x 33		3 x 28			38												
	270	a 340	b 140	S 200	M 125	L 125	400												
9	13	16	17	3 x 19			36	37	45	48'	48"	53							
	55	340	340	S 400	M 500	L 500	360	360	460	220	135	175							

CAPACITIES.

12	36	37																	
	300	300																	
11	16	17	3 x 28			33	38	38											
	300	300	S 170	M 105	L 105	350	385	375											
10	45																		
	240																		
9	57																		
	460																		

a = On/Off Switch in. b = On/Off Switch out. H.T.+1, H.T.+2 and L.T.+ Shorted to Chassis.

REPAIRING AND RENEWING COMPONENTS.

When effecting repairs always bear the following in mind :—

1. After repairs always return wiring and screening to their original positions.
2. Any insulated leads must always be at least 3 mm. apart.
3. Washers, spring washers and insulating material must be replaced exactly as before repairs.
4. Rivets may be replaced by bolts and nuts.
5. Moving parts should be lubricated with a little pure vaseline, if necessary.
6. Compounded condensers must be soldered at least 1 cm. from the compound.
7. Compounded condensers must be suspended free from other wiring.
8. Resistances must always be suspended free from other components (development of heat).

UNCASING CHASSIS. NEVER LIFT UP THE CHASSIS BY THE COILS.

1. Remove knobs from volume control, drive and wavelength switch.
2. Unsolder the chassis and speaker earth connections.
3. Loosen the driving cable from the pointer and remove it from the guide pulleys by loosening two screws in the adjustable pulley ; remove the wavelength indicator cable from the wavelength switch.
4. Remove the screws in the bottom board and also in the two chassis ; bottom board, together with chassis, can then be removed from the cabinet.

TAKE CARE NOT TO DAMAGE THE MOUNTING STRIP OF THE H.F. CHASSIS.

Before the chassis is replaced in the cabinet, the driving cable must be replaced on the drum and secured with two clips (Fig. 7). For this purpose, crocodile clips with extension pieces soldered to them are used.

When the chassis has been reassembled, the driving cable is tensioned by pushing out the adjustable guide pulley until the spring in the drum almost touches the stop.

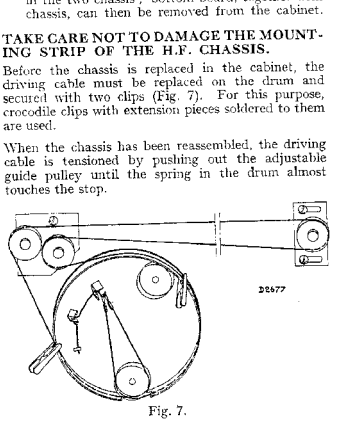


Fig. 7.

RENEWING THE SCALE.

It is not necessary to uncase the chassis.

1. Remove screen plate by loosening the four machine screws.
2. Remove one clamping plate and loosen the other.
3. Remove glass scale.
4. When fitting new scale, see that the rubber bands are fitted in the correct positions.

RENEWING THE POINTER.

1. Remove the screen plate.
2. Take out pointer and guide bar with the two fixing plates.
3. File down the collar at one end of the guide bar and remove the plate.
4. Renew the pointer with bush.
5. Reassemble in the reverse order ; solder guide bar to the plate.

CONTROL CABLES.

These cables are supplied per metre : inner cable in two types :—

1. Thick cable (A) for operating the wavelength indicator.
2. Thin cable (B) for driving the pointer.

Before cutting the inner cable, tin the cable, using acid free soldering grease and clip through the centre of the tinned part. This prevents unravelling of the cable.

Cut the outer cable with a pair of cutting pliers and trim with a file, removing all burr from the inside.

Control cables must always be handled very carefully, as even a light kink causes heavy running and backlash.

COILS AND TRIMMERS.

These are renewed in the following manner :—

1. Unsolder the leads.
2. Slightly bend up the lugs holding the components to the chassis.
3. Lift the coils vertically from the chassis.
4. Fit new coils.
5. Press down lugs with lever.
6. Resolder electrical connections.

If the lugs are broken off the chassis, coils may be fixed by means of a so-called repair clip.

DESCRIPTION OF WAVELENGTH SWITCH.

Wavelength switch comprises :—

1. One or more switch units.
2. Stop plate to determine the settings.
3. Spindles, springs and brackets.

Switch units are comprised of (see Fig. 8) :—

Stator.

Rotor.

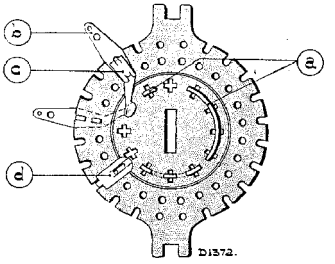


Fig. 8.

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

THE WAVELENGTH SWITCH AS SHOWN IN THE CIRCUIT.

Contact springs are represented by circles; open points on the stator by black dots.

The outer ring of circles indicate the contact springs on that side of the switch which is facing the stop plate; inner circles indicate the contact springs on that side which is remote from the stop plate.

Rotor contacts are represented by arcs and radial lines, drawn as full lines on the stop plate side and as dotted lines on the remote side.

Rotor contacts are provided with lugs which fit into holes in the rotor and are fixed to the rotor by clinching these lugs with a pair of flat-nosed pliers. The compressed lugs serve as contacts on the other side of the rotor.

INDICATION OF ROTOR CONTACTS.

The rotor contacts are indicated by means of a figure code. The first figure gives the number of holes covered, while subsequent figures indicate numbers of the holes into which the lugs are fitted; as seen from the centre of the arc with the lugs downwards reading from left to right. The two contacts shown in Fig. 9 are indicated by 4.1.4. and 5.2.3.5.

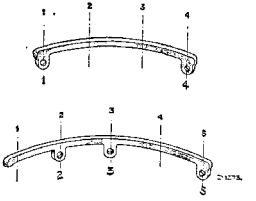


Fig. 9.

LOUDSPEAKER (TYPE 2314).

Before repairs to the loudspeaker are undertaken, it must be definitely ascertained that the speaker is faulty (try out the receiver with other speakers and transformers).

Rattle and resonances may be caused by :—

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

If repairs to the speaker are necessary, see that :—

1. The bench is quite free from dust.
2. The front and back plates are never removed from the magnet.
3. The defect may be due to :—
   (a) Dirt in the air-gap.
   (b) Speech coil distorted or jammed.
4. The dust cover is replaced immediately after the repairs.

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

If the chassis is to be renewed or the core in the air-gap re-centred, the special centring jig (Fig. 10) should be used.

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

Fig. 10.

LIST OF COMPONENTS AND TOOLS.

When ordering please always state :—

1. CODE NO. (IMPORTANT).
2. Description.
3. Type No. of Receiver.

Fig.	Pos. (Item).	Description.	Code No.
11	1	Cabinet	28.244.810
11	2	Speaker silk	06.601.110
11	3	Knob (colour 036)	23.610.654
11	4	Grub screw for knob	07.854.040
11	5	Station scale	28.710.780
11	6	Trade mark disc	28.936.531
		Pointer assembly	25.873.040
12	8	Tension spring for drum	28.740.490
12	9	Rubber insert	25.655.951
12	10	Plug socket plate	28.873.030
12	11	Systoflex, 3 × 4 mm.	06.100.110
12	12	Control cable	33.635.050
12	13	Control cable A	33.635.590
12	14	Nipple for control cable A	28.118.570
12	15	Bottom bush	28.890.240
12	16	Valveholder (4 pins)	28.838.850
12	17	Driving spindle with bush	28.880.110
12	18	Driving cord	06.606.290
12	19	Valve cap	28.838.740
12	20	Speaker clamping bracket	25.012.210
12	21	Battery cord (complete)	25.873.050
12	22	Cable tag	08.191.120
12	23	Valveholder (5 pins)	28.838.860
12	24	Valveholder (7 pins)	28.838.870
12	25	Metallised paper	06.595.130
12	26	Backplate	28.401.750
12	27	Clip for backplate	28.752.072
12	28	Flat spring for backplate	28.750.040
12	29	Reflector plate for scale	28.367.630
12	30	Cable B for pointer	33.006.070
12	31	Wire spring for drum	28.942.631
12	32	Tension spring for W/L indicator	28.740.580
12	33	Nipple for cable B	28.118.580
12	34	Cord clip	28.078.611
		Speaker chassis }	28.253.260
		Paper ring } for speaker type 2314	28.445.390
		Clamping ring }	28.445.821
8		Stator	28.934.580
8		Rotor	28.477.210
		Spring for stop plate	28.751.890
		Ball for top plate	89.205.040
8		Stator contact	28.750.970
8		Clip for stator contact } for W/L switch	28.077.392
8		Guide bracket for rotor	28.077.380
		Rotor contact, 1.1	28.904.161
		Rotor contact, 2.2	28.904.390
		Rotor contact, 3.2	28.904.211

LIST OF COMPONENTS AND TOOLS—continued.

Fig.	Pos. (Item).	Description.	Code No.
		Single pole plug	08.281.720
		Wander plug, green, marked grid —	25.873.060
		Wander plug, black, marked H.T. —	25.873.070
		Wander plug, blue, marked H.T. + 1	25.873.080
		Wander plug, red, marked H.T. + 2	25.873.090
		TOOLS.	
1		Service oscillator	GM.2880F
		Test prod for test boards	23.685.570
6		Universal testboard	7629 & 4256
		Lever for fixing coils	09.991.560
		Box spanner for electrolytic condenser	09.991.540
		Trimming box spanner, 8 mm.	09.991.810
		Trimming box spanner, 6 mm.	09.992.040
		Trimming screwdriver	09.991.501
5		15° jig	09.991.741
10		Centring jig	09.991.530
		Feeler gauges	09.990.840
		Clip for fixing coils	28.080.870
		Condenser 32,000 $\mu\mu$F	28.199.800
		Condenser, 0.1 μF	28.199.090
		Wax S 413	02.851.360
		Resistance 25,000 ohms, $\frac{1}{2}$ W.	25.770.390

Components not given above will be found on the General Part List.

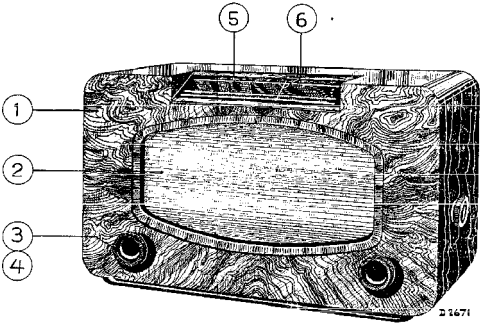

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Fig. 11

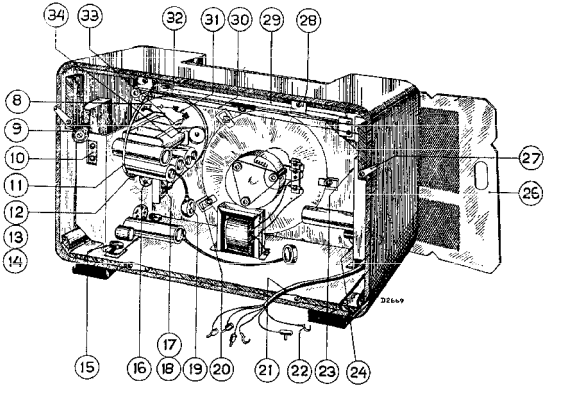
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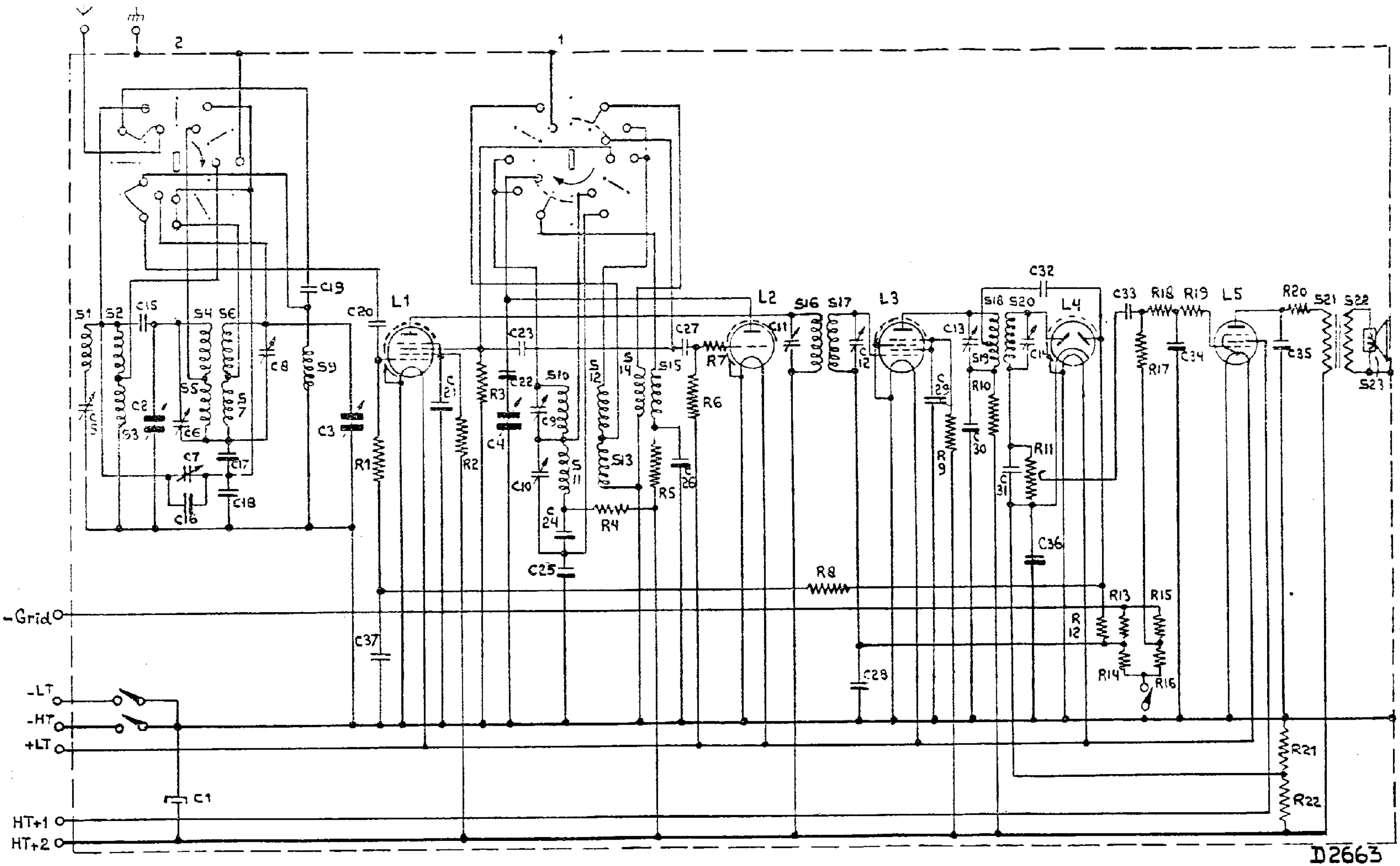
Fig. 12

S:	1, 2,3. 4,5,6,7. 9, 10,11, 12,13, 14,15, 16,17, 18,19,20. 21,22 23.	S
C:	5. 15, 2. 6,7,16,1, 17,18,8, 19,3, 20,37, 21. 22,4,23,9,10,24,25. 26,27. 11, 12,28, 29, 13 30, 31, 14, 32, 36 33, 34, 35	C
R	1, 2, 3, 4, 5, 6, 7, 8, 9 10, 11, 12,13,14,15,16,17,18,19 20,21,22,	R



D2663

CONDENSERS.

Designation.	Value.	Code No.
C1	8 μF	28.182.370
C2	11—490 μμF	28.212.190
C3	11—490 μμF	
C4	11—490 μμF	
C5	12—170 μμF	See Coils.
C6	2, 5—30 μμF	See Coils.
C7	2, 5—30 μμF	28.211.830
C8	2, 5—30 μμF	See Coils.
C9	2, 5—30 μμF	See Coils.
C10	2, 5—30 μμF	See Coils.
C11	12—170 μμF	See Coils.
C12	12—170 μμF	28.211.310
C13	12—170 μμF	See Coils.
C14	12—170 μμF	28.211.310
C15	20 μμF	28.206.370
C16	25 μμF	28.206.210
C17	16,000 μμF	28.201.100
C18	25,000 μμF	28.201.120
C19	50 μμF	25.073.100
C20	100 μμF	28.206.270
C21	0.1 μF	28.199.090
C22	20,000 μμF	28.201.110
C23	500 μμF	28.190.200
C24	764 μμF	28.193.240
C25	1,615 μμF	28.193.250
C26	20,000 μμF	28.199.020
C27	100 μμF	28.206.270
C28	0.1 μF	28.201.180
C29	10,000 μμF	28.198.990
C30	10,000 μμF	28.198.990
C31	100 μμF	28.206.270
C32	100 μμF	28.206.270
C33	10,000 μμF	28.198.990
C34	100 μμF	28.206.270
C35	2,000 μμF	28.198.920
C36	0.1 μF	28.201.180
C37	50,000 μμF	28.201.150

VALVES.

L1	L2	L3	L4	L5
VP2B	PM2HL	VP2B	2D2	PM22D

COILS.		
Designation.	Value.	Code No.
S1	130 ohms	28.570.481
C5	12-170 $\mu\mu$F	
S2	25 Ohm	
S3	100 Ohm	
S4	4.5 Ohm	28.570.541
S5	50 Ohm	
C6	2, 5-30 $\mu\mu$F	
S6	4.5 Ohm	
S7	45.0 Ohm	28.570.491
C8	2, 5-30 $\mu\mu$F	
S9	0.5 Ohm	28.588.110
S10	10.0 Ohm	
S11	35.0 Ohm	
S12	4.5 Ohm	28.570.501
S13	9.0 Ohm	
C9	2, 5-30 $\mu\mu$F	
C10	2, 5-30 $\mu\mu$F	
S14	1.0 Ohm	28.587.601
S15	.01 Ohm	
S16	130.0 Ohm	
S17	130.0 Ohm	28.572.450
C11	12-170 $\mu\mu$F	
C13	12-170 $\mu\mu$F	
S18	40 Ohm	28.570.720
S19	90 Ohm	
S20	130 Ohm	
S21	2,000 Ohm	28.530.530
S22	0.2 Ohm	
S23	3.0 Ohm	28.220.200

RESISTANCES.		
Designation.	Value.	Code No.
R1	1 M. Ohm	28.770.550
R2	0.2 M. Ohm	28.773.930
R3	0.1 M. Ohm	28.773.900
R4	64,000 Ohm	28.773.880
R5	32,000 Ohm	28.773.850
R6	16,000 Ohm	28.773.820
R7	40 Ohm	28.773.560
R8	1 M. Ohm	28.770.550
R9	0.16 M. Ohm	28.773.920
R10	5,000 Ohm	28.773.770
R11	0.5 M. Ohm	28.814.570
R12	1 M. Ohm	28.770.550
R13	0.1 M. Ohm	28.773.900
R14	10,000 Ohm	28.773.800
R15	50,000 Ohm	28.773.870
R16	25,000 Ohm	28.773.840
R17	0.5 M. Ohm	28.773.970
R18	0.1 M. Ohm	28.773.900
R19	0.1 M. Ohm	28.773.900
R20	250 Ohm	28.773.640
R21	80,000 Ohm	28.773.890
R22	0.5 M. Ohm	28.773.970

CURRENTS AND VOLTAGES.

	L1	L2	L3	L5	
Va	135	63 (1) 53 (2)	127	125	Volts
Vg2	32	—	43	135 or 120	Volts
—Vg	0.7	+2	0.7	—2.5	Volts
Ia	0.5	2.3 (1) 1.25 (2)	1.85	5.2	Milliamps.
Ig2	0.46	—	0.57	0.8	Milliamps.

Total filament current ... ... ± 0.75 amperes.
Total anode current ... ... ± 11 milliamps., medium and long waves.
+ 12 milliamps., short wave.

(1) Short wave.
(2) Medium and long waves.

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 used 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 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.

S:		17,16.			14,	15, 3,2,5,4, 12,13,10,11, 6,7,	9,	1.		S
C:	28,	12, 21, 11, 23.	27,	16,	17,18,	7,6,10,9,8,20,15,19,	26, 22,	2,4,5,3, 24,25,	37,	C
R:		3, 2.	6, 7,			5.	1, 4,			R

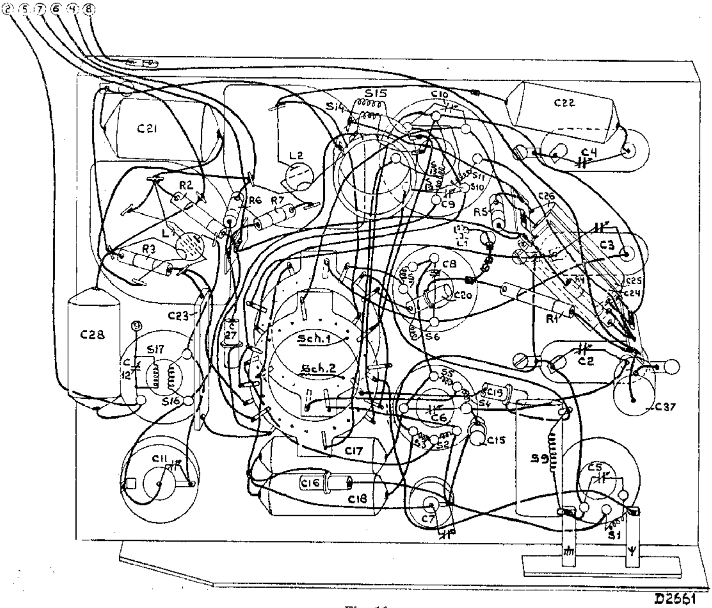


Fig. 16

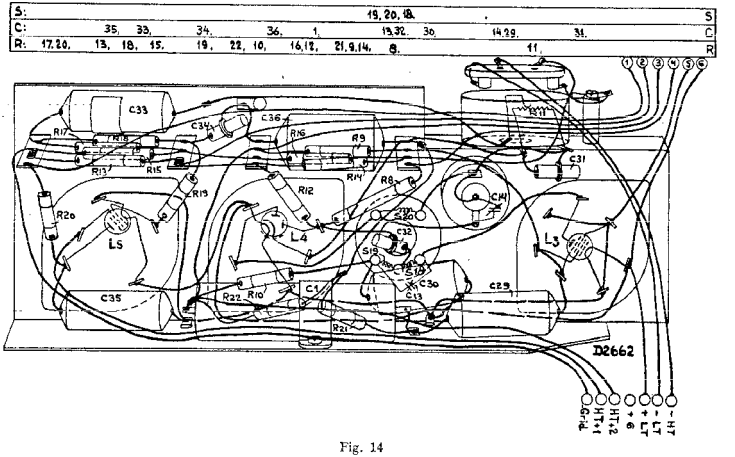

S: 19, 20, 18
C: 35, 33, 34, 36, 1, 19,32, 30, 14,29, 31
R: 17,20, 13, 18, 15, 19, 22, 10, 16,12, 21,9,14, 8, 11
C33
C34
C36
R17
R19
R16
R9
R13
R15
R14
R8
R12
C31
R18
CH
R20
L5
L4
L3
C32
S19
S18
C30
C29
C35
R22
R10
C1
C13
R21
D2662
Pick-up
HT1
HT2
HT
D2664

Fig. 14

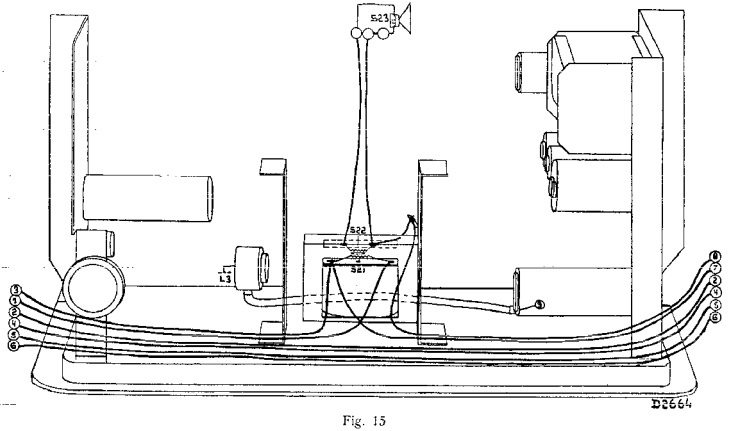

S23
S22
S21
L3
D2664

Fig. 15