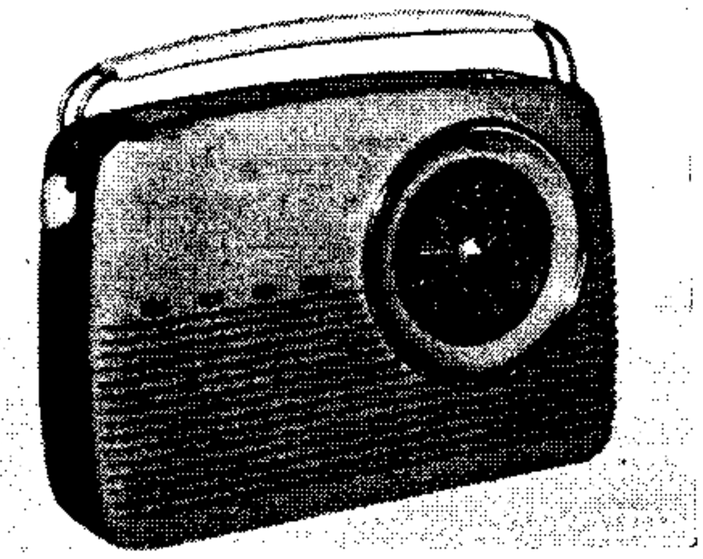
Supplement to Wireless & Electrical Trader, 16 May 1959

BUSH MB60

2-band Receiver for Mains/Battery Operation



Appearance of the Bush MB60.

THE Bush MB60 is a 5-valve 2-band portable receiver housed in a 2-tone cabinet and designed to operate from all-dry batteries or A.C. mains of 110-250 V, 50 c/s. It is fitted with an internal ferrite rod aerial and provision is made for the connection of an external aerial. The waveband ranges are 187-570 m and 1,070-1,900 m.

Release date and original price: June, 1957, £15 17s 6d. Purchase tax extra.

CIRCUIT DESCRIPTION

Ferrite rod aerial coils **L3** (M.W.) and **L2** (L.W.) are tuned by R.F. section of tuning gang **C3,** and by parallel trimmers **C2** (M.W) and **C4, C5, C6** (L.W.). Provision is made for the connection of a car aerial via **C1, L1.** Heptode valve **V1** is employed as frequency changer with electron coupling.

Oscillator grid coil **L6** is tuned by the oscillator section of the tuning gang **C13.** Parallel trimming by **C14** (M.W.) and **C15, C16, C17** (L.W.). Tracking by **C18** and the adjustable core of **L6.** Reaction coupling from oscillator anode via **C19, L7.**

V2 and **V3** are variable-mu R.F. pentodes operating as intermediate frequency amplifiers with tuned transformer couplings **L4, L5; L8, L9;** and **L10, L11.**

Intermediate frequency 470 kc/s

Diode signal detector is part of diode-pentode valve **V4.** Audio frequency component in its rectified output is developed across volume control **R11,** which also operates as diode load, and is passed via **C29** to the control grid of **V4** pentode section, which operates as A.F. amplifier. **V4** is grid current biased by **R12.**

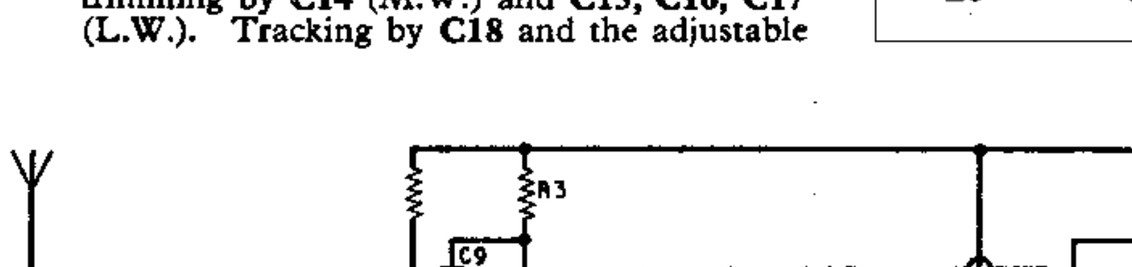
The D.C. component developed across potential divider **R9, R10** is tapped off and fed back as bias to **V1, V2** and **V3,** giving automatic gain control.

R.-C. coupling by **R14, C31** and **R15** between **V4** pentode and pentode output valve

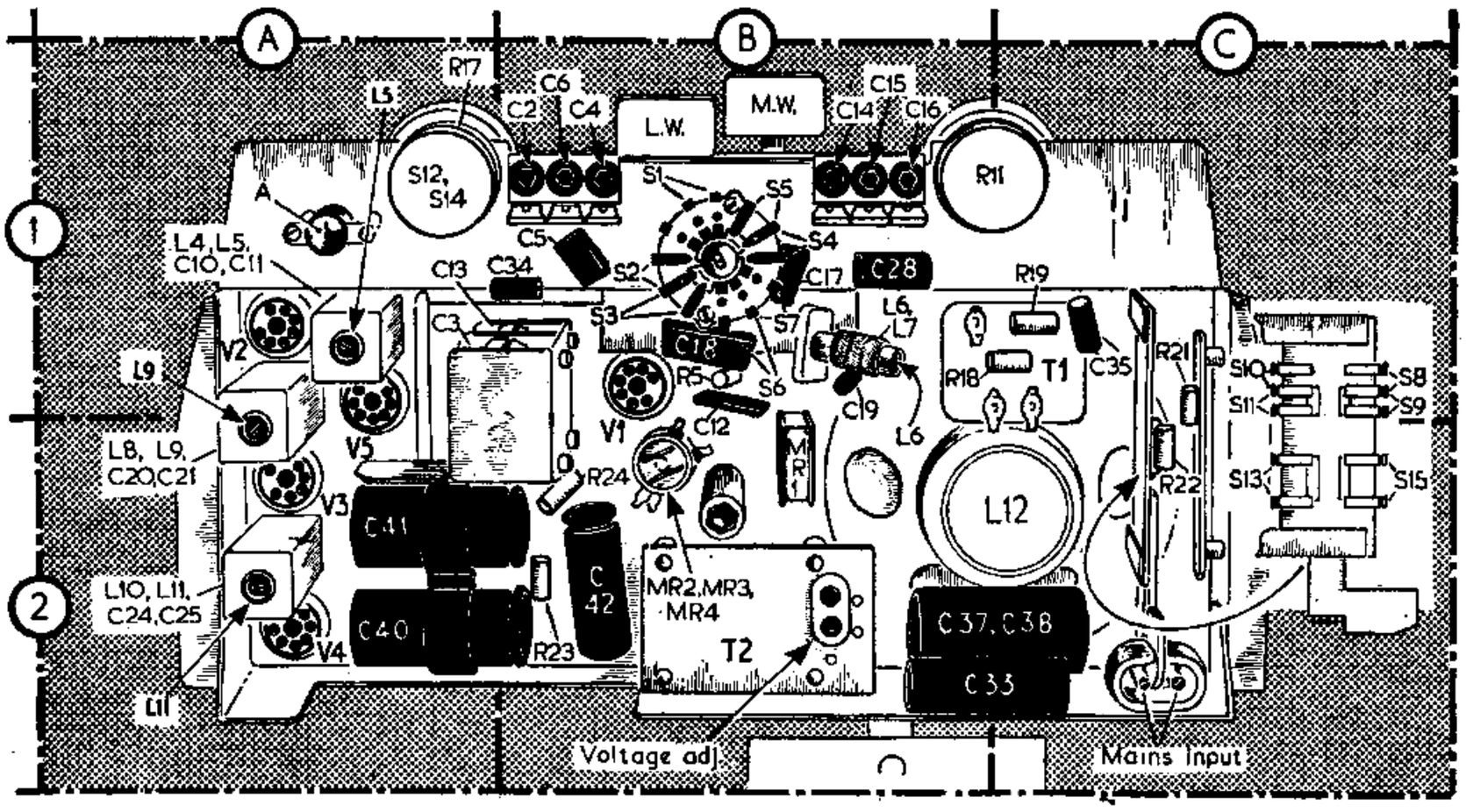
(*Continued overleaf col.* 1)

Resistors			
R1	2·2MΩ		E4
R2	100kΩ		E4
R3	2·7kΩ		F4
R4	27kΩ		E3
R5	33kΩ		B1
R6	33kΩ		E4
R7	33kΩ		F3
R8	27kΩ		F4
R9	2·7MΩ		F4
R10	2·7MΩ		F4
R11	500kΩ		B1
R12	10MΩ		F4
R13	2·7MΩ		F4
R14	1MΩ		F4
R15	1.8MΩ		F4
R16	330kΩ		F4
R17	100kΩ		A1
R18	10kΩ		C1
R19	1kΩ		C1
R20	560Ω		F4
R21	1.8kΩ		C1
R22	100Ω		C2
R23	10Ω		B2
R24	10Ω		B2
Coils*			
L1	—		E3
L2	—		E3
L3	—		D3
L4	16·0		A1
L5	16·0		A1
L6	4·0		B1
L7	2·0		B1
L8	16·0		A2
L9	16·0		A2
L10	16·0		A2
L11	16 0		A2
L12	3·0		C2
Capacitors			
C1	1,800pF		F3
C2	30pF		B1
C3	523pF		A1
C4	30pF		B1
C5	160pF		B1
C6	30pF		B1
C7	560pF		E4
C8	0·01μF		E3
C9	0·04μF		F3
C10	110pF		A1
C11	110pF		A1
C12	100pF		B1
C13	523pF		A1
C14	30pF		B1
C15	30pF		B1
C16	30pF		B1
C17	450pF		B1
C18	515pF		B1
C19	0·01μF		B1
C20	110pF		A2
C21	110pF		A2
C22	0·04μF		F3
C23	0·04μF		F4
C24	110pF		A2
C25	110pF		A2
C26	68pF		F4
C27	3·3pF		F4
C28	0.1μF		B1
C29	0.003μF		F4
C30	0·01μF		F4
C31	0·003μF		F4
C32	0·003μF		F3
C33	50μF		C2
C34	0·01μF		B1
C35	0·04μF		C1
C36	0·1μF		E4
C37	50μF		B2
C38	20μF		C2
C39	0·5μF		E3
C40	3,000μF		A2
C41	3,000μF		A2
C42	1,000μF		B2
Miscellaneous*			
T1	a 460·0		C1
	b 0·2		
T2	a 420·0		B2
	b 0·8		
	c 0·8		
	d 770·0		
	(pri. total)		
MR1 †			B2
MR2-MR4 ‡			B2
S1-S7		—	B1
S8-S11		—	C1
S12, S14		—	A1
S13, S15		—	C2

**Approximate D.C. resistance in ohms.*
†*Westinghouse. 16RC1-1-8-1*
‡*S.T.C. FSX1634C*



Circuit diagram of the Bush MB60, with diagrams of the valve base connections drawn as seen from the free ends of the pins.



Rear view of the chassis. As only the edge of the switch unit fitted in locations C1, C2 is seen, a side view has been added to the right of it to show the contacts.

Circuit Description—*continued*

V5. Tone correction by negative feedback via **R18, C35, R19, C28, R11** and **C29.** Tone control by **R17, C32** and **C34.** Bias for **V5** is obtained from the voltage drop across **R20,** which is in series with the negative H.T. lead and chassis.

For A.C. mains operation, switches **S12, S14, S8(M)** and **S10(M)** close. H.T. current is then supplied by half-wave metal rectifier **MR1.** H.T. smoothing by **C37, R21** and **C38.** Filament current is supplied from full-wave rectifier unit **MR3, MR4.** Filament smoothing by **C40, C41, C42, R24** and **R23.** Stabilizing rectifier **MR2** limits positive excursions of the filament voltage.

For battery operation, power supplies are carried by switches **S12, S14, S9(B), S11(B), S13(B)** and **S15(B).**

CIRCUIT ALIGNMENT

Equipment Required.—An accurately calibrated signal generator, modulated 30 per cent at 400c/s; an output meter; a single loop of insulated wire to form a coupling loop; a 0.1μF capacitor; and a non-metallic screwdriver trimming tool.

The receiver and signal generator should be allowed to warm up for at least ten minutes before commencing the alignment procedure.

I.F. Stages

1.—Remove chassis from cabinet. Connect output meter across **T1** secondary winding. Connect signal generator, via the 0.1μF capacitor, to **V2** control grid (pin 6). Set the volume control to maximum and the tone control for maximum top response.
2.—Switch receiver to M.W. and tune it to 300m. Feed in a modulated 470kc/s signal and adjust the cores of **L11** (A2), **L10** (F4), **L9** (A2) and **L8** (F4) for maximum output, progressively reducing the signal generator output as the circuits are brought into line.
3.—Transfer the signal generator to **V1** control grid (pin 6). Feed in a modulated 470kc/s signal and adjust the cores of **L5** (A1) and **L4** (F3) for maximum output. Disconnect signal generator.

R.F. and Oscillator Stages

4.—Check that with the tuning gang at maximum capacitance the cursor coincides with the datum line on the tuning scales. Couple the signal generator output to the receiver by means of the single loop of insulated wire placed about three feet from the receiver and with its plane at right angles to the ferrite rod aerial.
5.—With the receiver switched to M.W., tune it to 500m. Feed in a 600kc/s signal and adjust the core of **L6** (B1) for maximum output.
6.—Tune receiver to 200m. Feed in a 1,500kc/s signal and adjust **C14** (B1) and **C2** (B1) for maximum output.
7.—Repeat operations 5 and 6.
8.—Switch receiver to L.W. and tune it to 1,400m. Feed in a 214kc/s signal and adjust **C15** (B1), and **C16** if necessary; and **C4** (B1), and **C6** if necessary, for maximum output.
9.—The ferrite rod L.W. aerial coil **L2** (E3) has been aligned at the factory and should not be moved. Alignment of the M.W. ferrite rod aerial coil **L3** (D3) will normally not be necessary. If alignment of **L3** is essential, switch the receiver to M.W. and tune it to 500m. Feed in a 600kc/s signal and slide the former of **L3** along the ferrite rod for maximum output, then seal the former of **L3** to the ferrite rod to prevent it from moving.

GENERAL NOTES

Switches.—S1-S7 are the press-button operated waveband switches ganged in a single rotary unit and shown in the rear view illustration of the chassis in location reference B1. **S1, S2, S4** and **S6** close on M.W., **S3, S5** and **S7** close on L.W.

S8-S11, S13 and **S15** (location reference C1) are the mains/battery changeover switches ganged in a single slide-type unit operated automatically by the insertion or removal of the mains connector at the rear of the cabinet. Switches with suffix **(M)** close for mains operation and those with suffix **(B)** close for battery operation.

S12 and **S14** (location reference A1) are the on/off switches ganged with tone control **R17.**

Batteries.—Early versions of this receiver employed a combined L.T. and H.T. battery. The battery unit recommended by the manufacturers was an Ever Ready B147, rated at 1.5V (L.T.) and 90V (H.T.). The later versions (serial numbers 12,001 onwards), as in the case of our sample receiver from which this *Service Sheet* was prepared, use separate L.T. and H.T. batteries, and those recommended are: L.T. two Ever Ready U2 cells, rated at 1.5V each; H.T. Ever Ready B131, rated at 90V.

Modifications.—Early versions of this receiver contain the following circuit variations: car aerial coupling coil **L1** is omitted; **C1** is 5.6pF and is connected between the aerial socket and the junction of **C7, L2; S14** is connected in the L.T. negative lead; **C39** is 0.25μF.

VALVE ANALYSIS

Valve voltages given in the table below are those derived from the manufacturer's information. They were measured on the 10V and 1,000V ranges of a Model 7 Avometer, chassis being the negative connection in every case.

The receiver was switched to M.W. and was operating from A.C. mains.

H.T. voltage measured at **C37** was 105V; filament voltage measured at **C40** was 1.3V, **V5** bias voltage measured across **R20** was −4.9V.

Valve		Anode (V)	Screen (V)
V1	DK96 mixer ..	80	70
	DK96 osc. ..	30	—
V2	DF96	85	60
V3	DF96	85	60
V4	DAF96	15	15
V5	DL96	83	85

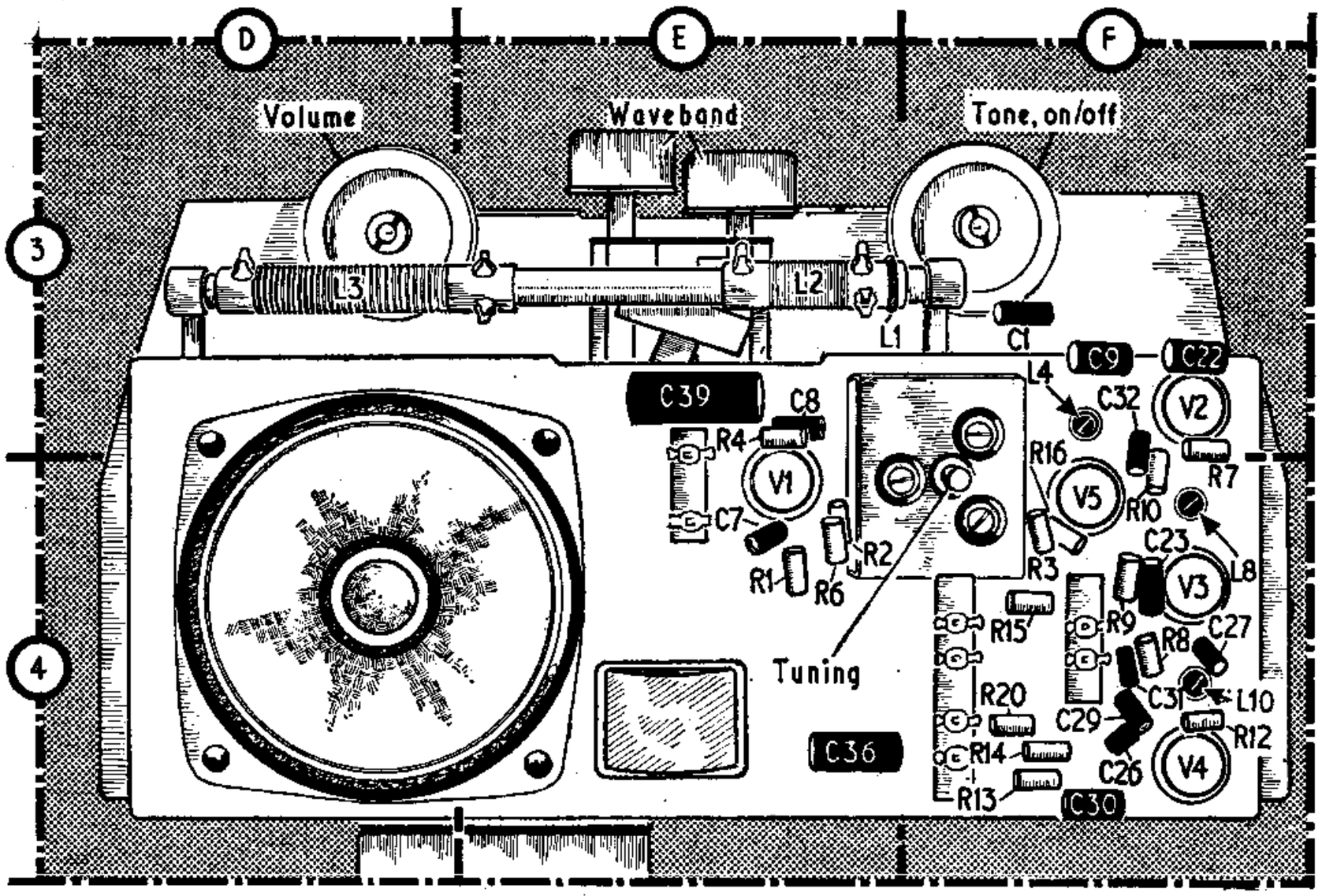


Illustration of the front of the chassis.

Printed in England by Cornwall Press Ltd., Paris Garden, London, S.E.1.