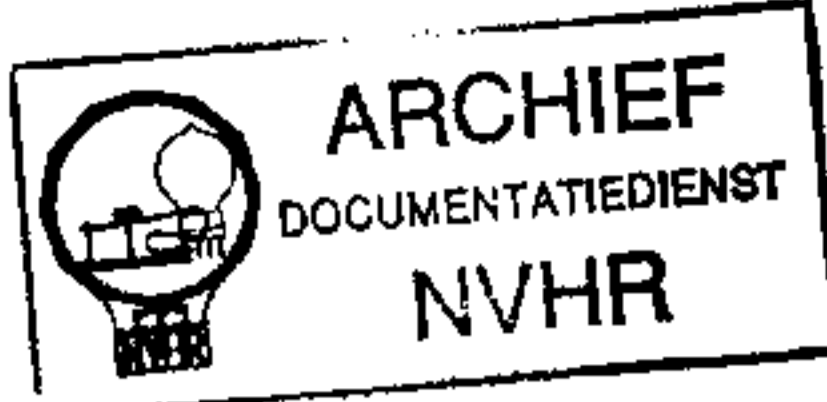
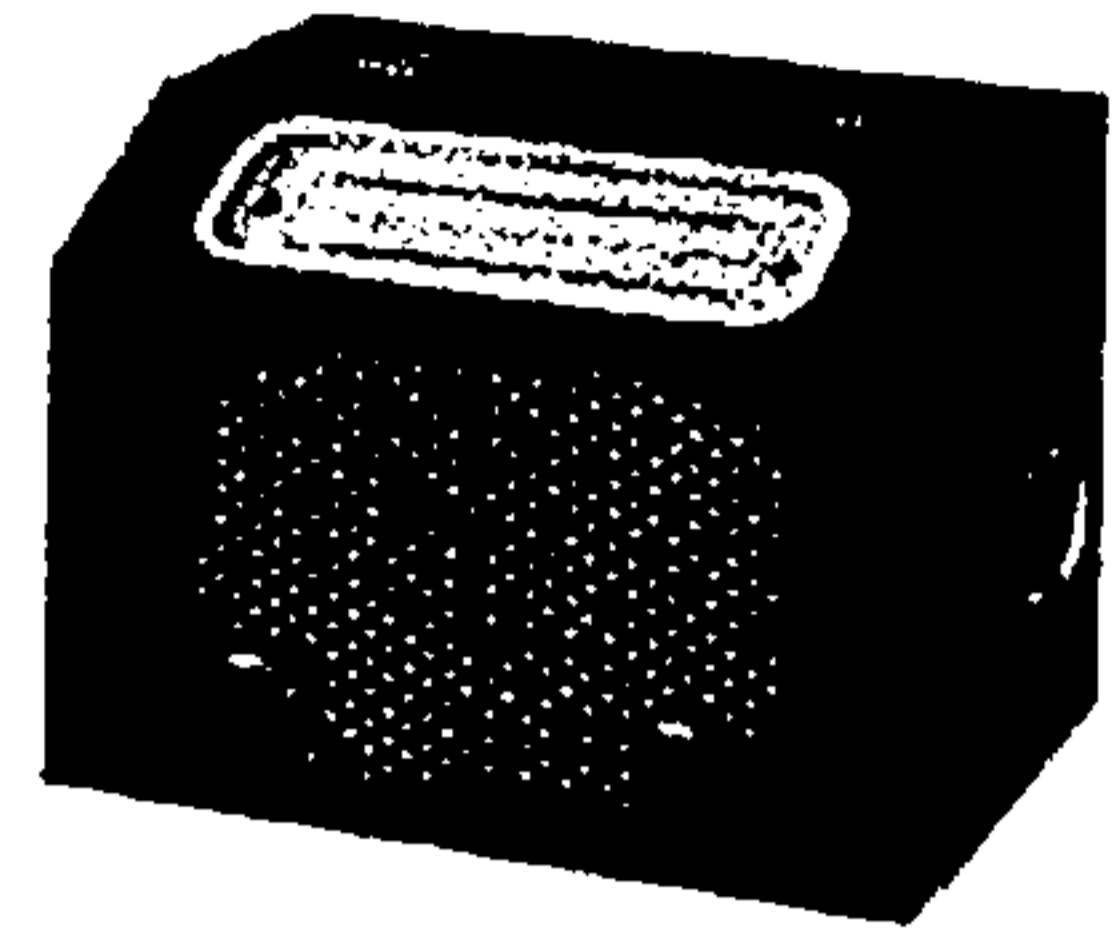


Ned. Ver. v. Historie v/d Radio



BUSH BP90

All-dry Battery Portable



FOUR all-dry battery valves are employed in the Bush BP90, a 2-band portable superhet with self-contained frame aerial and batteries. The waveband ranges are 180-550 m and 850-2,000 m. Early models used a combined H.T. and L.T. battery, but later ones used separate H.T. and L.T. units.

Release date and original price: November, 1946, £14 14s; reduced April, 1949, to £13 11s 4d, including batteries. Purchase tax extra.

CIRCUIT DESCRIPTION

Tuned frame aerial input **L1**, **C21** (M.W.) and **L1**, **L2**, **C21** (L.W.) precedes a heptode valve (**V1**, Mullard metallized **DK32**) operating as frequency changer with electron coupling.

Oscillator grid coils **L3** (M.W.) and **L4** (L.W.) are tuned by **C22**. Parallel trimming by **C23** (M.W.) and **C24** (L.W.); series tracking by **C7** (M.W.) and **C9** (L.W.). Reaction coupling by coils **L5** (M.W.) and **L6** (L.W.).

Second valve (**V2**, Mullard metallized **DF33**) is a variable- μ R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C3**, **L7**, **L8**, **C4** and **C11**, **L9**, **L10**, **C12**.

Intermediate frequency 465 kc/s.

Diode second detector is part of single diode triode valve (**V3**, Mullard **DAG32**). Audio frequency component in rectified output is developed across diode load resistor **R7** (which also acts as volume control), and passed via **C15**, **R9** and **R8** to

grid of triode section, which operates as A.F. amplifier. I.F. filtering by **C13**, **C14**, **R6** and **C18** in diode and triode anode circuits respectively.

The D.C. potential developed across **R7** is tapped off and fed back through a decoupling circuit **R4**, **R1**, **C1** as G.B. to F.C. valve giving automatic gain control.

Resistance capacitance coupling by **R10**, **C17**, **R11** between **V3** triode and pentode output valve (**V4**, Mullard **DL35**). Fixed tone correction by **C18** in anode circuit.

The G.B. potential for **V4** is obtained from the voltage drop across **R12** in the H.T. negative lead to chassis.

COMPONENTS AND VALVES

CAPACITORS		Values (μ F)	Locations
C1	V1 C.G. decoup. ...	0.05	G4
C2	V1 S.G. decoup. ...	0.05	D4
C3	1st I.F. transformer tuning	0.00008	B2
C4		0.00008	B2
C5	V1 osc. C.G. ...	0.0005	G4
C6	H.T. Reservoir ...	2.0	F3
C7	Osc. M.W. tracker	0.000805	H4
C8	Osc. L.W. trimmer	0.00018	G3
C9	Osc. L.W. tracker	0.00039	G4
C10	V2 C.G. decoup. ...	0.05	F4
C11	2nd I.F. transformer tuning	0.00006	C1
C12		0.00006	C1
C13	I.F. by-pass ...	0.0001	E3
C14	I.F. by-pass ...	0.0001	E3
C15	A.F. coupling ...	0.005	D3
C16	I.F. by-pass ...	0.0001	E3
C17	A.F. coupling ...	0.05	D3
C18	Tone corrector ...	0.005	D4
C19†	M.W. aerial trim	0.00004	H4
C20†	L.W. aerial trim	0.00004	H4
C21†	Aerial tuning	—	A1
C22†	Oscillator tuning	—	A1
C23†	Osc. M.W. trim ...	0.00004	G4
C24†	Osc. L.W. trim ...	0.00004	G4

† Variable

‡ Pre-set.

RESISTORS		Values (ohms)	Locations
R1	V1 C.G. decoup. ...	2,200,000	G4
R2	V1 S.G., decoup. ...	20,000	E4
R3	V1 osc. C.G. ...	47,000	F4
R4	A.G.C. decoup. ...	2,200,000	G4
R5	V2 C.G. resistor ...	4,700,000	F4
R6	I.F. stopper ...	47,000	H8
R7	Volume control ...	500,000	H3
R8	V3 grid stopper ...	100,000	D8
R9	V3 grid resistor ...	4,700,000	D3
R10	V3 anode load ...	470,000	D4
R11	V4 grid resistor ...	1,000,000	D4
R12	V4 G.B. resistor ...	820	D4

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	M.W. frame aerial	1.0	—
L2	L.W. frame aerial	12.0	—
L3	Oscillator tuning coils	1.5	H3
L4		2.0	H3
L5	Oscillator	—	H3
L6	reaction coils, total	6.5	H3
L7	1st I.F. trans.	Pri. 7.0	B2
L8		Sec. 7.0	B2
L9	2nd I.F. trans.	Pri. 7.0	C1
L10		Sec. 7.0	C1
L11	Speech coil	2.5	—
T1	Output trans.	Pri. 500.0	B1
		Sec. 0.5	
S1-S7	W/band switches ...	—	G3
S8	L.T. circ. switch ...	—	E3

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating from a set of new batteries. The receiver was tuned to the lowest wavelength on the M.W. band, and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 100 V range of a model 7 Avometer, chassis being the negative connection. The voltage measured across R12 was 8.6 V.

VALVES	Anode		Screen	
	V	mA	V	mA
V1 DK32	81.5	0.5	42.0	1.75
	Oscillator			
V2 DF33	81.5	2.3	81.5	.15
V3 DAC32	81.5	0.5		
V4 DL35	9.0	0.04	81.5	1.0
	77.0	4.2		

GENERAL NOTES

Switches.—S1-S7 are the waveband switches, ganged in a single rotary unit beneath the chassis. The diagram inset in the top left-hand corner of the circuit diagram shows the unit in detail, as seen from the rear of an inverted

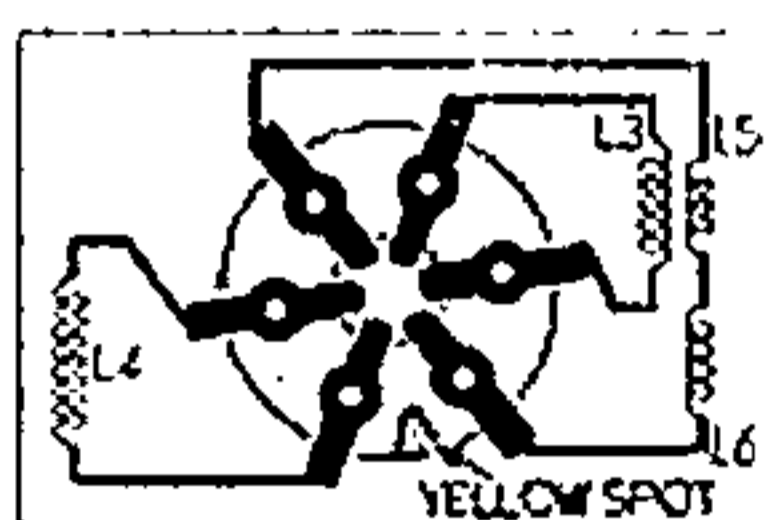


Diagram identifying the connecting tags of the oscillator coil unit.

chassis. All the odd-numbered switches S1, S3, S5, S7 close on M.W. (knob anti-clockwise); on L.W. all the even-numbered switches close.

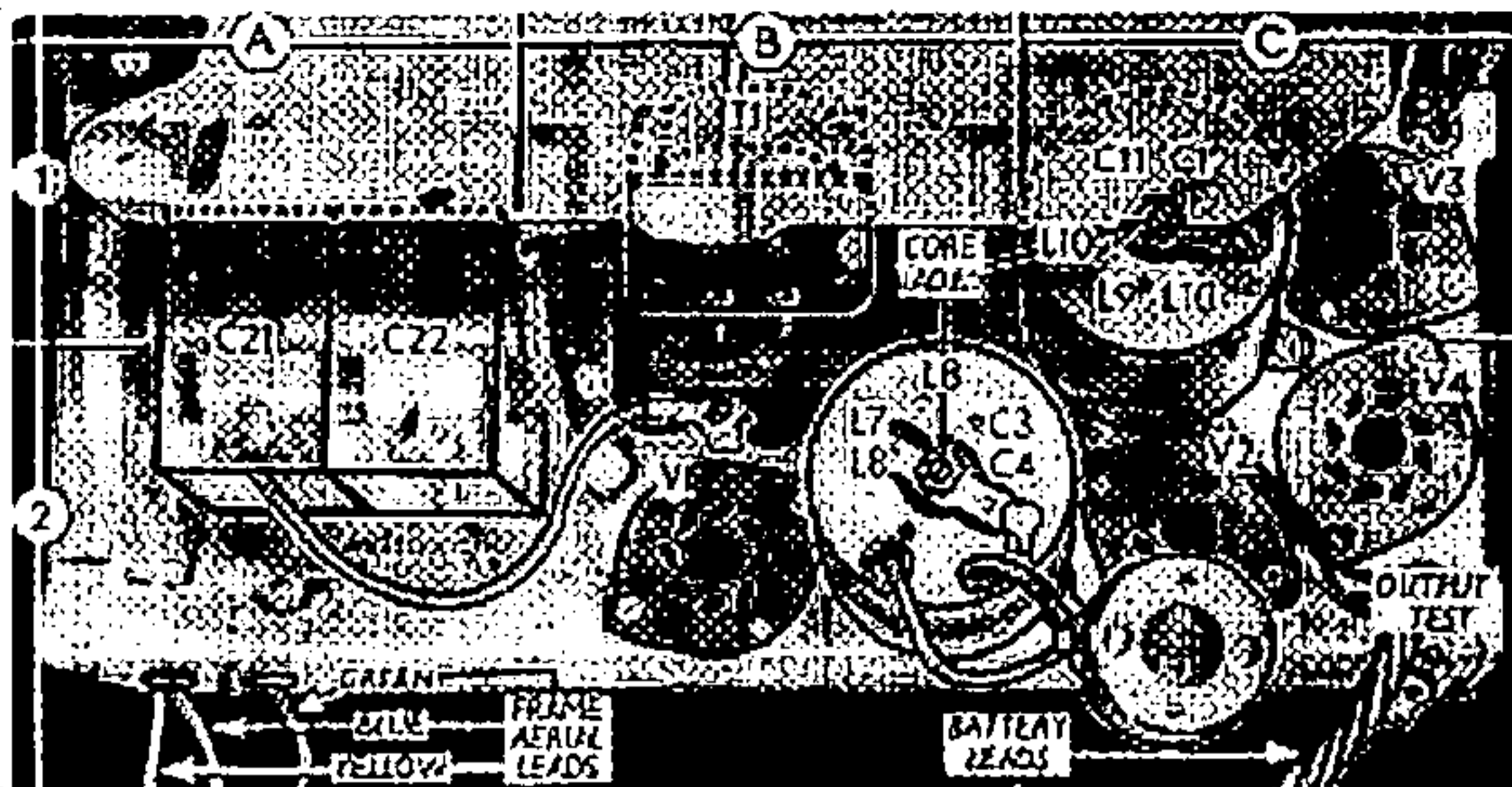
S8 is the Q.M.B. L.T. circuit switch, ganged with the volume control R7.

External Speaker.—No provision is made for an external speaker, but a convenient point for the connection of one of low impedance (about 5-1 Ω) is provided by the "output test" tags at the rear of the chassis.

Coils.—L1, L2 are the frame aerial windings, for which the connections are indicated in our plan view. The oscillator coils L3-L6 are in a single unscreened unit beneath the chassis. The connections to the tags on its base are identified in the diagram above.

Batteries.—In our version, which was a recent model, separate all-dry H.T. and L.T. batteries were employed. The H.T. unit was an Ever Ready type H.T.90, rated at 90 V, with wander-plug sockets; the L.T. unit was an Ever Ready Alldry 1, rated at 1.5 V, with a two-pin socket. In earlier versions, up to serial No. 18/15000, a combined 90 V H.T. and 1.5 V L.T. unit was used, with a 4-pin connecting socket. The type was Ever Ready Batymax B103 or Drydex 503.

Plan view of the chassis, in which some of the detail is drawn in broken line to indicate that it is shown "through" the scale backing plate.



Chassis Divergencies.—In the earlier versions referred to under "Batteries," with serial numbers below 18/15001, the L.F. transformers were of a different pattern, and C16 and the "output test" tags were omitted. The frame aerial was also of a different shape, having been altered in the later version to accommodate the bulkier batteries.

Tuning Drive Wire Replacement.—The tuning drive is quite simple, and its course is shown in the sketch (Col. 3) which is drawn in three-quarter perspective as viewed from the same end as the gang drum, with the gang at maximum. It is helpful if the strut supporting the upper edge of the scale backing plate is removed during the process.

Take 8ft of drive wire, which can be obtained from the makers, and clamp and solder the ends into the anchor plate, forming a closed loop 30½ in in circumference. Run the wire as shown in our sketch, then fit the cursor in line with the extreme right-hand indentation at the top of the scale backing-plate (about 1½ in from right-hand edge of backing-plate). Finally adjust pointer as described under "Circuit Alignment."

CIRCUIT ALIGNMENT

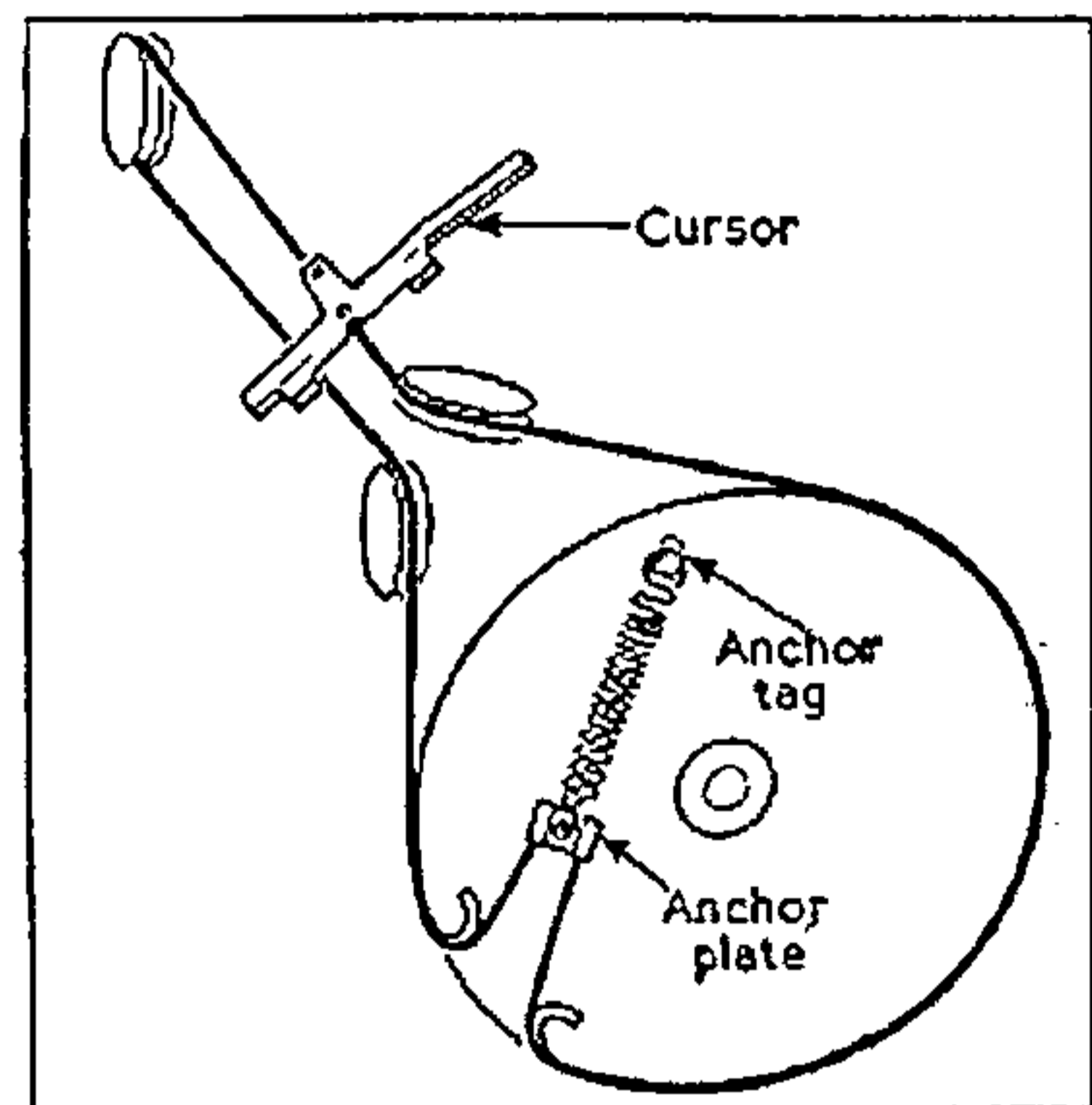
If only the aerial and oscillator circuits require alignment, the chassis need not be removed from the cabinet. Access to the oscillator trimmers is obtained through a hole in the bottom of the cabinet, normally covered by the left-hand runner (viewed from rear); this is removed by withdrawing three wood screws. The "output test" test tags at the rear of the chassis provide a convenient connection for the output meter.

With the gang at maximum the pointer should coincide with the calibration marks on the right-hand side of the scale. It may be adjusted in position by slackening the two drive drum screws and rotating the drum on its spindle.

L.F. Stages.—A damping unit consisting of a 30,000 Ω non-inductive resistor in series with a 0.05 μF capacitor should be made up, to be connected across the primary winding of a transformer when the secondary is being adjusted, and vice versa. Switch set to M.W., turn gang and volume control to maximum,

connect signal generator leads to control grid (top cap) of V2 and chassis, feed in a 465 kc/s (645.16 m) signal and adjust L10 (C1) and L9 (E3) for maximum output. Transfer "live" lead to top cap of V1 and adjust L8 (B2) and L7 (R4) for maximum output. Repeat these operations until no improvement results.

R.F. and Oscillator Stages.—The signal generator should be coupled to the receiver via a single loop of wire about the same size as the



Sketch of the tuning drive system, viewed from the drive drum end with the gang at maximum.

frame aerial, and placed 6 to 12 inches away from it. The chassis should be in the cabinet.

M.W.—With the set still switched to M.W., tune to 300 m on scale, feed in a 300 m (1,000 kc/s) signal and adjust C23 (G4) and C19 (H4) for maximum output. Check calibration at 200 m (1,500 kc/s) and 500 m (600 kc/s).

L.W.—Switch set to L.W., tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal and adjust C24 (G4) and C20 (H4) for maximum output. Check calibration at 1,500 m (200 kc/s) and 2,000 m (150 kc/s).

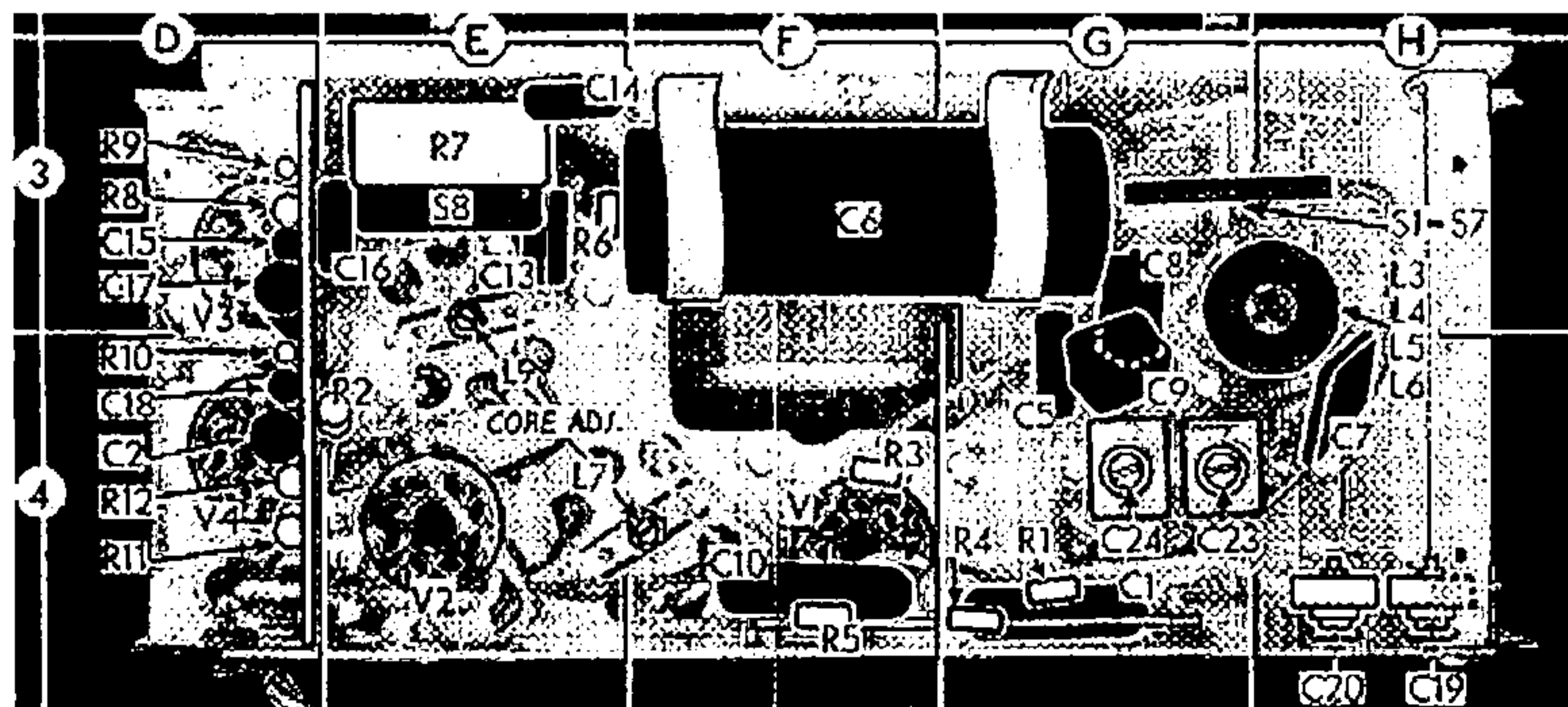
DISMANTLING THE SET

Removing Chassis.—Remove the two front control knobs (recessed screws), the back cover and batteries. The third knob (tuning) may now be removed by loosening the fixing screw inside the receiver;

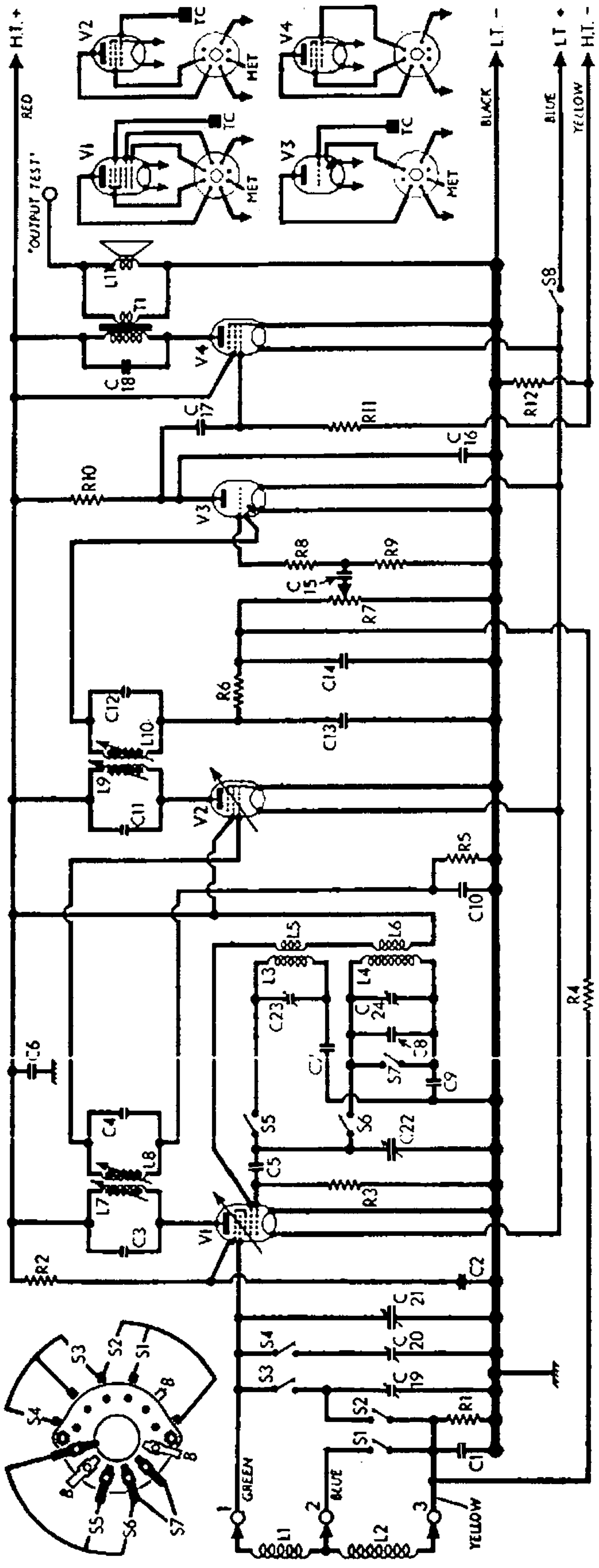
remove the two wood screws (with a paxolin spacing collar each), which form locating pegs at the top of the frame aerial, withdraw the two 1½ in 4BA bolts and nuts (with washers) from the bottom of the frame aerial, free the three spade connectors on side of frame, and lift the aerial out;

remove the two 4BA bolts holding the chassis to the two wooden battens in the cabinet; remove two 4BA nuts (one spring and one plain washer each) securing chassis brackets to front of cabinet, and withdraw chassis from cabinet.

When replacing, the green frame aerial lead should be connected to the rear tag on the frame; the blue lead to the centre tag; and the yellow lead to the front tag.



Under-chassis view. A diagram of the S1-S7 switch unit, indicated here by an arrow, is inset in the circuit diagram overleaf, viewed in the direction of the arrow in this illustration.



Circuit diagram of the Rush BP90, with the waveband switch unit diagram inset at top left-hand corner. L1, L2 are the frame windings.