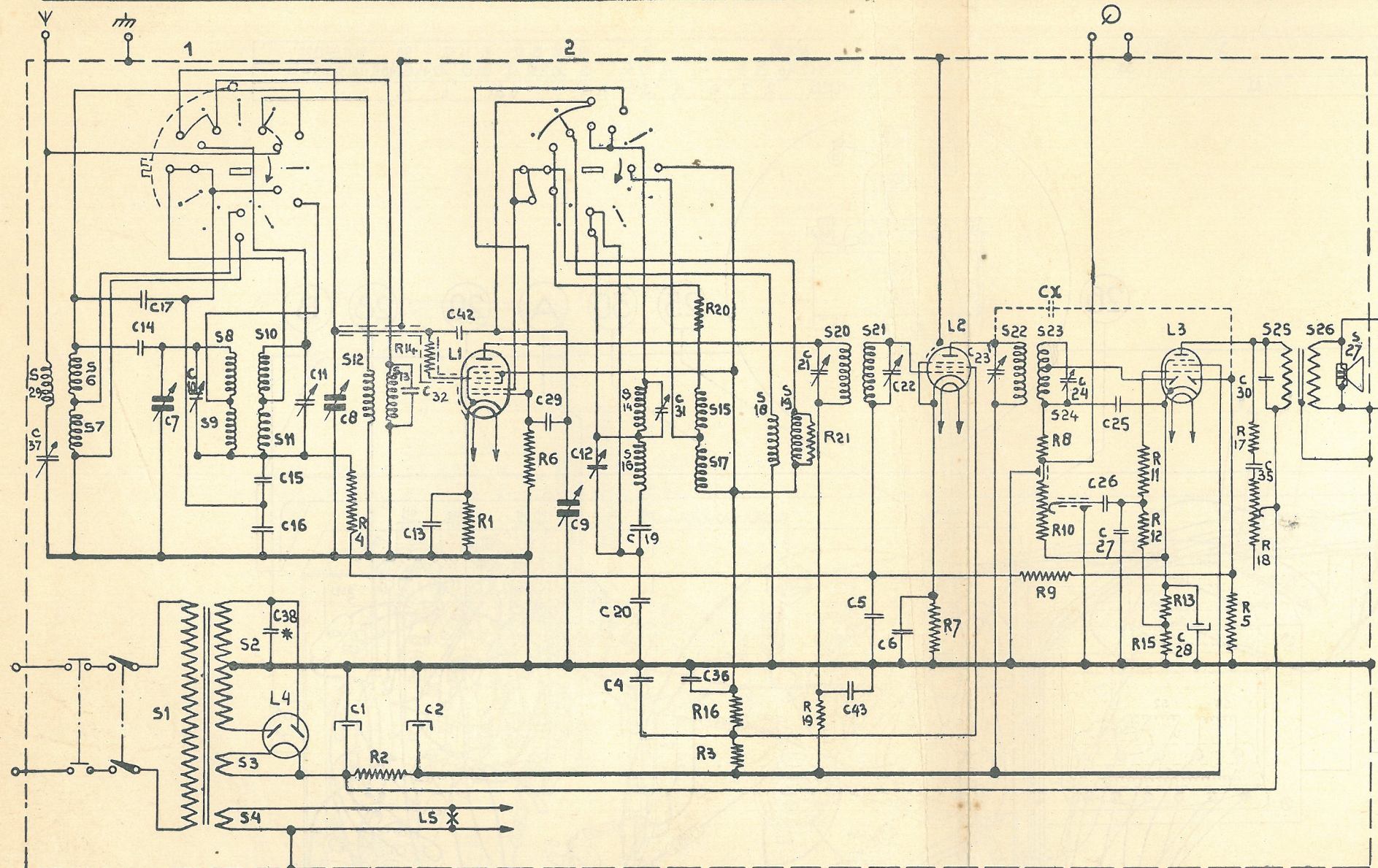


S: 6, 7, 29.	1, 2, 3, 4, 8, 9, 10, 11,	12, 13,	14, 16,	15, 17,	18, 19,	20, 21,	22, 23, 24,	25, 26, 27
C: 3, 7.	14, 7, 17, 10.	38, 15, 16, 11, 8,	1, 2, 32, 13,	42,	29, 9, 12,	19, 20, 31, 36,	4, 21, 43, 5, 22, 6,	23, X24, 26, 27, 25, 28, 30, 35
R:	2, 4, 14, 1,	6,	20,	16, 3, 21, 19,	7,	8, 10, 9,	11, 12, 13, 15, 5,	17, 18.



Waveband Switch at Short Wave.

NOTE:—CX = C44.

Fig. 12.

D2999

RESISTANCES.

No.	Value.	Code No.	No.	Value.	Code No.
R1	250 Ohm	28.773.64 or 28.770.190	R11	10,000 Ohm	28.773.80 or 28.770.350
R2	2,000 Ohm	28.802.66	R12	1 M. Ohm	28.770.55
R3	8,000 Ohm	28.770.99	R13	160 Ohm	28.770.17
R4	0.10 M. Ohm	28.773.90 or 28.770.450	R14	50 Ohm	28.773.57
R5	0.5 M. Ohm	28.770.52	R15	400 Ohm	28.770.86
R6	50,000 Ohm	28.773.87 or 28.770.420	R16	12,500 Ohm	28.771.01
R7	250 Ohm	28.773.64 or 28.770.190	R17	100 Ohm	28.773.60
R8	50,000 Ohm	28.773.87 or 28.770.420	R18	50,000 Ohm	28.812.50†
R9	2 M. Ohm	28.771.23	R19	8,000 Ohm	28.773.79 or 28.770.340
R10	0.5 M. Ohm	28.814.65†	R20	500 Ohm	28.773.67 or 28.770.220
			R21	20,000 Ohm	28.773.83 or 28.770.380

† or 49.500.010.

‡ or 49.471.000.

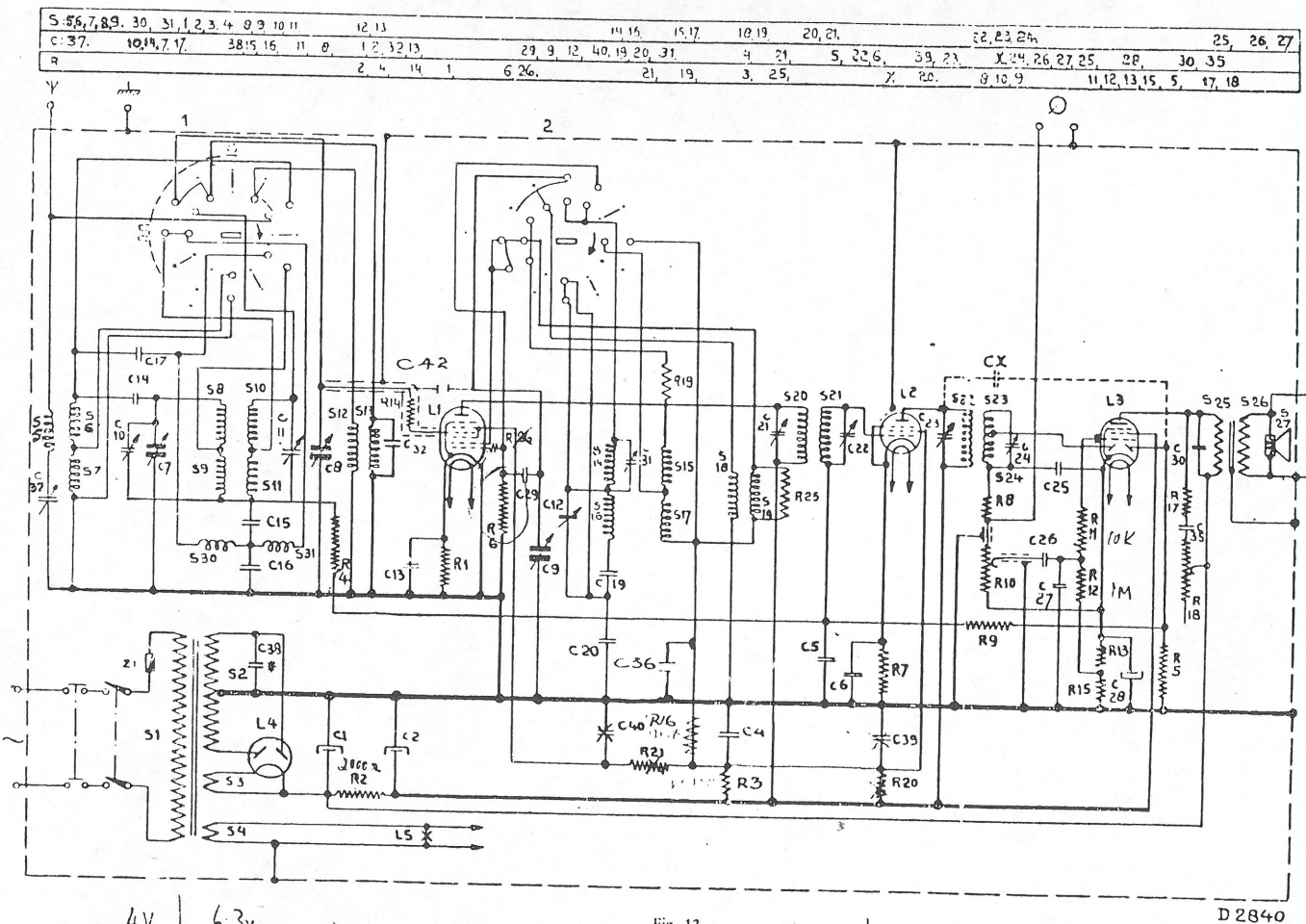
CONDENSERS.

No.	Value.	Code No.
C1	32 μ F	28.182.40
C2	32 μ F	28.182.40
C4	50,000 μ F	28.199.06
C5	50,000 μ F	28.201.15 or 28.199.06
C6	50,000 μ F	28.201.15 or 28.199.06
C7	11—490 μ F	28.211.89
C8	11—490 μ F	
C9	11—490 μ F	
C7	12—490 μ F	28.212.48
C8	12—490 μ F	
C9	12—490 μ F	
C10	See Coils	
C11	See Coils	
C12	30 μ F	28.212.06
C13	50,000 μ F	28.201.15 or 28.199.06
C14	16 μ F	28.206.36
C15	16,000 μ F	28.201.10 or 28.199.010
C16	25,000 μ F	28.201.12 or 28.199.030
C17	40 μ F	28.206.23
C19	700 μ F	28.195.97
C20	1,490 μ F	28.195.99
C21	70+30 μ F	28.212.46
C22	See Coils	
C23	70+30 μ F	28.212.46
C24	See Coils	
C25	80 μ F	28.206.26
C26	10,000 μ F	28.201.08 or 28.198.990
C27	80 μ F	28.206.26
C28	25 μ F	28.182.24
C29	50 μ F	28.206.24
C30	2,000 μ F	28.201.48
C31	See Coils	
C32	16 μ F	28.206.36
C35	50,000 μ F	28.201.64
C36	0.1 μ F	28.199.09
C37	70+30 μ F	28.212.46
C38	20,000 μ F	28.201.65†
C42	2 μ F	28.205.88
C43	50,000 μ F	28.199.06
C44	4 μ F	28.206.53

† Not fitted to receivers when mains transformer has separate coils (see sheet G2).

VALVES.

L1	L2	L3	L4	L5
FC4	VP4B	PEN4DD	1821	8042/37 or 8042/DO7

Fig. 12.
RESISTANCES4V 6.3V
L.V. 6.3V

D 2840

No.	Valve	Code No.	Price	No.	Valve	Code No.	Price
R1	250	4000 ohm	28 770 21.0	R12	1 M.ohm	28 770 55.0	
R2	8,00	2000 ohm	28 802 66.0	R13	160 ohm	28 770 17.0	
R3	250	2500 ohm	28 770 39.0	R14	50 ohm	28 773 57.0	
R4	0.1 M.ohm	28 770 45.0		R15	80 ohm	28 770 14.0	
R5	0.5 M.ohm	28 770 52.0		R17	100 ohm	28 773 60.0	
R6	50000 ohm	28 770 42.0		R18	50000 ohm	49 471 00.0	
R7	250	320 ohm	28 770 20.0	R19	500 4000 ohm	28 770 31.0	
R8	50,000	0.1 M.ohm	28 770 45.0	R20	80000 ohm	28 770 41.0	
R9		2 M.ohm	28 771 23.0	R21	0.16 M.ohm	28 770 47.0	
R10		0.5 M.ohm	49 500 01.0	R25	20000 ohm	28 770 38.0	
R11		10000 ohm	28 770 35.0	R26	40 ohm	28 770 11.0	

10 ohm R16
14 ohm R17

R16

12,500 ohm

CONDENSERS

No.	Value	Code No.	Pri
C1	32 μ F	28 182 40.0	
C2	32 μ F	28 182 40.0	
C4	50000 μ F	28 199 06.0	.05
C5	50000 μ F	28 199 06.0	.05
C6	50000 μ F	28 199 06.0	.05
C7	11-490 μ F		
C8	11-490 μ F	28 212 30.0	
C9	11-490 μ F		
C10	30 μ F	See coils	
C11	30 μ F		
C12	30 μ F	28 212 06.0	
C13	50000 μ F	28 199 06.0	.05
C14	16 μ F	28 206 36.0	
C15	12500 μ F	28 199 06.0	16,000 MMF .016
C16	40000 μ F	28 199 06.0	25,000 MMF .025
C17	40 μ F	28 206 23.0	
C19	680 μ F	49 080 00.0	
C19	775 μ F	49 080 30.0	
C20	1375 μ F	28 195 91.0	
C20	1375 μ F	49 080 31.0	1490 MMF .0015
C21	70 + 30 μ F	28 212 46.0	
C22	70 + 30 μ F	See coils	
C23	70 + 30 μ F	28 212 46.0	
C24	70 + 30 μ F	See coils	
C25	80 μ F	28 206 26.0	
C26	10000 μ F	28 198 99.0	.01
C27	80 μ F	28 206 26.0	
C28	50 μ F	28 182 32.0	25 MF
C29	50 μ F	28 206 24.0	
C30	2000 μ F	28 201 48.0	.002
C31	70 + 30 μ F	See coils	
C32	12.5 μ F	28 206 35.0	16 MMF
C35	50000 μ F	28 201 64.0	.05
C37	70 + 30 μ F	28 212 46.0	
C38	20000 μ F	28 201 65.0	.022
C39	50000 μ F	28 199 06.0	
C40	50000 μ F	28 199 06.0	
C36	0.1 MF		
C42	2 MMF		
C43	50,000 MMF	.05	
CX	4 MMF		

* Not fitted to receivers when mains transformer has separate coils (see sheet G2).

VALVES

L1	L2	L3	L4	L5
6X2	6B9	6BK1	6Z4	6X4
EC4	VP4B	EN400	1821	8042

- 1) 12A
2) 12A-26
3) 12A-29
4) 12A-46
5) 12A-49

MULLARD MAS12-34
Philips 470A

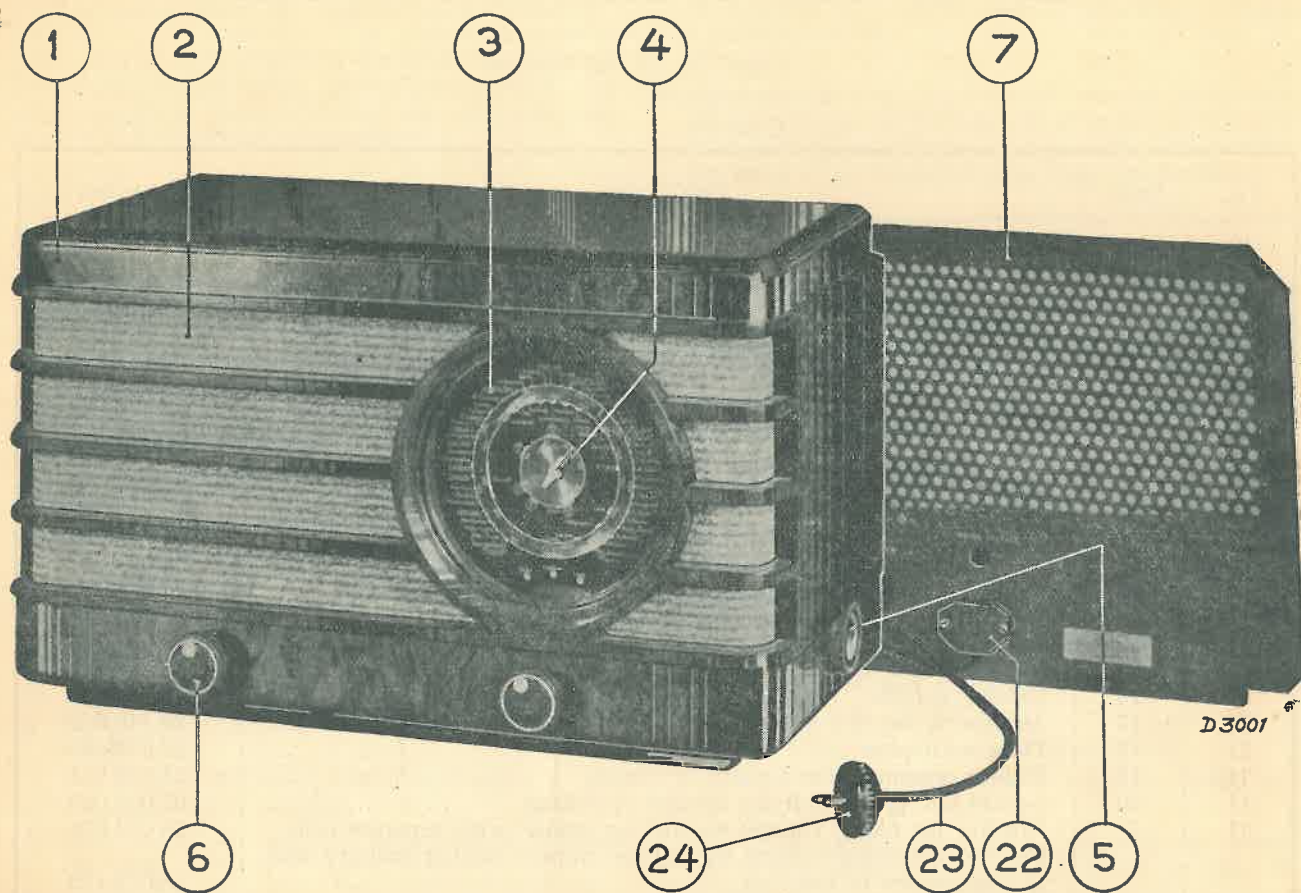


Fig. 10

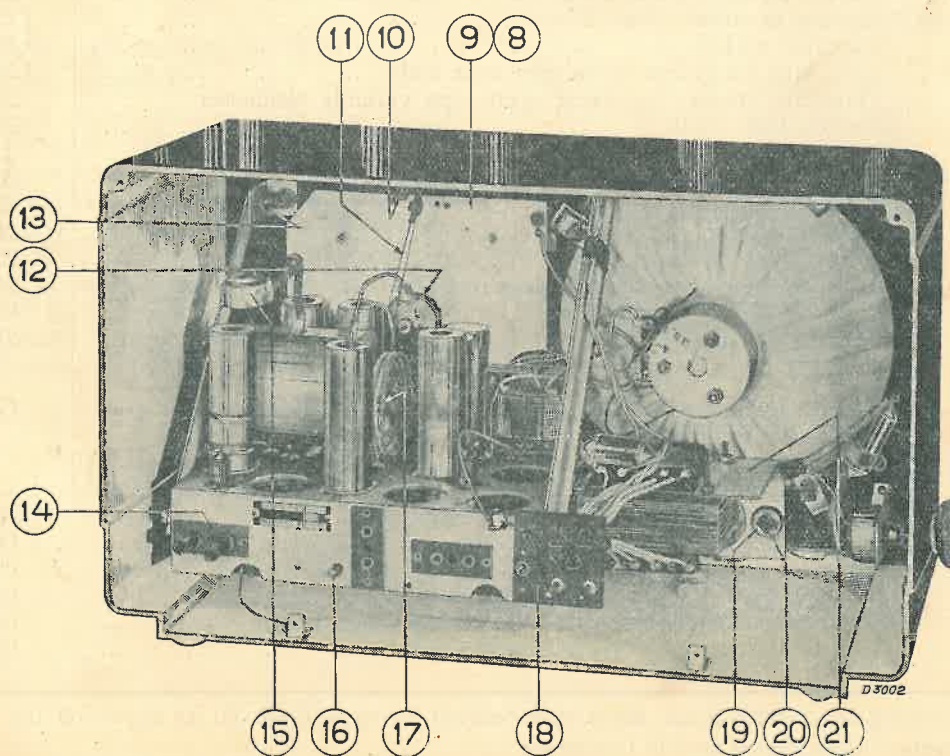


Fig. 11

CURRENTS AND VOLTAGES.

	L1 (FC4)	L2 (VP4B)	L3 (PEN4DD)	
Va	230	225	250	Volts
Vg235	78	155	230	Volts
Vg	2.2	1.9	4.6	Volts
Ia	1.5	5.1	34	Milliamps
Ig2	3.0	2.5	5	Milliamps
Ig35	4.3	—	—	Milliamps

Voltage across C1 = 270 volts.

Voltage across C2 = 220 volts.

The above values were measured without signal at the aerial socket. All voltages are in respect of cathode.

The measurements were made with Testboard GM.4526 or GM.7629; the volt meters having a resistance of 2,000 ohms per volt. If volt meters are used of which the internal resistance is less, the measurements will, generally speaking, also be lower.

The above values are averages taken from a large number of receivers and small deviations, therefore, do not necessarily indicate a fault. The total primary consumption is 50 w.

COILS.		
Designation.	Resistance.	Code No.
S1 } S2 } S3 } S4 }	Mains Transformer	28.536.270 or 28.536.280
S6 } S7 } S8 } S9 }	30 Ohm 100 Ohm 4.8 Ohm 42 Ohm	28.572.940
C10 } S10 } S11 }	30 $\mu\mu\text{F}$ 4.8 Ohm 42 Ohm	
S12 } S13 }	2.4 Ohm 0.1 Ohm	28.573.050
C11 } S14 }	30 $\mu\mu\text{F}$ 11 Ohm	
S15 } S16 }	7.5 Ohm 32 Ohm	28.572.930
S17 } S18 }	4 Ohm 0.1 Ohm	
S19 } C31 }	1.4 Ohm 30 $\mu\mu\text{F}$	28.572.910
S20 } S21 }	130 Ohm 130 Ohm	
C22 } S22 }	30+75 $\mu\mu\text{F}$ 130 Ohm	28.572.900
S23 } S24 }	30 Ohm 100 Ohm	
C24 } S25 }	30+75 $\mu\mu\text{F}$ 700 Ohm	28.533.720 or 28.537.291
S26 } S27 }	0.6 Ohm 4.0 Ohm	
S29	130 Ohm	28.220.510 28.587.880

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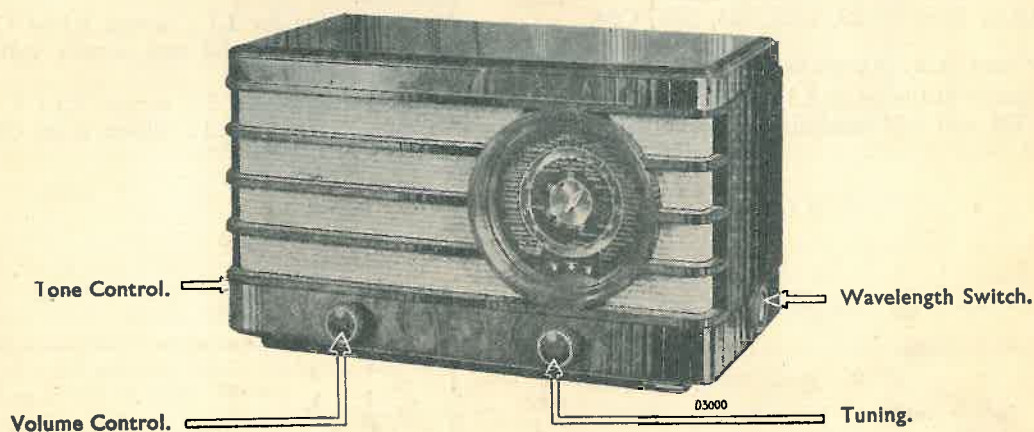
FOR APPOINTED PHILIPS
DEALERS ONLY

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PHILIPS

SERVICE MANUAL

FOR RECEIVER
Type 470 A



For use on alternating current mains.

GENERAL.

This receiver is of the superheterodyne type and embodies the following features:—

- Band filter pre-selection.
- Seven tuned circuits.
- I.F. filter circuit for suppression of signals at the I.F. frequency.
- Image frequency filter.
- Delayed automatic volume control.
- Continuous variable tone control.
- Large indirectly lighted station scale.
- Connection for external speaker.
- Connection for gramophone pick-up.
- Safety contact which breaks the current when the backplate is removed.
- Mains tapping plate for voltages of 110 to 245 v., 50 to 100 c/s.

Wave Ranges:—

S.W.: 16.7—51 m. (17.96—5.88 M.C.).

M.W.: 198—585 m. (1,515—512.8 K.C.).

L.W.: 720—2,000 m. (416.7—150 K.C.).

Weight: Packed, 32½ lb.; unpacked, 22½ lb.

Dimensions: width, 20 in.; height, 11 in.; depth, 10 in.

DESCRIPTION OF CIRCUIT.

S.W.

Aerial circuit: S12 inductively coupled to S13.
Grid circuit of L1: S13, tuning condenser C8 and C32.
Oscillator grid circuit: S18, tuning condenser C9, grid condenser C29 and grid leak R6.
Oscillator anode circuit: S19, R21.

M.W.

Aerial circuit: S6, coupled inductively and capacitively (C14) to S8.
Band filter: 1st circuit: S8, tuning condenser C7, trimmer C10, coupling condenser C16, and
2nd circuit: coupling condenser C16, S10, tuning condenser C8, and trimmer C11.
Oscillator grid circuit: S14, tuning condenser C9, trimmer C31, padding condenser C20.
Oscillator anode circuit: S15, R20.

L.W.

Aerial circuit: S6-S7 coupled inductively and capacitively (C14) to S8-S9.
Band filter: 1st circuit: S8-S9, tuning condenser C7, coupling condensers C15-C16, and
2nd circuit: coupling condensers C15-C16, S10-S11, tuning condenser C8.

Oscillator grid circuit: S14-S16, tuning condenser C9, trimmer C12 (C31) and padding condenser C19 (C20).

Oscillator anode circuit: S15-S17, R20.

Remark.—On Medium and Long Waves C29 is short-circuited and the padding condensers serve as grid condenser. R14 prevents parasitic oscillation of the pentode section of L1, and C42 counteracts the effect of the space charge from the fourth grid and so prevents radiation of the oscillator frequency.

Image Frequency Filter.

C17 together with first circuit of the band filter constitutes a filter which diverts from the coupling condensers and, therefore, also from the mixing valve, the voltage of all signals higher than that to which the band filter is tuned by twice the I.F.

I.F. Circuit.

Aerial filter circuit: S29, C37.

First Band filter: S20, C21, S21, C22.

Second Band filter: S22, C23, S23, S24, C24.

Detector and A.F. Amplifier Circuits.

The first anode of the diode L3, cathode, R10 (volume control), R8 and S24 comprise the detector circuit.

C25 short-circuits I.F. from R8 and R10. The A.F. voltage across R10 passes via C26 and R11 to the grid of L3. C27 acts as a filter for any residual I.F. voltage and R11 prevents oscillation of L3. S25, S26 is the speaker transformer.

Variable Tone Filter. R17, C35, R18.

Automatic Volume Control.

The second anode of the diode L3 is coupled to S22 by reason of the capacity C44. A direct voltage is thus set up across R5 which is proportional to the signal strength, and this voltage, passing by way of R9 and C5, controls the amplification of L2 and, further, via R4, the amplification of L1. The control is delayed by R13-R15.

Feed.

Mains transformer S1, S2, S3, S4.

Ripple condenser C38.

Smoothing filter C1, R2, C2.

Voltage for grids 2, 3 and 5 of L1; via R3-C4, R16-C36.

Anode voltage for L1: across R19-C43.

Anode voltage for L2 and screen voltage for L3: direct from C2.

Screen voltage for L2: across R3-C4.

Anode voltage for L3: direct from C1.

General.

Wire-Wound Trimmers.

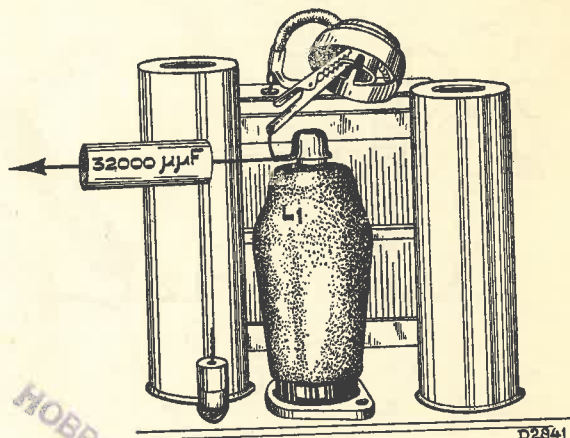
If maximum output cannot be obtained by removing turns, i.e., if the capacity is too small, a new trimmer must be fitted. **Extra wire** must not be added to increase a capacity which is too small, as extra turns cannot be wound tightly enough and would cause instability.

1. Upon replacement of coils or condensers in the I.F. or R.F. sections.
2. If the receiver is not sufficiently sensitive or selective (see E sheets).

1. Service oscillator GM2880F (see Fig. 1).
2. Output indicator: Universal testboard GM4256 or GM7629.
3. Aperiodic amplifier GM2404.
4. 15° jig for establishing the relation between condenser setting and scale.
5. Insulated trimming key.
6. Trimming transformer.
7. Condensers 0.1 μ F and 32,000 μ F.
8. Resistances 50,000 and 80,000 ohms.
9. Fork for adjusting the scale.

1. For I.F.: condenser of 32,000 $\mu\mu\text{F}$.
2. For M. and L.W.: standard artificial aerial supplied with GM2880F.
3. For S.W.: S.W. artificial aerial (red spot on standard artificial aerial).

Before trimming is commenced the locking wax on the trimmers must be carefully removed with a pair of tweezers and the rotor of the trimmer moved up and down several times to ensure that all traces of the wax are removed. After trimming, the trimmers are again locked with wax, e.g., by holding the wax against a warm iron so that a few drops of the wax fall on to the centre of the trimmer.



A. I.F. Circuits.

I. The Band Filters.

1. Earth the receiver and tune to the lower end of the L.W. range (about 700 m μ).
2. Turn the volume control to maximum.
3. Connect output indicator to the extension speaker sockets, across the trimming transformer.
4. Apply modulated 128 K.C. signal across 32,000 $\mu\mu$ F to the top connection of L1 (see Fig. 2).
5. Connect 50,000 ohms resistance across C22 and 80,000 ohms across C23 (see Fig. 3).
6. Trim C24 and then C21 for maximum output (see Fig. 4).
7. Disconnect damping resistances from C23 and C22.
8. Connect 50,000 ohms resistance across C21 and 80,000 ohms across C24 (see Fig. 3).
9. Trim C23 and then C22 for maximum output (see Fig. 4).
10. Disconnect damping resistances.

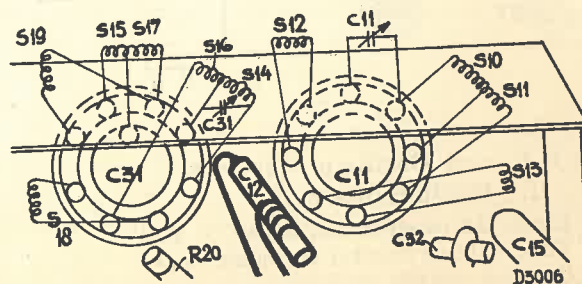


Fig. 3A.

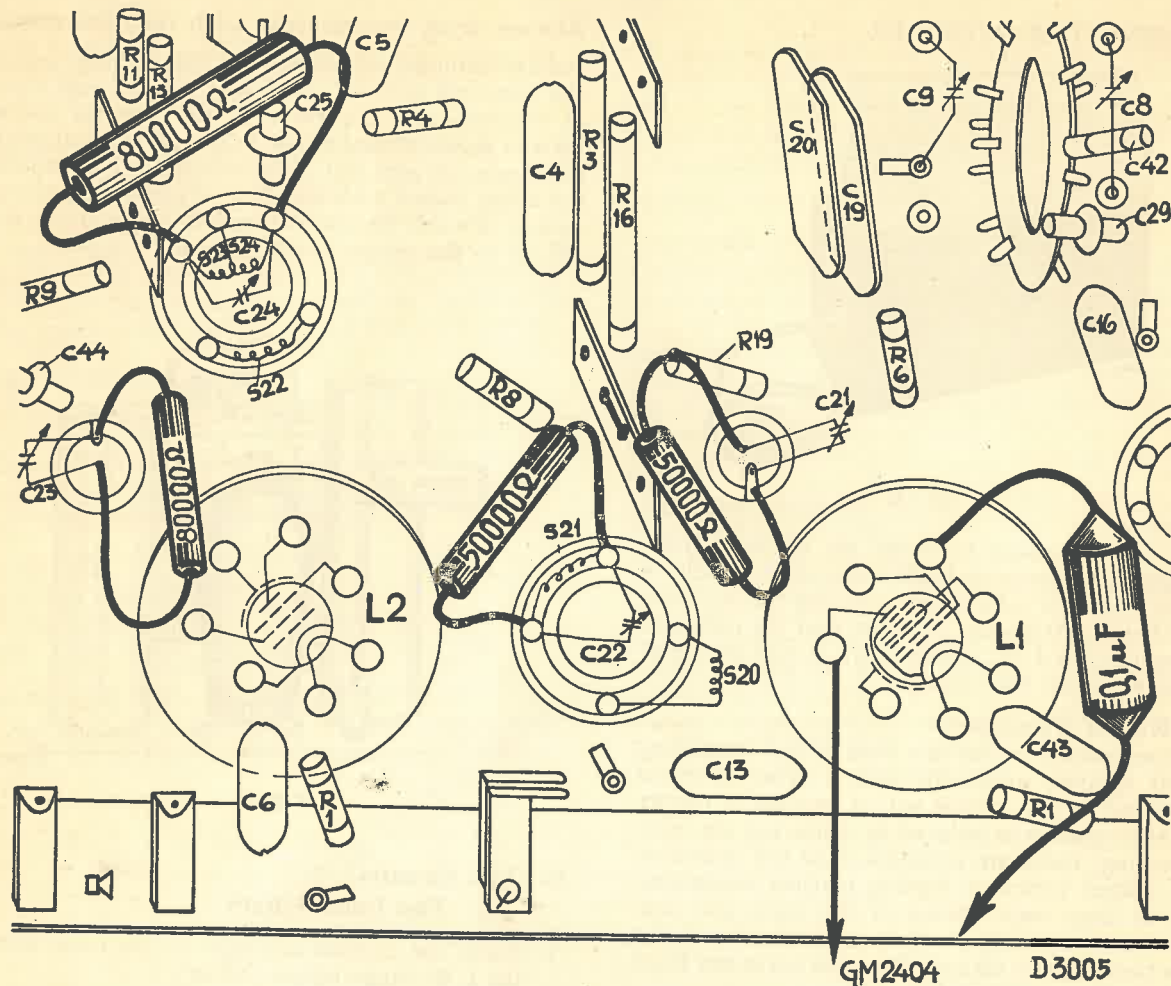


Fig. 3.

II. Aerial Filter.

1. Connect modulated I.F. signal via standard artificial aerial to the aerial socket.
2. Tune receiver to upper end of L.W. (about 2,000 m.).
3. Trim C37 for **minimum** output.

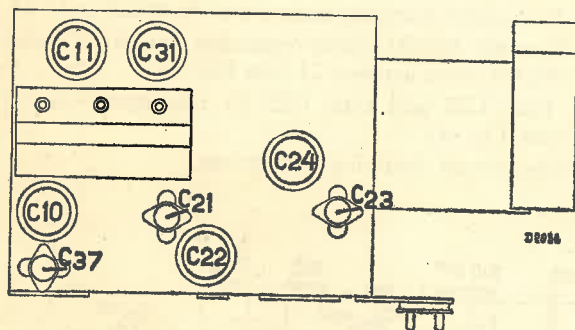


Fig. 4.

B. R.F. and Oscillator Circuits.

I. Medium Wave.

1. Earth the receiver and switch to M.W.
2. Turn volume control to maximum.
3. Connect output indicator via trimming transformer to the extension speaker sockets.

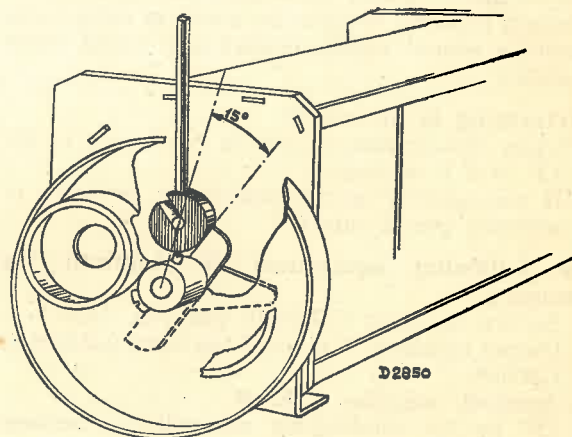


Fig. 5.

4. Fit 15° jig (see Fig. 5) and set the condenser to the jig (200 m.).
5. Apply modulated 1,442 K.C. signal (208 m.) by means of standard artificial aerial to the aerial socket.
6. Trim C31, C11, C10, C31, C11 for maximum output in that order (see Fig. 4).
7. Remove 15° jig.

II. Long Wave.

1. Earth the receiver and switch to L.W.
2. Set volume control to minimum.
3. Connect aperiodic amplifier GM2404 to anode of L1 (see Fig. 3).
4. Connect output indicator to output terminals of the aperiodic amplifier.
5. Earth the first grid of the mixing valve through a condenser of $0.1 \mu\text{F}$ (see Fig. 3).
6. Apply modulated 400 K.C. signal (750 m.), through standard artificial aerial to aerial socket.
7. Tune the variable condenser of the receiver for maximum output.
8. Disconnect aperiodic amplifier and condenser from the grid of L1.
9. Connect output indicator through transformer to the extension speaker sockets.
10. Turn volume control to maximum.
11. Trim C12 for maximum output (see Fig. 3A).

C. Calibration.

1. Apply modulated 857 K.C. signal (350 m.) through standard artificial aerial to the aerial socket.
2. Carefully tune the receiver to this signal.
3. Place fork A (Fig. 6) on the pointer spindle with one prong in the groove in the spindle and the other gripping the flat end of the spindle.
4. Loosen screw B.
5. By means of the fork, turn the pointer to 350 m. and tighten screw B.

6. Remove the fork and if necessary correct the setting by slightly bending the reflector plate behind the scale. To do this, place the thumb about $1\frac{1}{2}$ " from the top edge against the plate and slightly bend the top edge backwards or forwards.

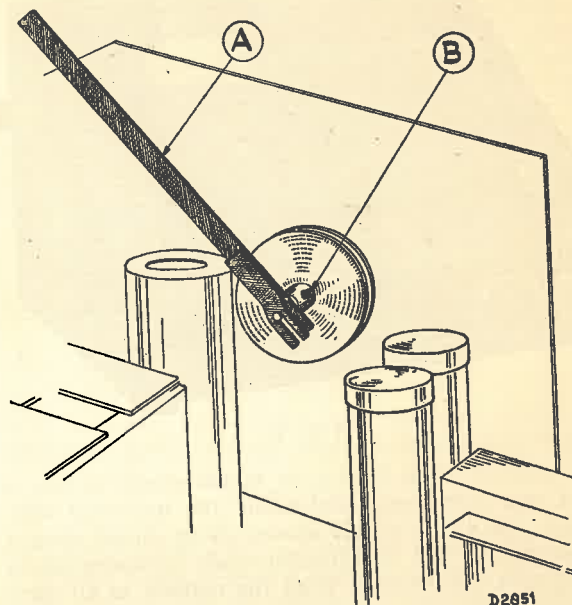


Fig. 6.