PHILIPS 200U

3-band A.C./D.C. Table Superhet

DESIGNED to operate from 200-250 V A.C. or 200-230 V D.C. mains, the Philips 200U is a 4-valve (plus rectifier) three-band table superhet housed in a plastic cabinet. The wave-band ranges are 13.8-50 m, 185.2-580.3 m, 1,150-2,000 m.

Release date and original price: May 1951 £12 10s. plus purchase tax.

CIRCUIT DESCRIPTION

Input from self-contained plate aerial, or external aerial, via coupling coils L2 (S.W.), L3 (M.W.) to single-tuned circuits L4, C25 (S.W.), L5, C25 (M.W.). On L.W. S1 closes and S3 opens, coupling the aerial input via the common impedance of C2 to the tuned circuit formed by L5, L3 and C25. I.F. filtering by L1, C22. R1 shunts the aerial input to prevent modulation hum. On M.W. S2 closes, shunting R2 across L3.

First valve (V1, Mullard UCH42) is a triode hexode valve operating as frequency changer. Oscillator anode coils L8 (S.W.), L9 (M.W.) are tuned by C29. L9 is also used for L.W., when it is shunted by C26. Parallel trimming by C26 (M.W.) and C26, series tracking by C27 (M.W. and L.W.). Inductive reaction coupling by L6 (S.W.) and L7 (M.W. and L.W.) with additional coupling across the common impedance of C27 on M.W. and L.W.

Second Valve (V2, Mullard UF41) is a variable-mu R.F. pentode with tuned transformer couplings C5, L10, L11, C6 and C11, L12, L13, C12.

Intermediate frequency 470 kc/s.

Diode signal detector is part of double diode triode valve (V3, Mullard UBC41). A.F. component in rectified output is developed across volume control R10, which acts as diode load, and is passed via series capacitor C15 and grid stopper R12 to grid of triode section. Second diode of V3 is connected to chassis. Bass boost at the low level settings of the volume control is provided by R9, C14.

D.C. potential developed across volume control R10 is fed back to F.C. and I.F. stages as bias giving automatic gain control. I.F. filtering by C13.

Resistance-capacitance coupling between V3 triode and pentode output valve (V4, Mullard UL41). Tone correction in anode circuit by C18, by the negative feed-back voltage developed across R15 in the cathode circuit, and by feed-back of speech coil voltages appearing across T1 secondary to the grid circuit of V3 via C17.

H.T. current is supplied by I.H.C. rectifying valve (V5, Mullard UY41). Smoothing by electrolytic capacitors C19, C20 and resistor R21. R.F. filtering by C21. R16 protects V5, and thermistor R17 protects the scale lamp and heater chain, against current surges.

Valve heaters, together with scale lamp, thermistor, ballast resistors R18, R19 and voltage adjustment resistor R20, are connected in series across the mains input.

GENERAL NOTES

Switches.—S1-S10 are the waveband switches, ganged in a three-position rotary unit below the chassis. Its position is indicated in our under-chassis view, and shown in detail in the diagram overleaf, where it is drawn as seen from the rear of an inverted chassis.

The table below it gives the switch positions for the three control settings, starting from the fully anti-clockwise position of the control. A dash indicates open and C closed.

(Continued col. 1 overleaf)

COMPONENTS AND VALUES

RESISTORS		Values	Locations
R1	Aerial shunt	10kΩ	G2
R2	M.W. aerial shunt	2·2kΩ	G3
R3	V1 hex. C.G.	820kΩ	F2
R4	V1 osc. C.G.	22kΩ	F2
R5	M.W. osc. shunt	10kΩ	G3
R6	Osc. anode feed	22kΩ	F3
R7	V1, V2 S.G. feed	18kΩ	F3
R8	A.G.C. decoupling	1·5MΩ	E3
R9	Tone compensator	15kΩ	D3
R10	Volume control	850kΩ	D2
R11	V3 C.G.	4·7MΩ	E3
R12	V3 C.G. stopper	56kΩ	E3
R13	V3 anode load	220kΩ	E2
R14	V4 C.G.	680kΩ	E3
R15	V4 G.B.	150Ω	E3
R16	V5 surge limiter	180Ω	C1
R17	Thermistor	—	E3
R18	Heater ballast {	430Ω	C1
R19	} resistors {	200Ω	C1
R20	Voltage adjust.	82Ω	C1
R21	H.T. smoothing	1kΩ	E2

CAPACITORS		Values	Locations
C1	Aerial series	0·001µF	—
C2	L.W. coupling	0·0018µF	G2
C3	L.W. aerial trim	90pF	G3
C4	V1 hex. C.G.	100pF	F2
C5	1st I.F. trans. {	110pF	A1
C6	} tuning {	110pF	A1
C7	V1 osc. C.G.	47pF	F3
C8	A.G.C. decoupling	0·047µF	F3
C9	Osc. anode coup.	470pF	G3
C10	V1, V2 S.G. decoup.	0·1µF	F2
C11	2nd I.F. trans. {	110pF	B1
C12	} tuning {	110pF	B1
C13	I.F. by-pass	56pF	E3
C14	Tone compensator	0·01µF	E3
C15	A.F. coupling {	0·0022µF	D3
C16	} {	0·01µF	E3
C17	Neg. feed-back	22pF	E2
C18	Tone corrector	0·0047µF	C1
C19*	H.T. smoothing {	50µF	C1
C20*	} {	50µF	C1
C21	R.F. by-pass	0·033µF	D2
C22‡	I.F. filter tune	30pF	—
C23‡	S.W. aerial trim.	30pF	F2
C24‡	M.W. aerial trim.	12·5pF	G3
C25†	Aerial tuning	§489pF	A1
C26‡	L.W. osc. trimmer	575pF	F3
C27‡	M.W. osc. tracker	575pF	G3
C28‡	M.W. osc. trimmer	30pF	G3
C29†	Oscillator tuning	§489pF	A1

* Electrolytic.   † Variable.   ‡ Pre-set.
§ " Swing " value, min to max.
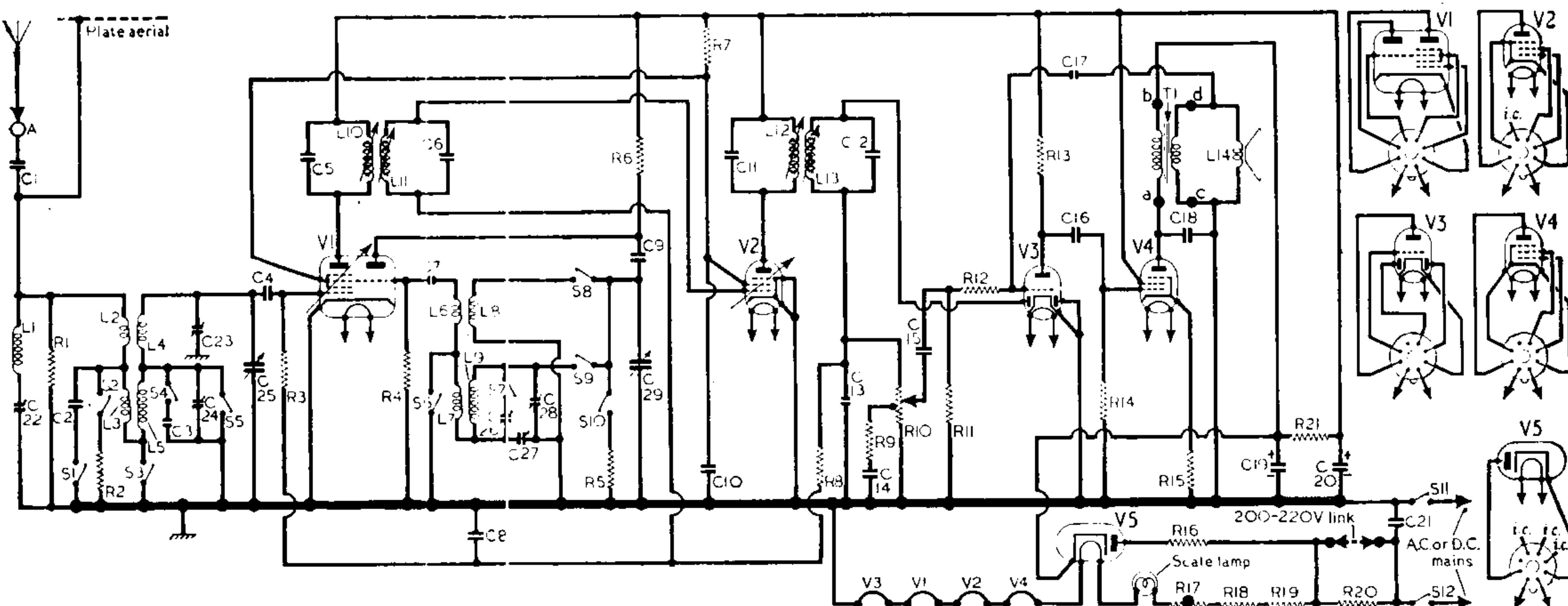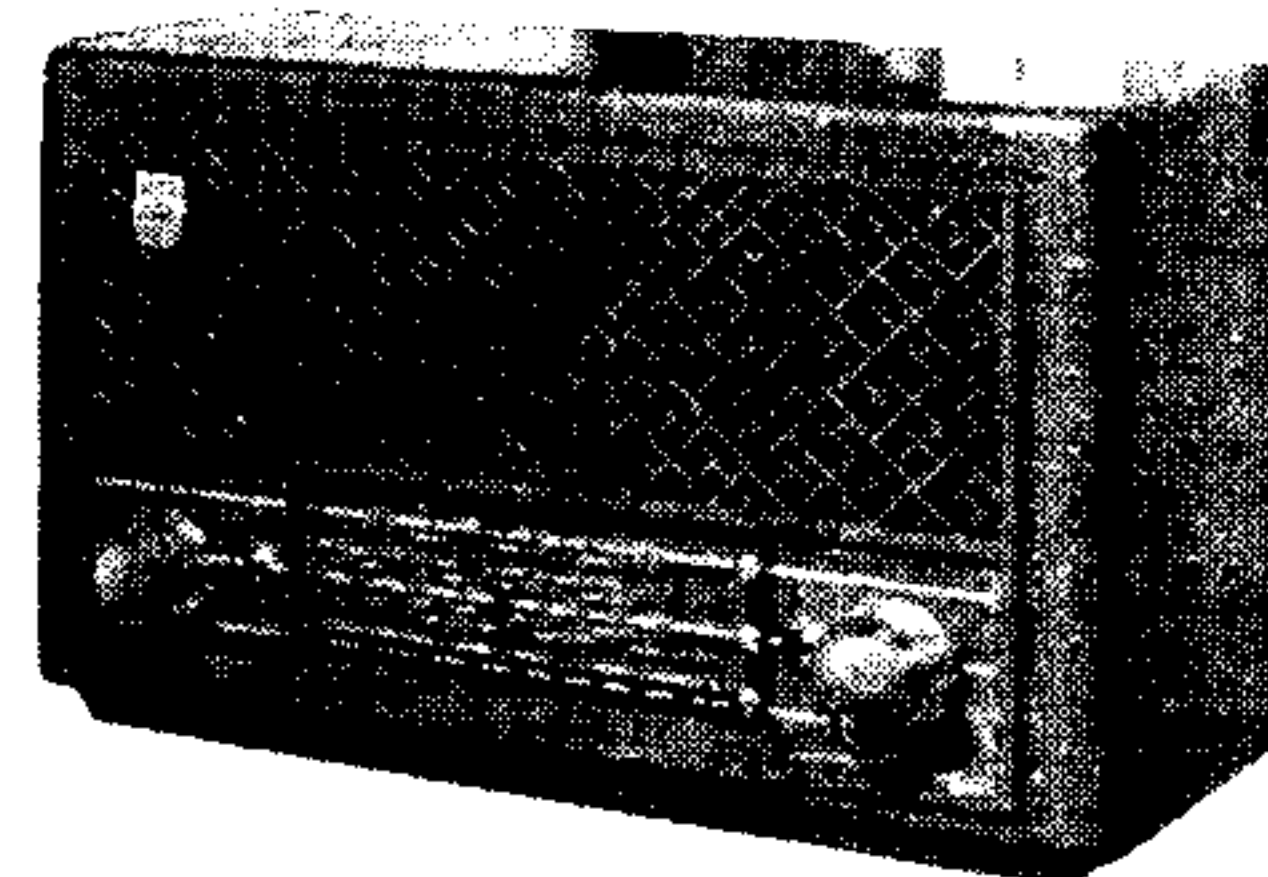
Circuit diagram of the Philips 200U A.C./D.C. superhet.   On L.W. S3 opens and S1 closes connecting the S.W. coil L4, the M.W. coil L5, and the M.W. coupling coil L3 in series to form the L.W. aerial tuning coil.

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	I.F. filter coil ...	30·0	—
L2	⎫	2·1	G2
L3	⎬ Aerial coils ⎰	22·0	G2
L4	⎰	0·2	G2
L5		4·4	G2
L6	⎫	0·5	G3
L7	⎬ Oscillator coils ⎰	1·6	G3
L8	⎰	0·2	G3
L9		2·1	G3
L10	⎱ 1st I.F. ⎰ Pri. ...	12·3	A1
L11	⎰ trans ⎱ Sec. ...	12·3	A1
L12	⎱ 2nd I.F. ⎰ Pri. ...	12·3	B1
L13	⎰ trans ⎱ Sec. ...	12·3	B1
L14	Speech coil ...	5·0	—
T1	⎰ Primary ...	380·0	C1
	⎱ Secondary...	0·8	G3
S1-S10	Waveband switches	—	—
S11, S12			
S12	Mains sw..g'd R10	—	D2

General Notes—continued

S11, S12 are the mains switches mounted on the volume control **R10**.

Plate Aerial.—This consists of a strip of metallized paper gummed to the roof of the cabinet.

Scale Lamp.—This is a Philips type 8097D with a tubular bulb and an M.E.S. base. It is rated at 20 V, 0.1 A.

Mains Voltage Adjustment.—This consists of a single link, indicated in our under-chassis view, which when set for 200-220 V A.C. or D.C. operation (figure 1 on paxolin strip in line with window) shorts out **R20**. For 220-250 V A.C. or 220-230 V D.C. operation (figure 2 in line with window) the link is open and **R20** is in circuit.

Tuning Coils.—Only four coils are used to cover the three wavebands in both the aerial and oscillator circuits, these coils being connected in the conventional way for S.W. and M.W. coupling and tuning, and in the following manner for L.W. operation.
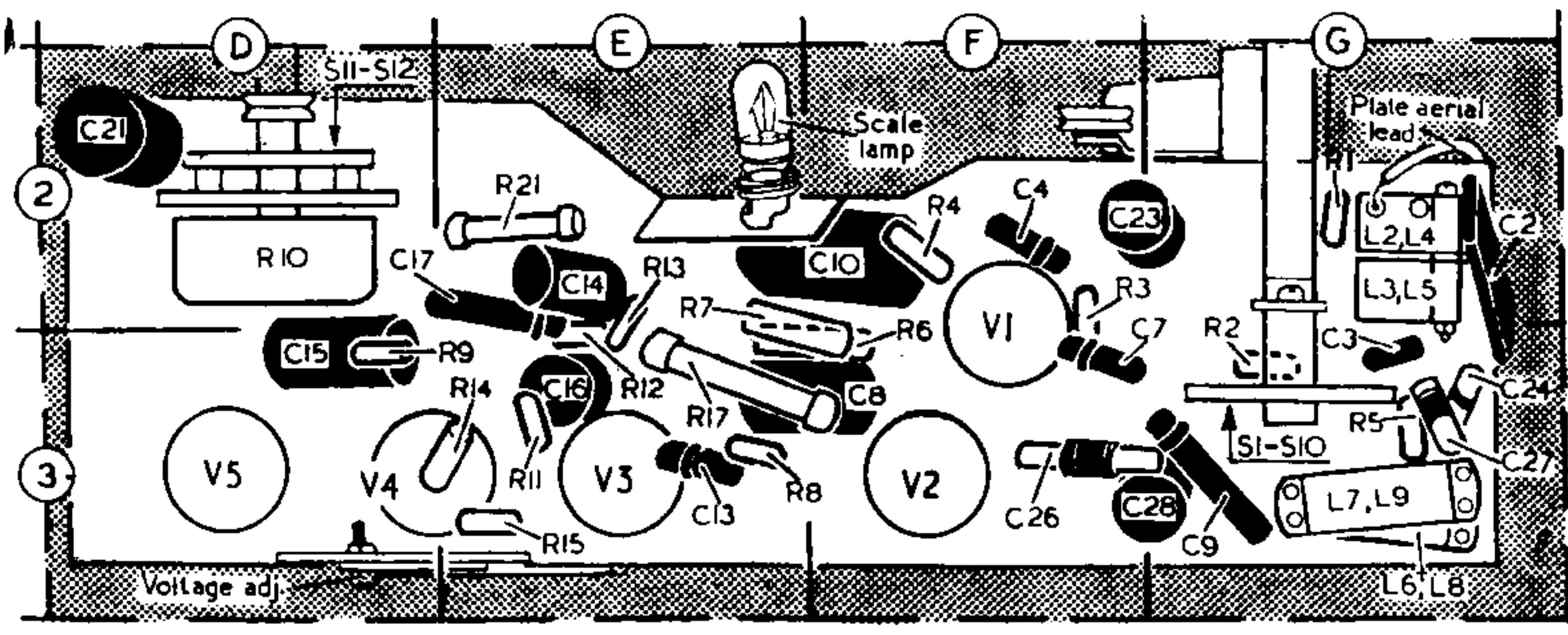
M.W. coupling coil **L3** is connected in series with M.W. tuning coil **L5** to form the L.W. tuning coil, the aerial being coupled via the common impedance of **C2**. In the oscillator stage, L.W. coverage is obtained by using the M.W. circuit and shunting it with **C26**.

Drive Cord Replacement.—About 3ft of cord is required, and it should be made up with a loop at each end to measure 865 mm (34.36in or 34⅜in) overall, using special metal collars to clamp the ends. Turn the gang to maximum capacitance, hook one end of the cord to the spring and run on as shown in the sketch (col. 2), starting anti-clockwise round the drum. Do not hook the end of the spring to its anchor tag until the end of the run, when both cord loops are secured to it.

Modifications.—In some models a 1 kΩ grid stopper is connected between the junction of **C16**, **R14** and **V4** control grid, and a 27 Ω resistor is connected between **S6** and the junction of **L6, L7**.

Diagram of the waveband switch unit, with the associated table below.
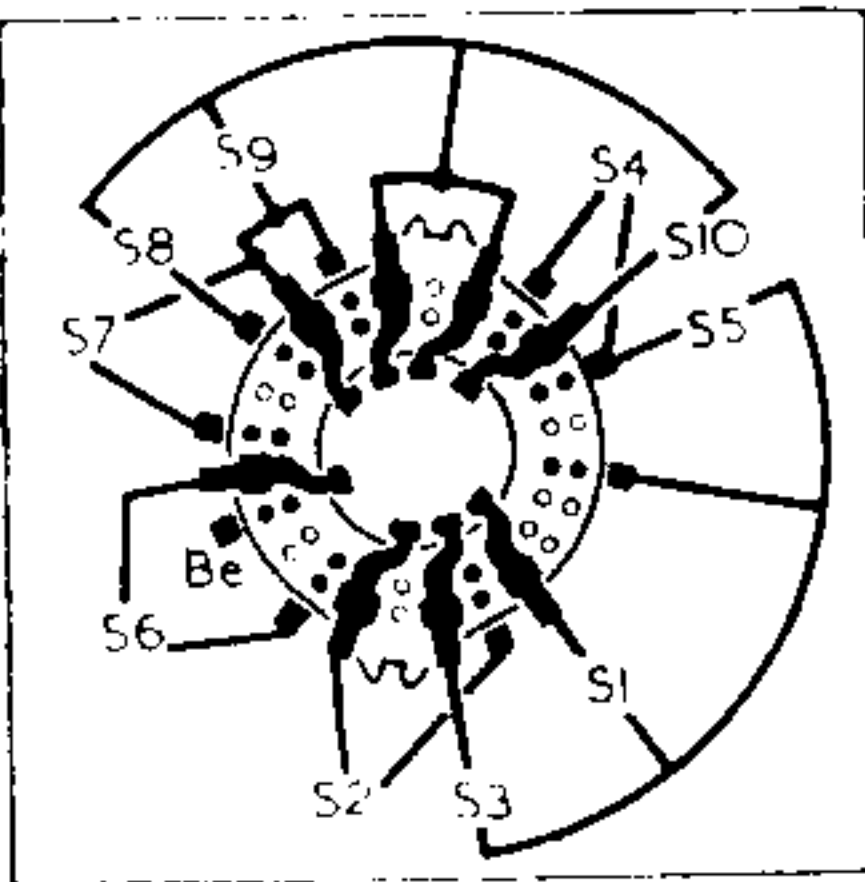
Switches	M.W.	S.W.	L.W.
S1	—	C	C
S2	C	—	—
S3	C	—	—
S4	—	—	C
S5	—	C	—
S6	—	C	—
S7	—	—	C
S8	—	C	—
S9	C	—	C
S10	C	—	C

Underside view of the chassis. **C24, C26** and **C27** are special Philips trimmers.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those taken from the manufacturers' information. They were measured on a receiver which was operating from A.C. mains of 220 V with the voltage adjustment set appropriately. The volume control was turned to maximum but there was no signal input.

Voltage readings were measured with a 20,000 ohms per volt meter, chassis being negative.

Valves	Anode		Screen		Cath.
	V	mA	V	mA	V
V1 UCH42	155	2·5		3·5	—
	Oscillator				
	93	3.0			
V2 UF41	155	5·0	85	2·0	—
V3 UBC41	65	0·5	—	—	—
V4 UL41	151		155	9·0	8·5
V5 UY41	208 †				180·0

† A.C. volts.
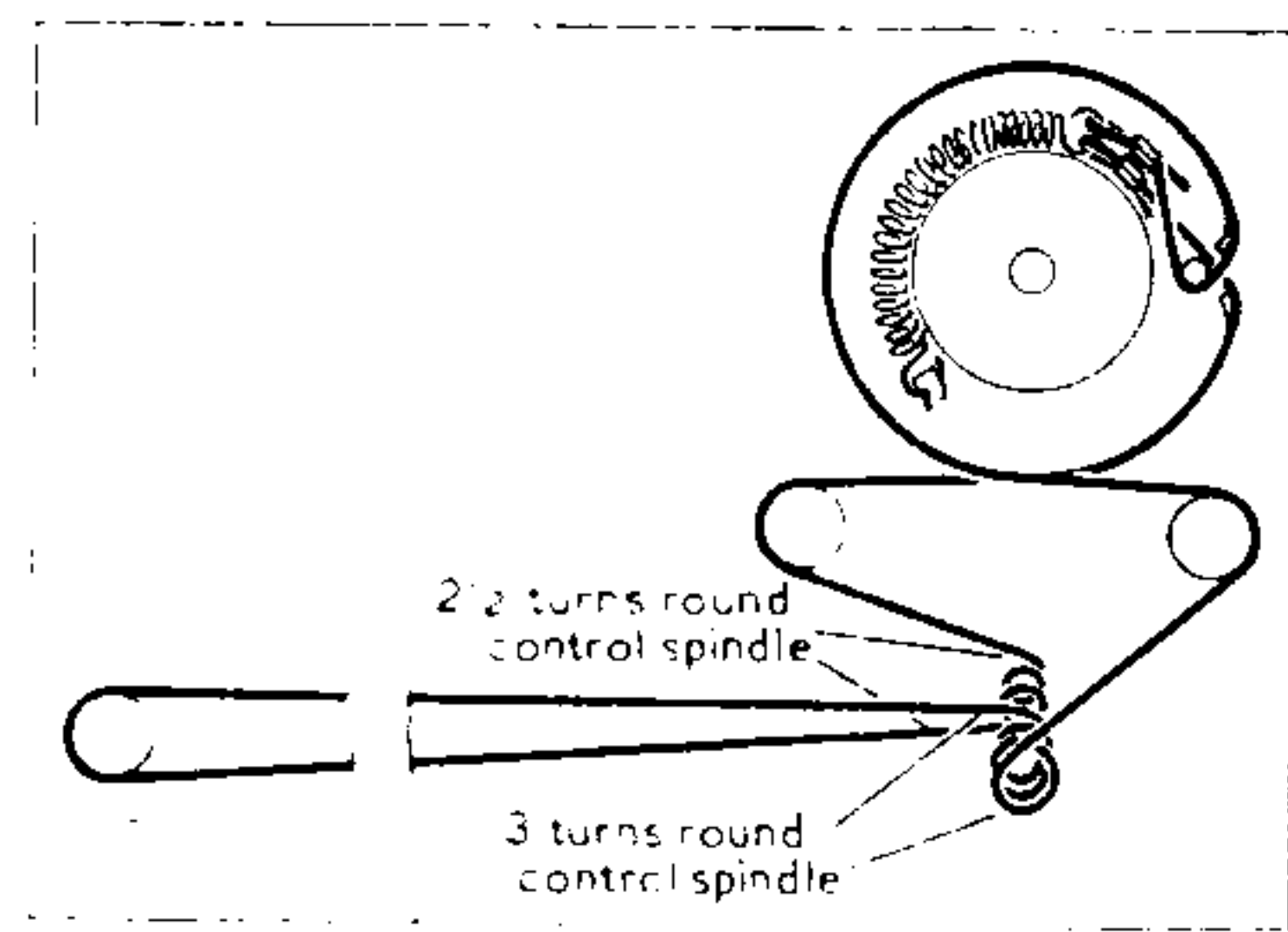
Sketch showing the tuning drive.

DISMANTLING THE SET

Removing Chassis.—Remove two control knobs (recessed grub screws passing through spindles);

unsolder plate aerial lead from its termination on L2 (location reference G2);

remove two cheese-head bolts with clamps securing the rear edge of the chassis;

slacken off the screw on the cursor carriage, accessible through the base of the receiver, and disengage the drive cord;

withdraw chassis to the extent of the speaker leads, and unsolder them from the speech coil tags.

When replacing, connect the black lead to the lower speech coil tag and the yellow lead to the top tag.

CIRCUIT ALIGNMENT

All the following adjustments can be made accessible upon the removal of the cabinet back and base cover (one unit).

I.F. Stages.—Switch set to M.W., turn gang to minimum and volume control to maximum. Unscrew the cores of coils **L13, L12** (location reference B1) and **L11, L10** (A1). Connect the output of signal generator via a 0.032 μF capacitor in the "live" lead to control grid (pin 6) of **V1** and chassis. Feed in a modulated 470 kc/s (638.3 m) signal and adjust the cores of **L13** and **L12** for maximum output. Transfer signal generator leads to control grid (pin 6) of **V1** and chassis. Adjust the cores of **L11** and **L10** for maximum output, reducing the input as the circuits come into line to avoid A.G.C. effects. Do not readjust the cores of **L13** and **L12**.

I.F. Filter.—Transfer "live" signal generator lead to A socket, and with the set switched to M.W. and the gang at maximum, feed in a strong 470 kc/s signal and adjust **C22** (in top front of cabinet) for minimum output.

R.F. and Oscillator Stages.—Check that with the gang at maximum the cursor is about 1 mm to the left of the "M" at the end of the M.W. tuning scale. **C24, C26** and **C27** are trimmed by adjusting the amount of wire with which they are wound. Wire can be removed but none must be added. If it is found that the capacitance of one of these trimmers needs increasing, a new trimmer should be fitted.

S.W.—Switch set to S.W. and connect the output of the signal generator "live" lead, via a suitable dummy aerial, to the A socket. Feed in a 13.76 m (21.8 Mc/s) signal, tune it in, and adjust **C23** (F2) for maximum output.

M.W.—Switch set to M.W., turn gang to minimum capacitance and feed in a 184 m (1,630 kc/s) signal. Adjust **C28** (G3) and **C24** (G3) for maximum output. No adjustment should be required at the L.F. end of the band and **C27** (G3) should not need adjustment. It is set at 600 kc/s.

L.W.—Switch set to L.W. and tune to approximately 1,245 m. Feed in a 1,245 m (241 kc/s) signal and adjust **C26** (F3) for maximum output.

Plan view of the chassis. The tags on **T1** are coded **a-d** to agree with corresponding points in the circuit diagram.