

NUMBER FORTY-THREE (VOLUME TWO)

'TRADER' SERVICE SHEETS

BUSH SB4 BATTERY SUPERHET

THE Bush SB4 is a 4-valve battery superhet, employing an octode frequency-changer and a double-diode triode valve for second detection, A.V.C. and L.F. amplification. The output valve is an "economy" pentode. Several differences occur between early and recent chassis. This sheet deals mainly with the latest type, but the differences are fully explained under "General Notes."

CIRCUIT DESCRIPTION

Aerial input via coupling coils L1, L2 to inductively-coupled band-pass filter. Primary L3, L4 tuned by C17; secondary L6, L7 tuned by C20; coupling coils L8, L9. Image suppression by coil L5 and condenser C1. Local-distant switching by switch S1 and resistance R1 which shunts aerial-earth circuit.

First valve (V1, Mullard metallised FO2) is an octode operating as frequency-changer with electron coupling. Oscillator grid tuning coils L10, L11 tuned by C23; anode reaction coils, L12, L13: tracking by C6, C26 (M.W.) and C7, C27 (L.W.).

Second valve, a variable-mu H.F. pentode (V2, Mullard metallised VP2) operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings L14, L15 and L16, L17.

Intermediate frequency 123 KC'S.

Diode second detector forms part of double-diode triode (V3, Mullard

metallised TDD2). Second diode, fed from V2 anode by condenser C13, provides D.C. potential which is fed back through decoupling circuit R14, C3 as G.B. to frequency-changer and I.F. valves, giving automatic volume control. Delay voltage is obtained from drop along automatic G.B. resistance R18.

Audio-frequency output from rectifier diode is developed across manual volume control R8, tapped off, and passed by way of coupling condenser C11 and stopper resistance R9 to grid of V3 triode section.

Resistance-capacity coupling to output pentode (V4, Mullard PM22A). Fixed tone compensation by condenser C16 in anode circuit. Provision for connection of high-resistance external speaker across primary of T1, and for switching out internal speaker by plug and socket arrangement in secondary circuit of T1.

Grid-bias for V3 triode and V4 is obtained from voltage drop along resistances R17, R18 in common H.T. negative lead.

DISMANTLING THE SET

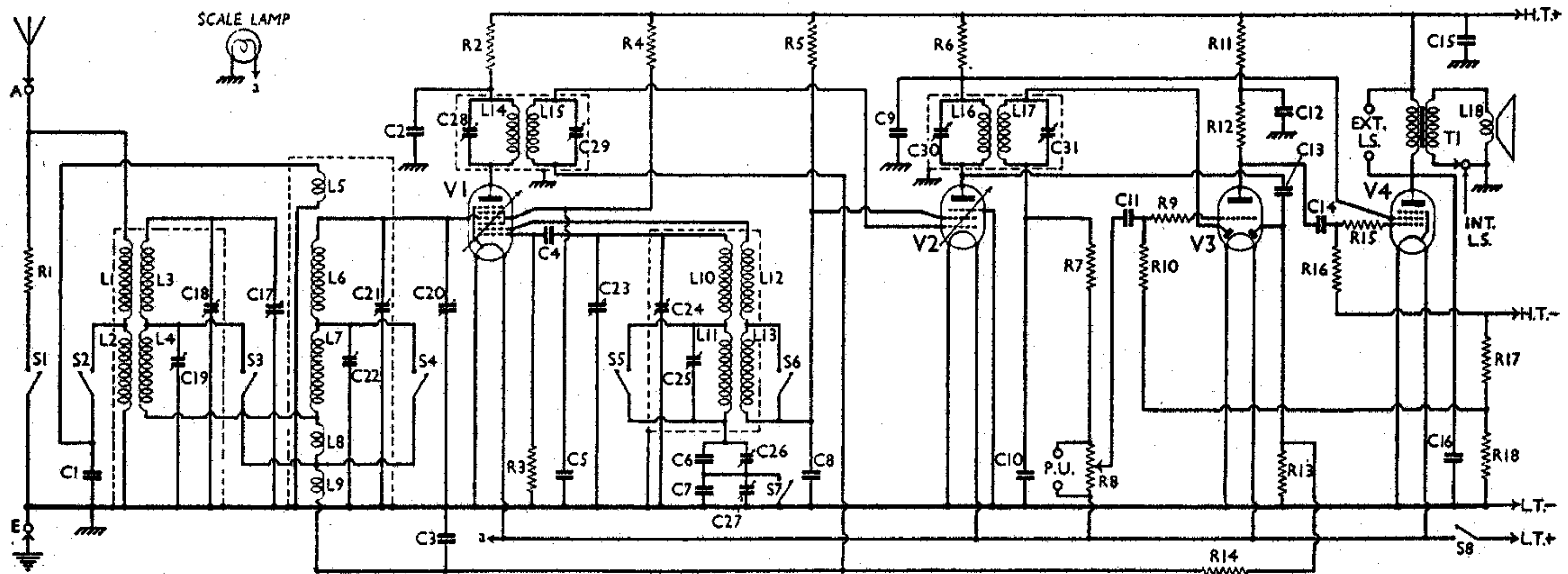
Removing Chassis.—Undo the clips holding the speaker and battery leads to the baffle and L.T. compartment. Remove control knobs (grub screws). When replacing, note that the large plain knob is the upper one, the small plain knob is at the left, while the small one marked "M.W., L.W." is at the right. Remove the four screws and washers

holding chassis to base of cabinet. Chassis may now be withdrawn to the extent of the speaker leads, which will be sufficient for most repairs. To remove it entirely, unsolder the four speaker leads from the tags on the speaker transformer. These tags are marked, from left to right, 4, 3, 2, 1, and the corresponding coloured leads are red, black, black, yellow.

Removing Speaker.—The four nuts and washers holding the speaker chassis to the sub-baffle must be removed to free the speaker. It is not possible to remove the speaker on its baffle, since one of the baffle holding screws is covered by speaker.

COMPONENTS AND VALUES

Table with 3 columns: Component, Description, and Values (µF). Lists components C1 through C31 and their functions and values.



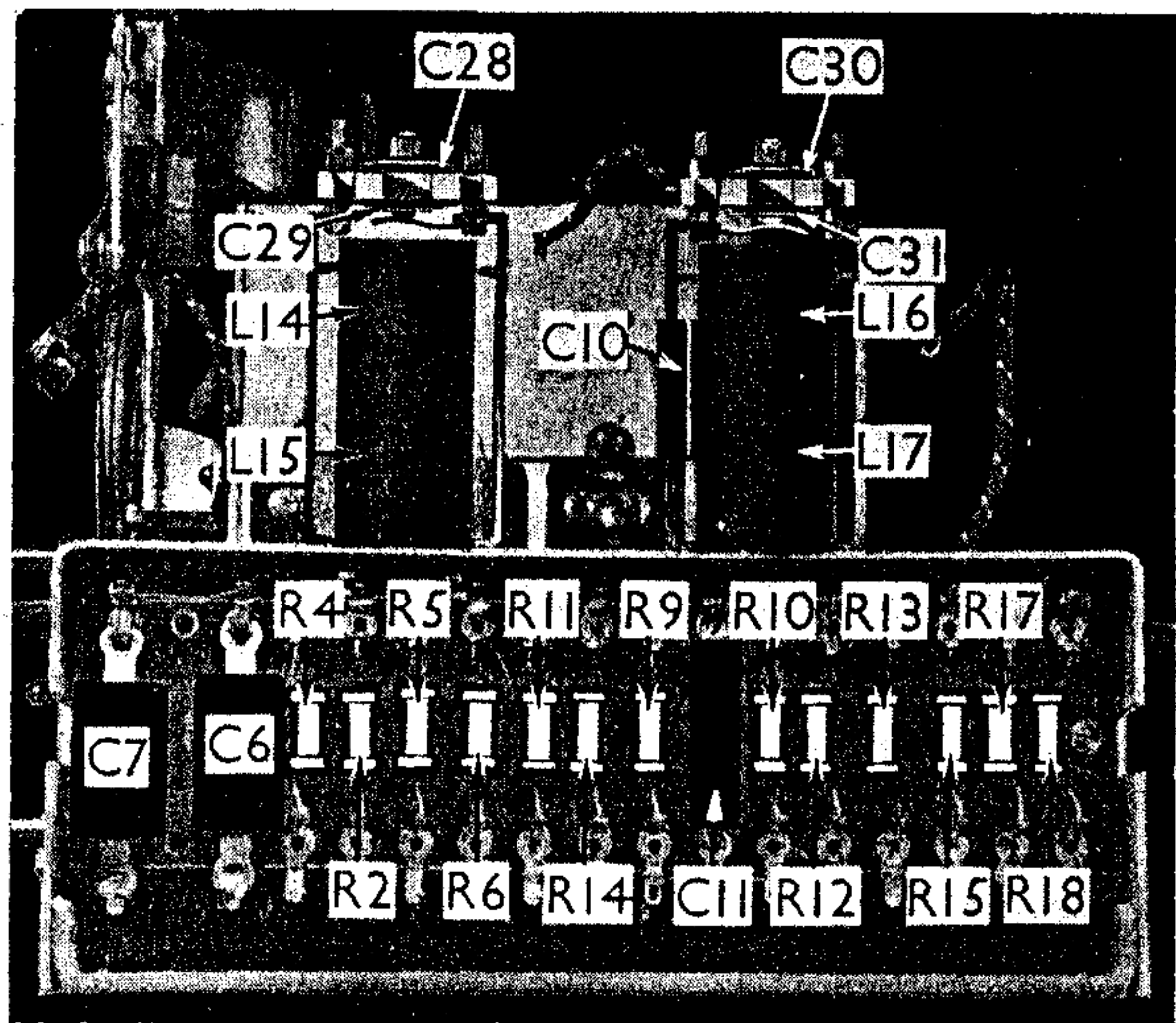
The circuit diagram of the latest model Bush SB4 battery superhet. In early models L5 is not employed, but a very small condenser, suitably connected, is substituted. In some models V1 is a heptode, in which case S6 is omitted. It will be seen that grid bias is automatic, no grid bias battery being used.



Resistances		Values (ohms)
R1	Local-dist. aerial-earth shunt..	50
R2	V1 pent. anode decoupling ..	10,000
R3	V1 osc. grid resistance ..	70,000
R4	V1 S.G.'s H.T. feed ..	100,000
R5	V1 osc. anode and V2 S.G. H.T. feed ..	10,000
R6	V2 anode decoupling ..	10,000
R7	I.F. stopper ..	50,000
R8	Volume control (diode load)..	500,000
R9	V3 triode grid I.F. stopper ..	500,000
R10	V3 triode grid resistance ..	5,000,000
R11	V3 triode anode decoupling ..	10,000
R12	V3 triode anode resistance ..	10,000
R13	V3 A.V.C. diode load ..	1,000,000
R14	A.V.C. circuit decoupling ..	1,000,000
R15	V4 grid H.F. stopper ..	100,000
R16	V4 grid resistance ..	500,000
R17	Automatic G.B. resistances	350
R18		250

Other Components		Values (ohms)
L1	Aerial coupling coils ..	1.5
L2		8.0
L3	Band-pass primary coils	3.0
L4		12.0
L5	Image suppression coil ..	Very low
L6	Band-pass secondary coils	3.0
L7		12.0
L8	Band-pass coupling coils	3.0
L9		0.5
L10	Oscillator tuning coils..	4.0
L11		8.5
L12	Oscillator reaction coils	2.0
L13		2.5
L14	1st I.F. trans. ...	Pri. 110.0
L15		Sec. 110.0
L16	2nd I.F. trans. ...	Pri. 60.0
L17		Sec. 60.0
L18	Speaker speech coil ..	2.0
T1	Speaker input trans. ...	Pri. 600.0
S1	Local-distant switch ..	0.25
S2-S7	Waveband switches, ganged..	—
S8	Filament switch, ganged R8 ..	—

End view of the chassis, showing the condenser and resistance bank, and the I.F. transformers and trimmers, from which the screens have been removed. In early chassis, the I.F. assemblies were of a different pattern.



VALVE ANALYSIS

Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 FC2*	130	0.6	50	0.8
V2 VP2	105	2.15	120	1.4
V3 TDD2	100	1.9	—	—
V4 PM32A	140	2.1	80	0.45

\*Osc. anode (G2) 120 V 0.45.

The voltage and current readings listed in the table are those given by the makers

for an average SB4 chassis working with no aerial or earth connected, and with a new H.T. battery in use. All voltages were measured with a high resistance (1,000 O per V) meter, chassis being negative in each case. When measuring anode currents, the usual precautions should be taken, if necessary, to avoid instability.

GENERAL NOTES

**Switches.**—S1 is the Q.M.B. sensitivity switch, which is closed in the least sensitive position.

S2-S7 are the wavechange switches, which are in one assembly, and are indicated in the under-chassis view. S6 may be omitted in chassis employing a Cossor 210 PG in the first valve position. All the wavechange switches are closed in the M.W. position, and open in the I.W. position.

S8 is the Q.M.B. mains switch, ganged with the volume control R8.

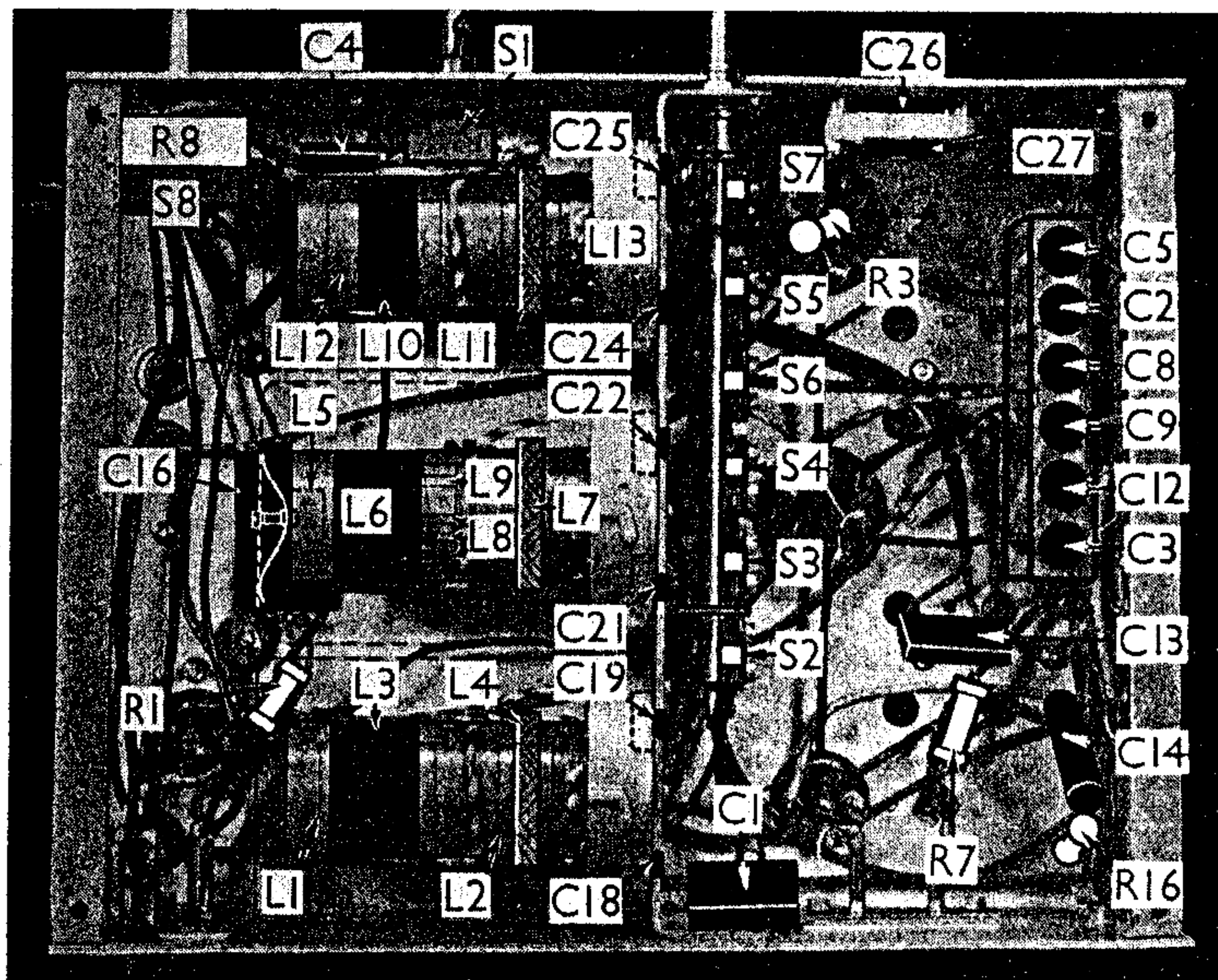
**Coils.**—The band-pass and oscillator coils are in three screened units beneath the chassis. In our under-chassis view the screens have been removed, but are indicated by dotted lines. The screens are fitted by bayonet catches, and to remove the upper one (in our illustration) it will probably be necessary first to detach the volume control and mains switch unit, R8, S8.

The bottom unit (in our illustration) contains L1-L4, L3 and L4 are respectively single layer and slab windings on the tubular former, while L1 and L2 are inside, on a smaller former, and are indicated by dotted lines.

The middle unit contains L5-L9. L5 is an image suppressor coil, which does not occur in early chassis. In its place, a very small adjustable condenser is employed, which is fixed underneath the chassis between R3 and C5.

In chassis containing L5, it will be observed that there is a central nut and screw projecting through the top of the middle coil screen. This is an adjustable coupling device for L5, and must not be

(Continued overleaf)



Under-chassis view. The switch assembly is clearly marked. The coil screens at the left have been removed, but are shown by broken lines. The coils inside the main formers are similarly indicated, as are the various trimmers at the bases of the coils.



**BUSH MODEL S.B.4**  
(continued)

altered. The screen can be removed without disturbing it. L6 and L7 correspond with L3 and L4 in the bottom unit. L8 and L9 are wound in slots in a small former mounted transversely inside the main tubular former. L8 occupies three slots, and L9 one.

The top unit contains L10 and L11 wound on the main former, and L12 and L13 on a smaller former inside. C4, associated with this unit, is inside the screen.

The I.F. coils and trimmers in the latest type of chassis are of the type shown in our plan and end chassis views. They have tubular screens, with a double trimmer adjustment at the centre of the top of each screen. In each case the outer hexagonal nut adjusts the primary trimmer, while the central grub screw adjusts the secondary. The coils are mounted with the primary above the secondary in each case, and the second unit also contains the fixed condenser C10.

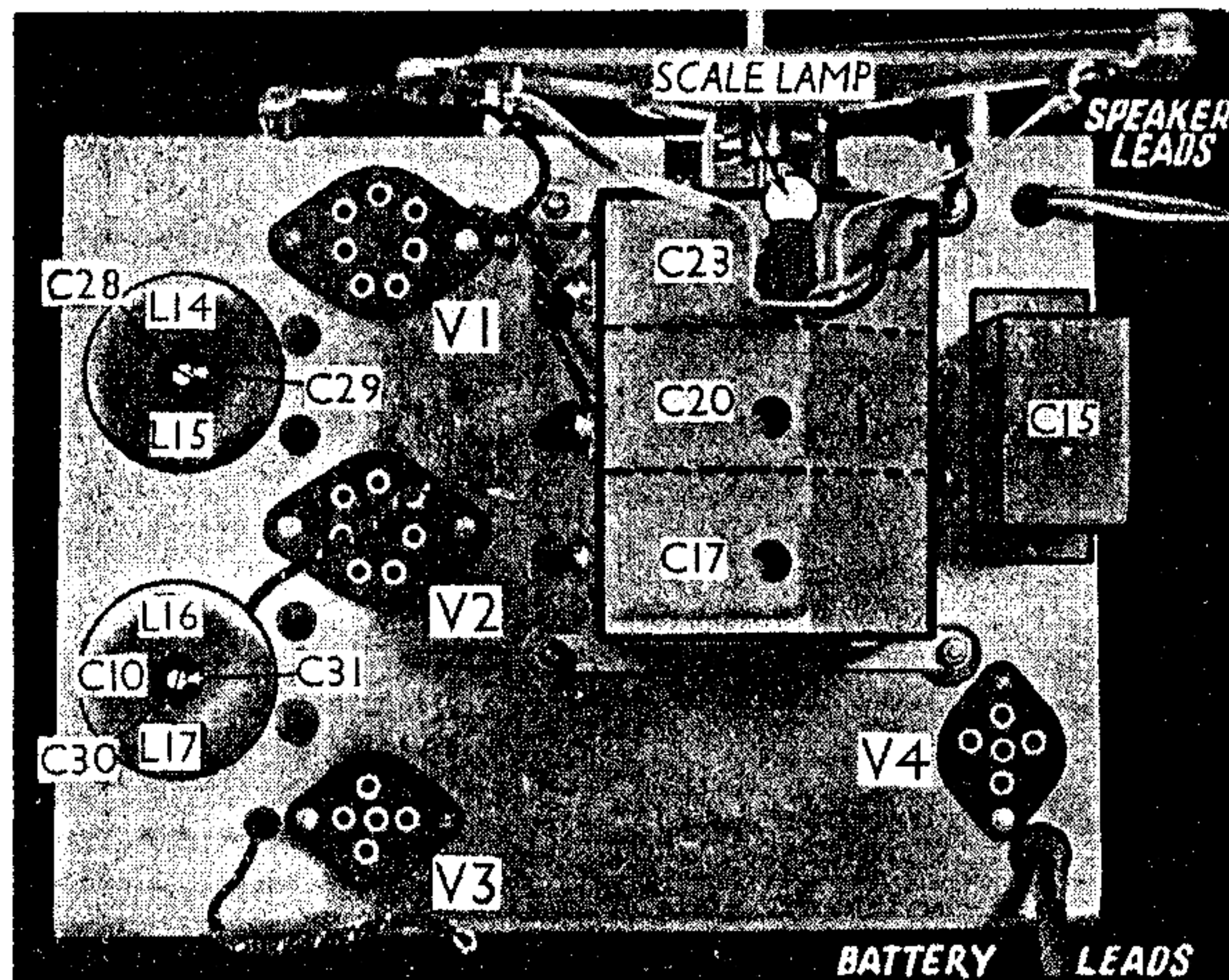
In early models a different form of I.F. transformer is employed, similar to those in the S.B.1 receiver. (Service Sheet No. 11, Vol. I.) In this type the coils are mounted similarly, but there are two separate trimmers reached through holes in the screen. In addition to C10, the second unit in the early models also contains C13 and R7, which therefore do not appear where indicated in our under-chassis view.

**Chassis Divergencies.**—Most of the differences between early and late chassis are explained under Switches and Coils above.

Some models may contain a Cossor 210 PG heptode in place of the Mullard FC2 octode in the V1 position. Where the heptode is employed, there will be found an extra resistance (not shown in our illustrations) connected between the top of L15 and the control grid of V2. Its value is 10,000 O. In addition, R3 becomes 40,000 O instead of 70,000 O, and S6 is omitted, so that L13 is not shorted on the M.W. band.

**Scale Lamp.**—This is an Osram M.E.S. type rated at 3.5 V, 0.15 A.

Plan view of the chassis. The I.F. transformers shown on the left are of the latest type, with concentrically adjusted trimmers. The tuning condenser trimmers are beneath the chassis.



**Condenser C1.**—The value of this is  $0.01 \mu\text{F}$  in late chassis, but may be  $0.0011 \mu\text{F}$  in early models.

**Condenser C16.**—This is shown from plate of V4 to chassis in our diagram, but may be connected across the primary of T1 in some models.

**Resistance R1.**—This is covered with rubber tubing to prevent contact with the screen of the bottom coil unit.

**Trimmers C18, C19, C21, C22, C24, C25.**—These are situated at the bases of the three coil units, and are reached through holes in the partition between the switch unit and the coil units.

**Trackers C26, C27.**—These are in one unit, adjusted by a nut and grub screw at the front of the chassis. The hexagonal nut adjusts C26, and the grub screw C27.

**Condenser Block C2, C3, C5, C8, C9, C12.**—This contains six  $0.1 \mu\text{F}$  condensers, each having the earthed case as one connection.

**Battery Cable.**—The two L.T. leads are rubber covered, brown for LT+ and black for LT-. The two H.T. leads are rubber covered and braided, red for H.T.+ (144 V) and black and green for H.T.-. Grid bias is automatic.

The L.T. battery is an Exide CZH2, and the H.T. a Drydex 144V.

**Valve Connections.**—V1, the octode, has a 7-pin base and a top cap. Looking at the underside of the base, or of the valve-holder, and starting with the pin at the apex of the symmetrical figure (No. 1 in the B.V.A. code), this is the oscillator anode. Pin 2 (in a clockwise direction) is the oscillator grid; Pin 3, the screening grids; Pins 4 and 5, the filament; Pin 6, metallising; Pin 7, the anode; Top cap, pentode control grid. If a heptode is used, the connections are the same. V2 connections are given in Sheet No. 11, Vol. I, p. 260.

V3 has a 5-pin base and top cap. The filament and triode anode connections are normal. The "grid" pin is the A.V.C. diode, the "cathode" pin is the detector diode, while the top cap is the triode control grid.

V4 has normal connections.

**External Speaker.**—This should be of the high impedance type (15,000 O), and should be connected to the sockets provided. The internal speaker may be cut out if desired by removing the single plug from the socket at the rear of the chassis, but only after the external speaker has been connected.