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1445

PHILCO

An A.M./F.M. Table Receiver Designed to Operate

DESIGNED to operate from A.C. or D.C. mains of 200-250V, 50-60 c/s in the case of A.C., the Philco 102 is a 5-valve (plus rectifier) A.M./F.M. table receiver housed in a plastics cabinet. The band ranges covered are 188-550m (M.W.), 1,100-1,920m (L.W.), and 88-100 Mc/s (F.M.). It is fitted with internal A.M. and F.M. aerials and sockets are provided for the connection of an external speaker and an external F.M. aerial.

Release date and original price: August 1959, £14 14s 2d. Purchase tax extra.

VALVE ANALYSIS

Valve voltages given in the table (col. 2) are those derived from the manufacturers' information. They were measured with a 20,000Ω/V meter, chassis being the negative connection in every case. The receiver was operating from A.C. mains of 230V with the mains adjustment set at the 230-250V tapping.

Valve Table

Valve		Anode (V)	Screen (V)	Cath. (V)
V1 UCC85		*	—	—
V2a UCH81	†	97	—	—
	‡	42	—	—
V2b UCH81	†	187	74	—
	‡	146	75	—
V3 UF89	†	182	72	—
	‡	173	65	—
V4d UABC80	†	90	—	—
	‡	85	—	—
V5 UL84	†	190	190	14·14
	‡	180	178	12·75
V6 UY85	†	*	—	247·0[1]
	‡	*	—	242·0[2]

* *No reading quoted.*
† *Measured with receiver switched to A.M.*
‡ *Measured with receiver switched to F.M.*
[1] *Cathode current 83·5 mA.*
[2] *Cathode current 92mA.*

CIRCUIT DESCRIPTION

Aerial coils **L9** and **L10** are mounted on a ferrite rod to form an internal aerial. For M.W. reception, **S2** is closed to short-circuit **L10**, and **L9** is tuned by **C22** and **C23**. For L.W. reception, **L9** and **L10** are connected in series and **S3** is closed to connect the additional tuning capacitor **C21**.

Triode-heptode valve **V2** operates as frequency changer, the output of oscillator section **a** being coupled via **C25** to the injector grid of mixer section **b**. **V2a** grid resistor **R13** is connected to chassis by A.M. switch **S10**. Oscillator grid coil **L11**

Capacitors		
C1	470pF	A2
C2	470pF	A2
C3	47pF	E4
C4	47pF	E4
C5	15pF	E4
C6	220pF	E4
C7	7pF	E4
C8	47pF	E4
C9	—	B2
C10	1,500pF	E4
C11	5pF	E3
C12	5pF	E3
C13	19pF	E3
C14	11·5pF	E3
C15	50pF	E3
C16	—	B2
C17	12pF	E3
C18	88pF	B3
C19	40pF	B3
C20	40pF	B2
C21	96pF	B1
C22	40pF	B2
C23	316pF	B2
C24	3,900pF	B2
C25	220pF	B2
C26	0·005μF	C2
C27	0·005μF	B2
C28	100pF	B2
C29	136pF	B1
C30	40pF	B1

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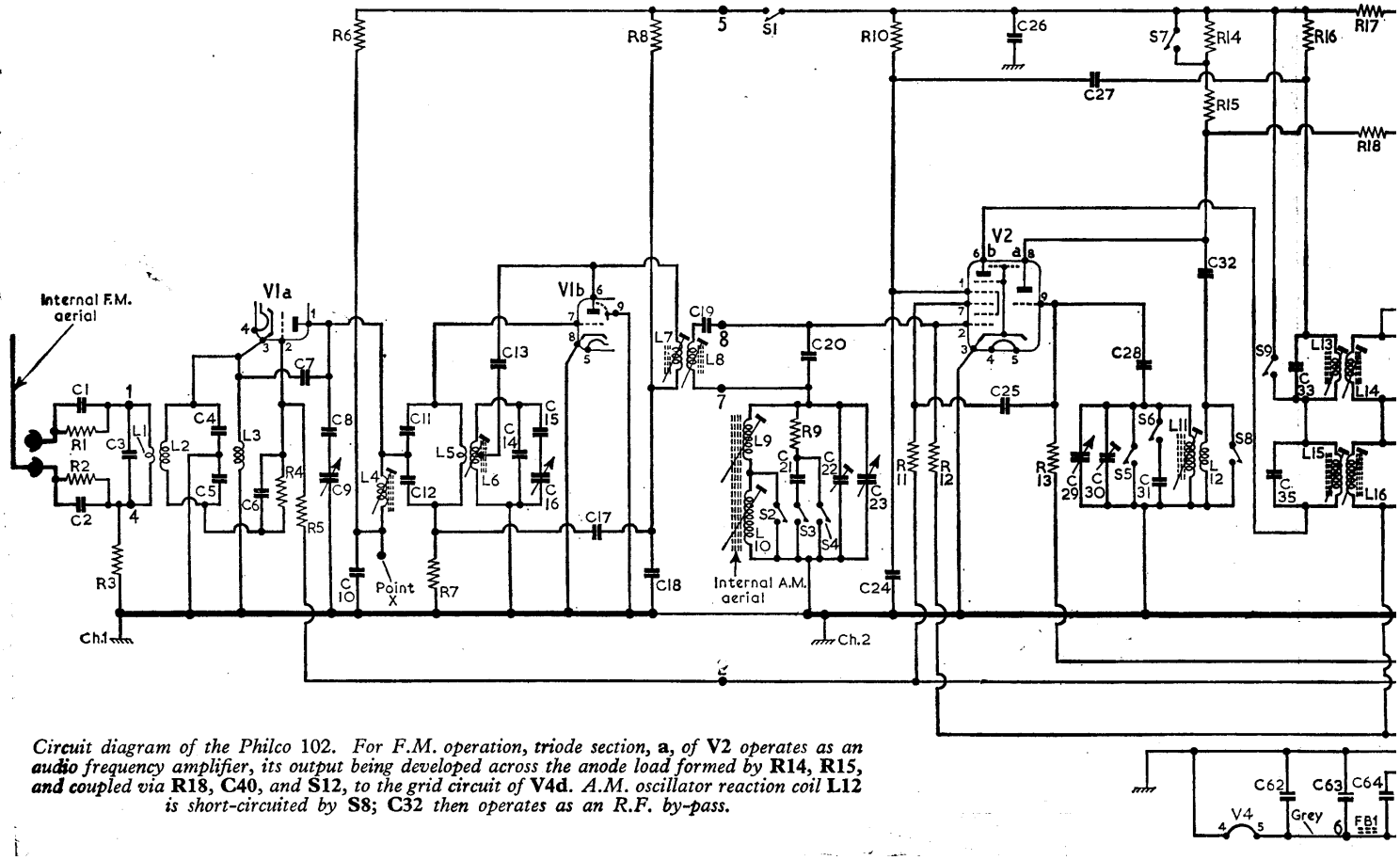


Circuit diagram of the Philco 102. For F.M. operation, triode section, a, of **V2** *operates as an audio frequency amplifier, its output being developed across the anode load formed by* **R14, R15,** *and coupled via* **R18, C40,** *and* **S12,** *to the grid circuit of* **V4d.** *A.M. oscillator reaction coil* **L12** *is short-circuited by* **S8; C32** *then operates as an R.F. by-pass.*

102

from Either A.C. or D.C. Mains Supply

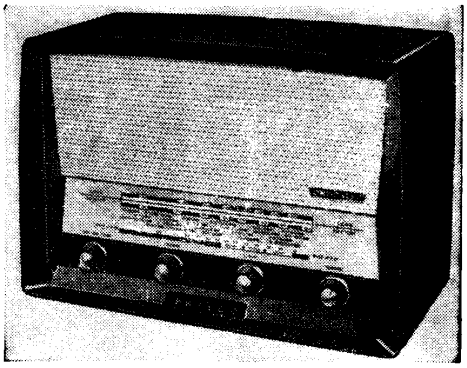
is tuned by **C29** and **C30** on M.W. and, in addition, by **C31** on L.W. Reaction coupling from **V2a** anode via **C32** and **L12**.

Variable-mu valve **V3** operates as intermediate frequency amplifier with tuned A.M. transformer couplings **C35, L15, L16, C36,** and **C44, L20, L21, C45,** to A.M. diode detector **V4c**. The primary winding, **L13,** of the second F.M. intermediate frequency transformer is short-circuited by **S9**.

A.M. intermediate frequency 470 Kc/s

The audio frequency component in the

(*Continued overleaf, col.* 1)



Appearance of the Philco 102

COMPONENT VALUES AND LOCATIONS

C31	277pF	B1
C32	220pF	B2
C33	12pF	B2
C34	12pF	B2
C35	220pF	B2
C36	220pF	B2
C37	0·006μF	C2
C38	0·005μF	C2
C39	0·01μF	C2
C40	0·005μF	B1
C41	18pF	C2
C42	56pF	C2
C43	500pF	C1
C44	220pF	C2
C45	220pF	C2
C46	100pF	C2
C47	0·04μF	C2
C48	0·02μF	C1
C49	100pF	C1
C50	300pF	C1
C51	4μF	C1
C52	0·02μF	C1
C53	220pF	C1
C54	32μF	C2
C55	40μF	C2
C56	3,900pF	D2
C57	40μF	C2
C58	500pF	D1
C59	10μF	C2
C60	0·001μF	D2
C61	0·02μF	D2
C62	0·005μF	B2
C63	0·001μF	‡A2
C64	0·001μF	E3
C65	0·001μF	E3
C66	0·002μF	B2

Resistors

R1	1·8MΩ	A2
R2	1·8MΩ	A2
R3	68Ω	‡A2
R4	680kΩ	E4
R5	1·5MΩ	E4
R6	2·2kΩ	E4
R7	680kΩ	E3
R8	6·8kΩ	E4
R9	100Ω	B1
R10	22kΩ	B2
R11	68kΩ	B2
R12	1MΩ	B2
R13	47kΩ	B2
R14	22kΩ	B1
R15	15kΩ	B2
R16	2·7kΩ	C2
R17	470Ω	C2
R18	220kΩ	B2
R19	47kΩ	C2
R20	3·3kΩ	C2
R21	220Ω	C1
R22	100kΩ	C1
R23	100kΩ	C1
R24	1MΩ	C1
R25	4·7MΩ	B1
R26	2·7MΩ	B1
R27	27kΩ	C1
R28	2·2MΩ	B1
R29	1MΩ	C1
R30	10MΩ	D1
R31	120kΩ	D1
R32	500Ω	C2
R33	1MΩ	D1
R34	680kΩ	D2
R35	270Ω	C2
R36	680Ω	C2
R37	250Ω	D2
R38	2·2kΩ	D2
R39	100Ω	D1

Coils*

L1	—	E4
L2	—	E4
L3	—	E4
L4	—	E4
L5	—	E3
L6	—	E3
L7	—	E3
L8	—	E3
L9	—	A2
L10	—	C2
L11	3·0	B1
L12	—	B1
L13	—	B2
L14	—	B2
L15	6·5	B2
L16	6·5	B2
L17	—	C2
L18	—	C2
L19	—	C2
L20	6·5	C2
L21	6·5	C2
L22	—	†

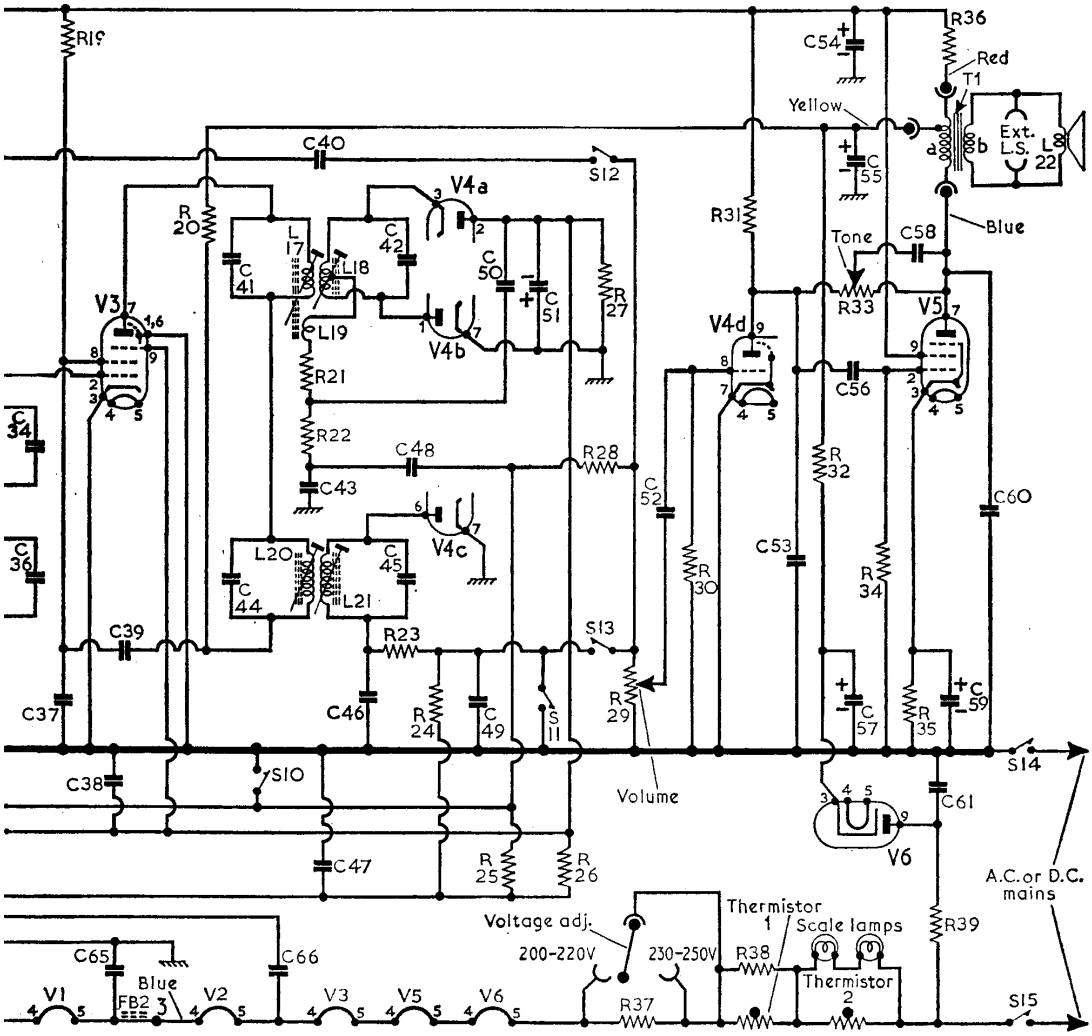
Transformer*

T1	a	400·0	†
	b	—	

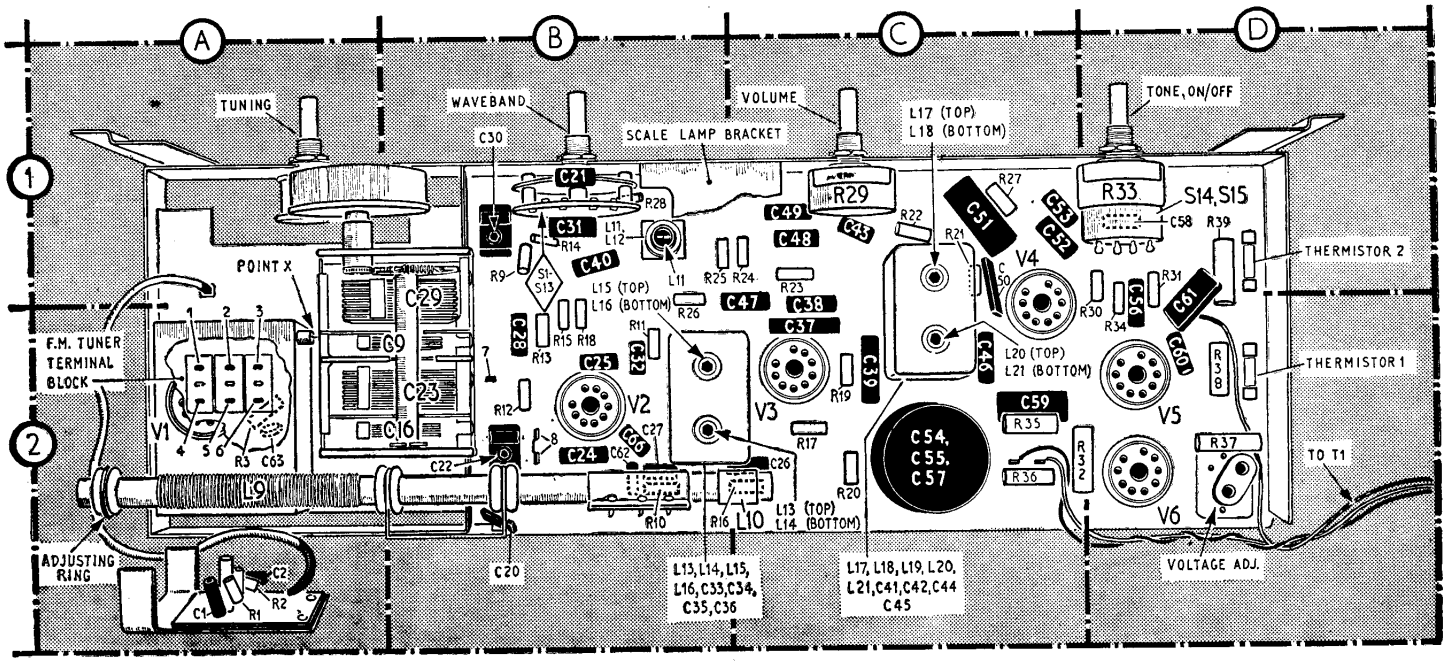
Miscellaneous

Thermistor 1 VA1010		D2
Thermistor 2 VA1010		D1
FB1	—	E4
FB2	—	E4
S1-S13	—	B1
S14, S15	—	D1

numbers in these tables are used when ordering spare parts, ted to mention the fact on the order, as these numbers may om those used in the manufacturers' service manual.



* Approximate D.C. resistance in ohms.
† Mounted on speaker.
‡ Below tuner unit.



Plan view of the chassis. The details of the F.M. tuner unit are not included in this illustration, two detailed views being provided in col. 6. The unit is shown cut away to reveal the terminal block; its terminals are numbered as in our circuit diagram overleaf. The two scale lamps are not shown.

Circuit Description—*continued*

rectified output of **V4c** is passed via I.F. filter circuit **R23, C49,** and A.M. switch **S13,** to **R29,** which operates as a combined diode load and volume control. The D.C. component of the rectified signal developed across **R29** is fed back as A.G.C. bias to **V2b** and **V3** via decoupling circuit **R24, C47.**

V4d operates as an A.F. amplifier, its output being resistance-capacitance coupled by **R31, C56** and **R34** to the control grid of pentode output valve **V5.** Tone correction by **C60,** and tone control by **R33, C58** in the anode circuit of **V5.**

H.T. current is supplied by half-wave rectifying valve **V6.** Smoothing by **C57, R32, C55,** section **a** of output transformer **T1, R36** and **C54.**

Operation on F.M.

Balanced aerial input is coupled via **L1, L2** to a conventional F.M. tuner employing an earthed-grid R.F. amplifier **V1a** and self-oscillating mixer **V1b.** The R.F. and oscillator circuits are capacitance tuned by **C9** and **C16.**

V2b and **V3** form a two-valve F.M. intermediate frequency amplifier which is connected by tuned transformers **L7, L8, C19, C20; C33, L13, L14, C34;** and discriminator transformer **C41, L17, L18, L19, C42,** to diode sections **a** and **b** of **V4,** which operate in a ratio detector circuit.

F.M. intermediate frequency 10.7 Mc/s

The audio frequency output of the ratio detector is developed across **C43** and fed via **C48** and **R13** to the grid of **V2a,** which for F.M. operation functions as an A.F. amplifier. The output of **V2a** is developed across the anode load comprising **R14, R15,** and is coupled via **R18, C40,** and F.M. switch **S12,** to volume control **R29. C32** operates as an R.F. bypass, A.M. oscillator reaction coil **L12** being short-circuited by **S8.**

V2b and **V3** are grid current biased by connecting **R24** to chassis via F.M. switch **S11.** The negative voltage developed across stabilizing capacitor **C51** is fed back as A.G.C. bias to the grid of **V1a,** the injector grid of **V2b,** and the suppressor grid of **V3.** A fraction of this voltage is also fed to the control grids of **V2b** and **V3.**

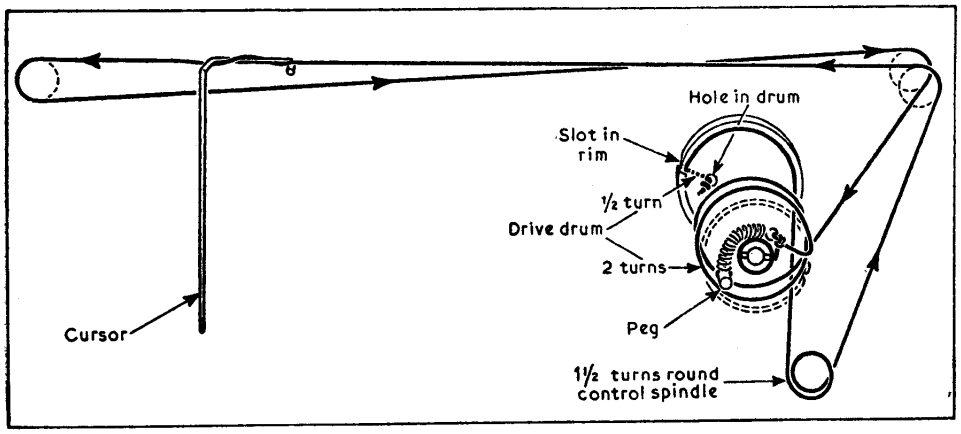


Diagram of the tuning drive system drawn as seen from the front of the chassis with the gang at minimum capacitance and with the tuning scale and backing plate removed. With the gang at maximum capacitance the cursor should be adjusted to coincide with the right-hand ends of the tuning scale apertures.

CIRCUIT ALIGNMENT

Equipment Required.—An A.M. signal generator, modulated 30 per cent at 400 c/s; an F.M. signal generator, deviated by ±25kc/s; an output meter; a 0.1μF capacitor and a 400pF capacitor; and two trimming tools, a hexagonal type and a non-metallic screwdriver type.

The chassis should be connected to the mains via an isolating transformer. Where this is not available ensure that the chassis is connected to the neutral side of the mains. No earth connection, either direct or through earthed equipment, should be made to the receiver. Connect the signal generator to the receiver via an isolating capacitor in its live output lead.

To facilitate accurate tuning of the receiver to the alignment frequencies, calibration dots are provided on the M.W. and L.W. tuning scales. At all times during the alignment procedure the signal generator attenuator should be adjusted to maintain approximately 100mW output from the receiver.

A.M. Alignment

1.—Connect the output meter across the speaker. Connect the A.M. signal generator between chassis and the control grid of **V2b** (tags **7** and **8,** location reference B2) via the 0.1μF capacitor in its live output lead. Switch the receiver to M.W. Turn the tuning gang to minimum capacitance and the volume control to its maximum clockwise position.

2.—Feed in a modulated 470kc/s signal and adjust the cores of **L21, L20** (location reference C2) and **L16, L15** (location reference B2) for maximum output.

3.—With the tuning gang at maximum capacitance check that the cursor co-

incides with right-hand ends of the tuning scale apertures.

4.—Loosely couple the signal generator to the ferrite rod aerial via a loop of insulated wire. Tune the receiver to the calibration dot at 517m. Feed in a 580kc/s signal and adjust the core of **L11** (B1) for maximum output. Then slide the adjusting ring along the ferrite rod for maximum output.

5.—Tune the receiver to the calibration dot at 214m. Feed in a 1,400kc/s signal and adjust **C30** (B1) and **C22** (B2) for maximum output.

6.—Switch the receiver to L.W. and tune to the calibration dot at 1,364m. Feed in a 220kc/s signal and slide the former of **L10** (C2) along the ferrite rod for maximum output.

F.M. Alignment

1.—Connect the output meter across the speaker and the F.M. signal generator to **V2b** control grid (tags **7** and **8**, location reference B2) via the 400pF capacitor in its live output lead. Switch the receiver to F.M. and allow it to warm up for at least ten minutes. Set the volume control 90 deg. back from its fully clockwise position and set the tone control to the maximum treble position.

2.—Feed in a 10.7 Mc/s signal, deviated by ±25kc/s and adjust the cores of **L17, L18** (location reference C1), and **L14, L13** (location reference B2) for maximum output. Remove the F.M. signal generator.

3.—Connect the A.M. signal generator to tags **7** and **8**. Feed in a modulated 10.7Mc/s signal and adjust the core of **L18** (C1) for *minimum* output. Disconnect the A.M. generator.

4.—Reconnect the F.M. signal generator to tags **7** and **8** and check that the level of F.M. output has been retained. If maximum A.M. rejection does not coincide with maximum F.M. output, **L18** should be adjusted for maximum A.M. rejection at the expense of a slight reduction in F.M. output.

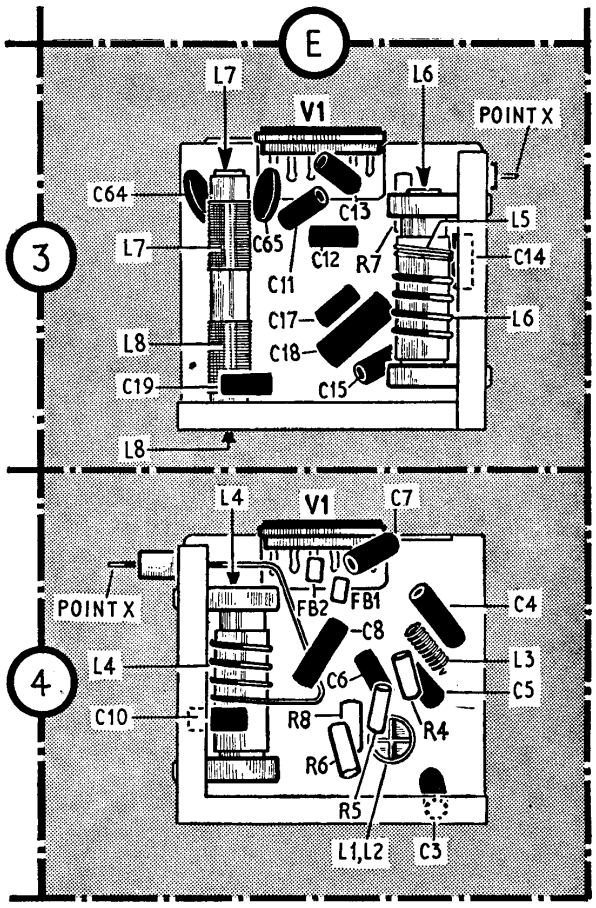
5.—Unscrew the core of **L8** (location reference E3) so that it protrudes from the former by approximately ⅜in. Transfer the F.M. signal generator to test point **X** on the tuner unit (location reference A2). Feed in a 10.7Mc/s signal and adjust the cores of **L8** and **L7** (location reference E3) for maximum output.

6.—With the tuning gang at maximum capacitance check that the cursor coincides with the right-hand ends of the tuning scale apertures.

7.—Transfer the F.M. signal generator to the aerial sockets. Tune the receiver to 91Mc/s. Feed in a 91Mc/s signal and adjust the core of **L6** (E3) for maximum output. If two peaks are obtained while adusting **L6**, tune to the first one obtained from the adjusting end of the coil former.

GENERAL NOTES

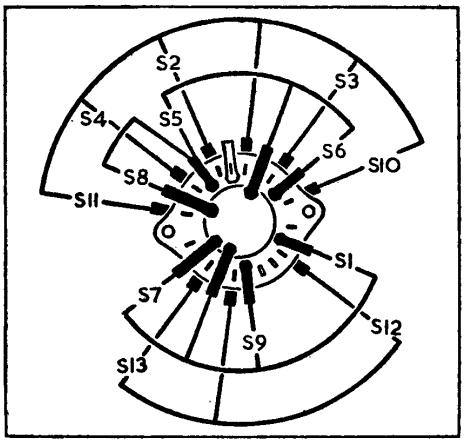
Switches.—S1-S13 are the waveband and A.M./F.M. change-over switches ganged in a single rotary unit and shown in our illustration of the chassis in location reference B2. A detailed diagram of the unit is shown in column 5, where the contacts are drawn as seen when viewed in the direction of the arrow in the chassis illustration. The table (col. 5) shows the switch operations for the three control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open, and **C** closed.



Two views of the F.M. tuner unit with the screening cover removed. At the top is the view as seen from the rear of the chassis and below it is shown a view from the other side, the front of the chassis. The screening cover is retained by a single self-tapping screw on the top, which also fixes the cleat for the aerial lead. The terminal block is not shown; details of this are given in the plan view of the chassis, col. 1.

Switch Table and Diagram

Switches	L.W.	M.W.	F.M.
1	—	—	C
2	—	C	C
3	C	—	—
4	—	—	C
5	—	—	C
6	C	—	—
7	C	C	—
8	—	—	C
9	C	C	—
10	C	C	—
11	—	—	C
12	—	—	C
13	C	C	—



The waveband switch unit is drawn as seen when viewed in the direction of the arrow in the plan view of the chassis.

Drive Cord Replacement.—Approximately 60in of nylon-braided glass yarn is required for a new drive cord. To replace the cord, remove the tuning scale (pull off four retaining clips) and the scale backing plate (remove two press-studs and tension springs).

Turn the gang to minimum capacitance. Tie a knot in one end of the cord and thread it through the hole in the rear of the drive drum, feeding it through from the front until the knot anchors. Pull the free end of the cord through the slot in the rim of the drive drum and run it as indicated in the sketch of the tuning drive system shown in cols. 1 & 2. Finally, pass the cord through the slot in the front of the drum and slip it through one end of the tension spring, attaching the other end of the spring to the moulded peg. Before knotting the cord to the spring, ensure that the spring is exerting sufficient tension on the cord.

Replace the cursor, scale backing plate and tuning scale. With the gang at maximum capacitance, check that the cursor coincides with the right-hand ends of the tuning scale apertures.

Scale Lamps.—These are two 12V, 0.1A lamps with clear spherical bulbs and M.E.S. bases.

Modifications.—In early versions of this receiver **R5** is 1MΩ, and **C63** is omitted. **C19** is connected between **L8** and tag **7** on the printed circuit panel.

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