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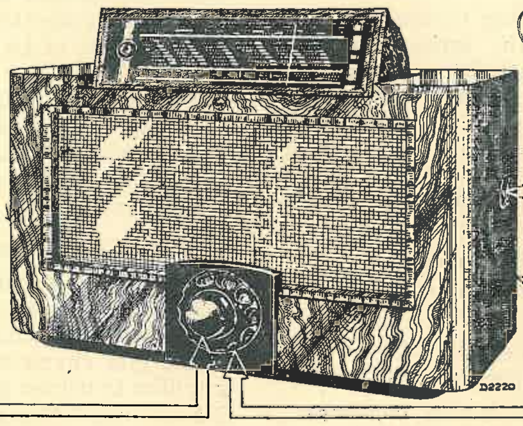
DEALERS ONLY

PHILIPS
SERVICE MANUAL

FOR RECEIVER
TYPE 785AX.

702



GENERAL.

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

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

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

Delayed automatic volume control.

Filter for suppressing interfering signals at the image frequency.

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

Loudspeaker with anti-directional cone.

Mains aerial.

Sockets for gramophone pick-up.

Sockets for extension speaker (5.5 ohms).

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

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

Wave ranges :—
- Short wave : 16,5—51 m. (18.2—5.89 M.C.).
- Medium wave : 195—585 m. (1,540—513 K.C.).
- Long wave : 720—200 m. (416—150 K.C.).

Weight : nett approx. 33 lb.

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

DESCRIPTION OF CIRCUIT.

Short Waves.

Aerial circuit : S32 inductively coupled to S33.

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

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

Oscillator anode circuit : S18 with damping resistance R38.

Medium Waves.

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

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

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

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

Oscillator anode circuit : S16.

Long Waves.

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

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

2nd circuit : coupling condensers S29 and C30. S11-S12, tuning condenser C10, trimmer C15.

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

The series padding condensers serve also as grid condenser.

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

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

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

I.F. CIRCUITS.

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

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

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

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

Detector and A.F. Circuits.

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

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

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

Visual Tuning Indicator.

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

Quality Correction.

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

Automatic Volume Control.

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

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

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

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

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

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

Supply.

L5 supplies the direct voltage to C1.

S5, R1 and C2 form the smoothing filter.

Anode voltage for L1, L2, L4 and L6 is fed direct from C2.

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

Voltage for grids 3 and 5 of L1 is decoupled by C4.

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

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

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

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

C51 suppresses mains interference.

Mains Aerial.

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

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

TRIMMING THE RECEIVER.

Fig. 1.

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

Re-trimming is required—

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

In trimming, use is made of the following—

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

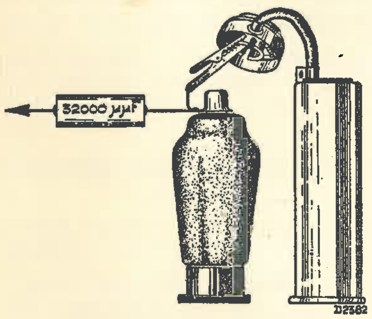


Fig. 2.

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

The following Artificial Aerials are used :—

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

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

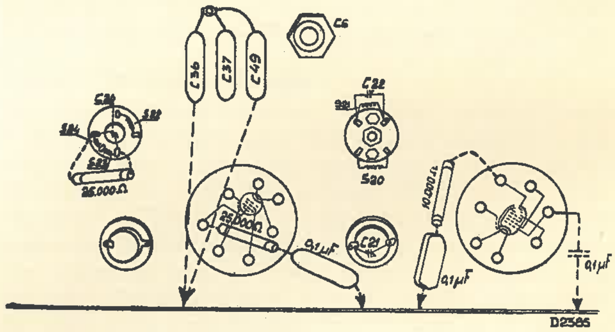


Fig. 3.

A. The I.F. Circuits.

Earth the receiver.

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

B. The R.F. and Oscillator Circuit.
I. For Medium Waves.

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

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

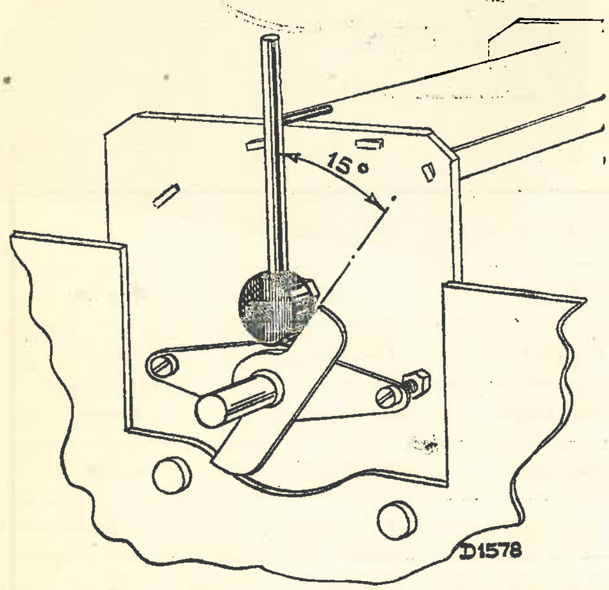


Fig. 4.

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

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

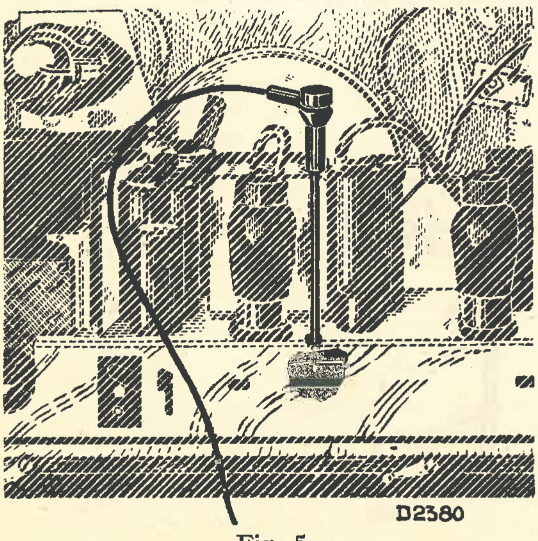


Fig. 5.

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

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

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

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

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

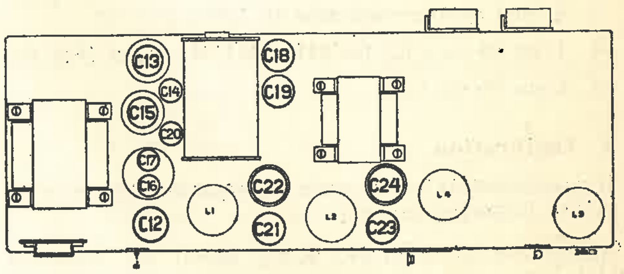


Fig. 6.

II. For Long Waves.

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

III. For Short Waves.

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

C. Image Frequency Filter.

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

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

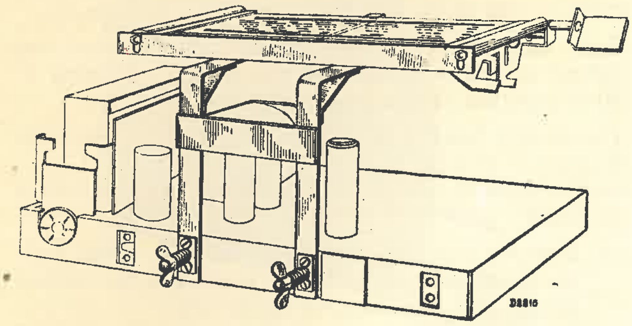


Fig. 7.

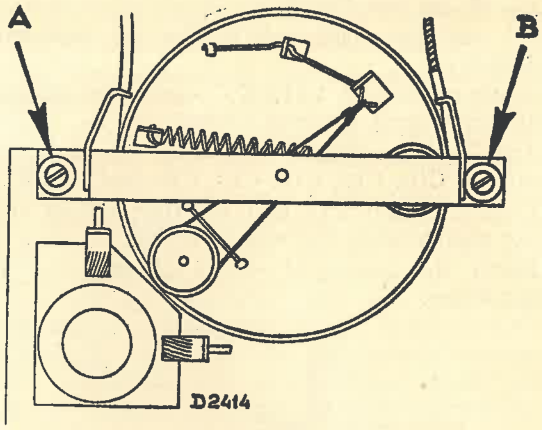


Fig. 7A.

D. I.F. Aerial Filter.

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

E. Calibration.

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

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

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

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

Note error.

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

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

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

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

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

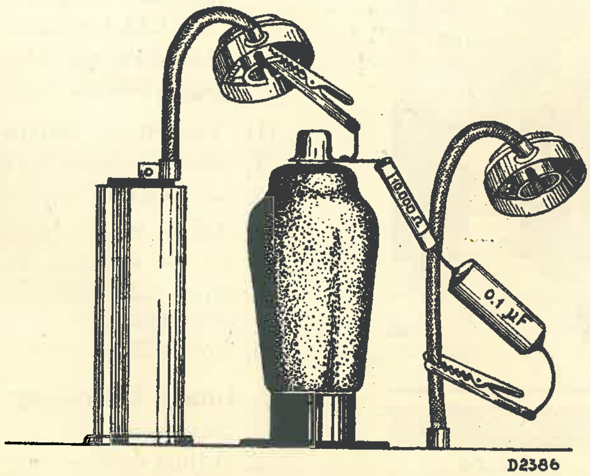


Fig. 2A.

TABLE OF VOLTAGES AND CURRENTS.

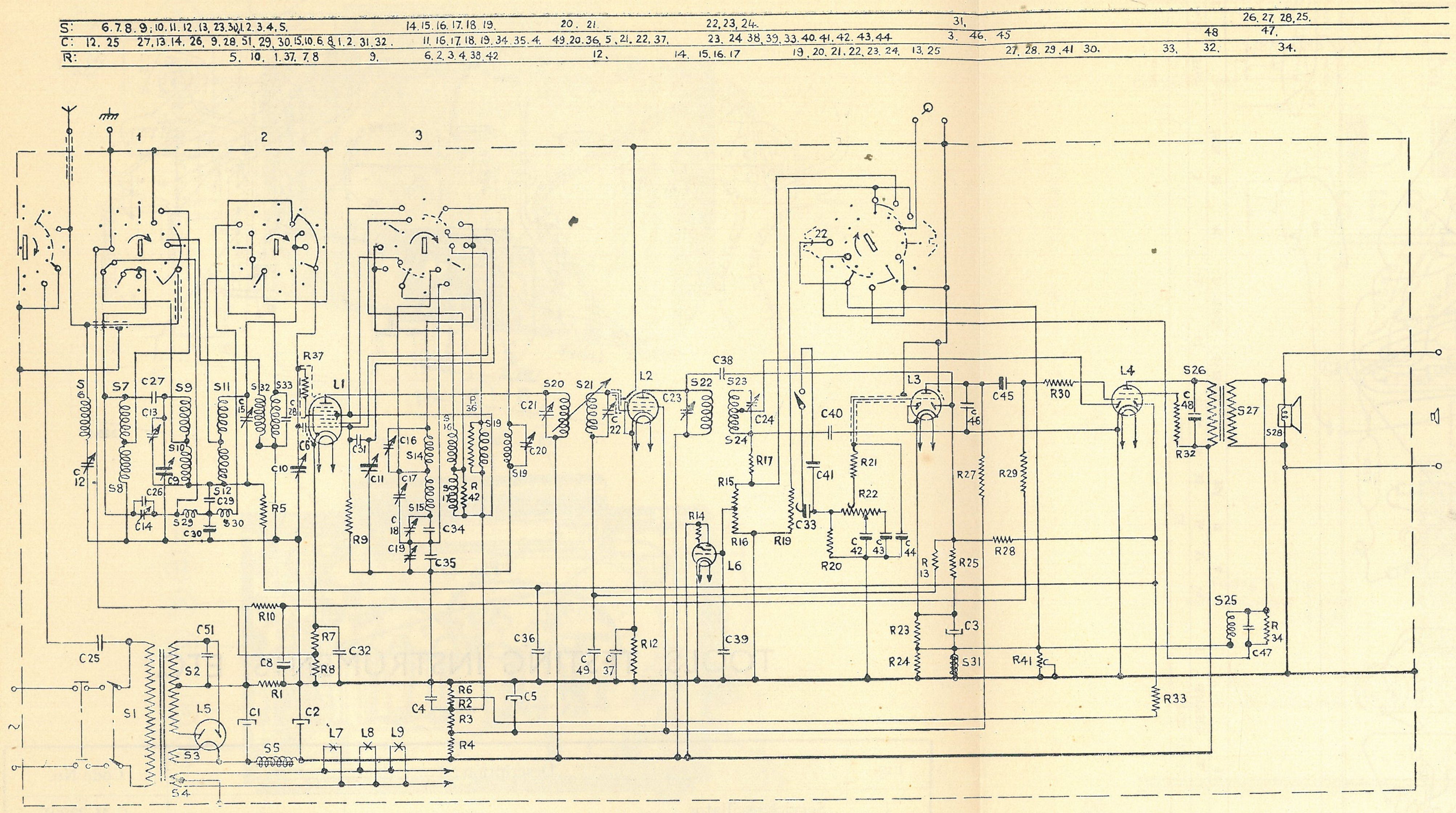
	L1 (FC4)	L2 (VP4B)	L3 (TDD4)	L4 (PEN4DD)	
Va	260	260	75	250	Volts
Vg′	55	150	—	260	Volts
Vg′ 2.3.5	55	—	—	—	Volts
Ia	1—0	8.5	0.7	32.0	Milliamps.
Ig′	g2 = 1.0 ma. g3.5 = 1.2 ma.	3.0	—	4.5	Milliamps.

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

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

COILS.

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



RESISTANCES.

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

R42 may be fitted across S17.

CONDENSERS.

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

* See page 11.

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