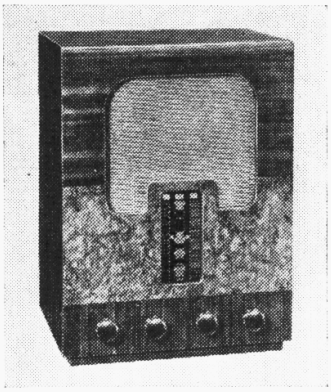
'TRADER' SERVICE SHEET 336

BUSH BA51

3-BAND BATTERY SUPERHET



The Bush BA51.

A SHORT-WAVE range of 16-51 m is covered by the Bush BA51 4-valve battery 3-band superhet. Provision is made for both a gramophone pick-up and an extension speaker, and a plug and socket arrangement allows the internal speaker to be cut out.

CIRCUIT DESCRIPTION

Two alternative aerial input sockets; **A1** direct on all bands and **A2** direct on SW, but via series resistances **R1** and **R2** on MW and LW respectively, to coupling coils **L1** (SW), **L2** (MW), **L3** (LW), and single tuned circuits **L4, C25** (SW), **L5, C25** (MW) and **L6, C25** (LW). Local-distant switch **S29** connects damping resistance **R4** across tuned circuits when closed ("local" position).

First valve (**V1, Mazda metallised TP23**) is a triode-pentode operating as frequency changer with internal coupling. Triode anode coils **L10** (SW), **L11** (MW) and **L12** (LW) are tuned by **C29**; parallel trimming by **C26** (SW), **C27** (MW) and **C6, C28** (LW); series tracking by **C7** (MW) and **C8** (LW). Grid reaction by coils **L7** (SW), **L8** (MW) and **L9** (LW).

Second valve (**V2, Mullard metallised VP2B**) is a variable-mu RF hexode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C30, C3, L13, L14, C4, C31** and **C32, C12, L15, L16, C13, C33.**

Intermediate frequency 465 KC/S.

Diode second detector is part of double diode triode valve (**V3, Mullard metallised TDD2A**). Audio frequency component in rectified output is developed across manual volume control **R13,** which also operates as load resistance, and passed via AF coupling condenser **C17** and stopper resistance **R14** to CG of triode section, which operates as AF amplifier. IF filtering by **C15, R12, C16.** Provision for gramophone PU across **R13.**

Second diode of **V3,** fed from **V2** anode via **C14,** provides DC potential, which is developed across load resistance **R17** and fed back through decoupling circuits as GB to FC (except on SW) and IF valves, giving automatic volume control.

Resistance-capacity coupling by **R16, C18, R18, R19** between **V3** triode and pentode output valve (**V4, Mullard PM22A**). Fixed tone correction by **C20.** Provision for connection of low impedance external speaker across secondary of internal speaker input transformer **T1.** Plug and socket device permits speech coil circuit to be broken, thus muting internal speaker if desired.

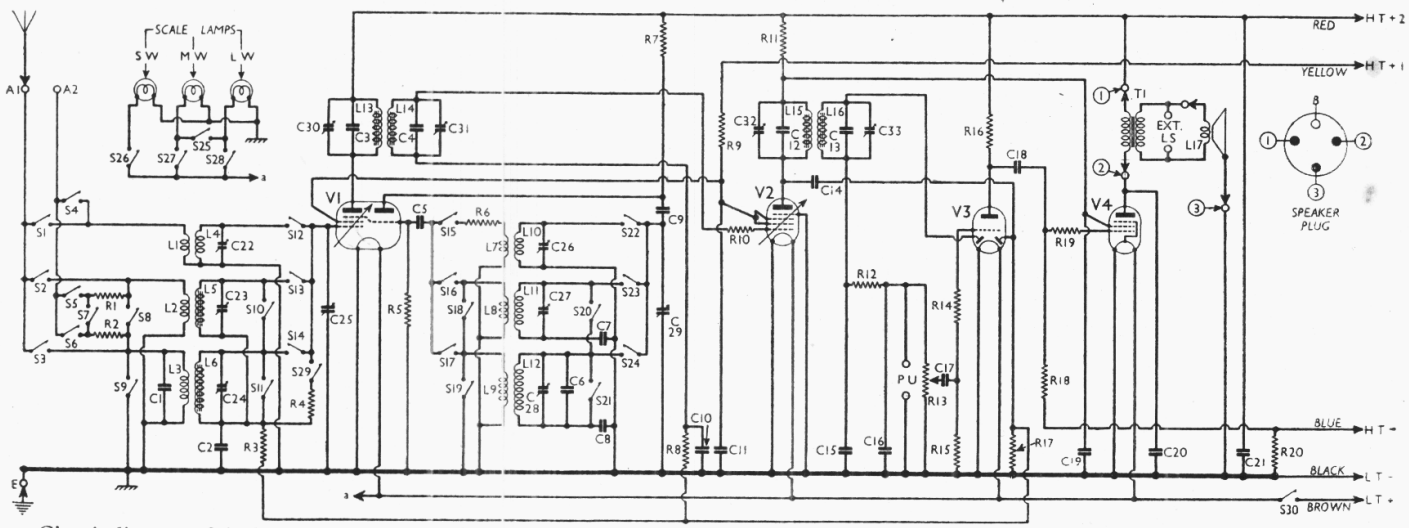
GB potential for **V4** is obtained automatically from drop along **R20** in HT negative lead.

COMPONENTS AND VALUES

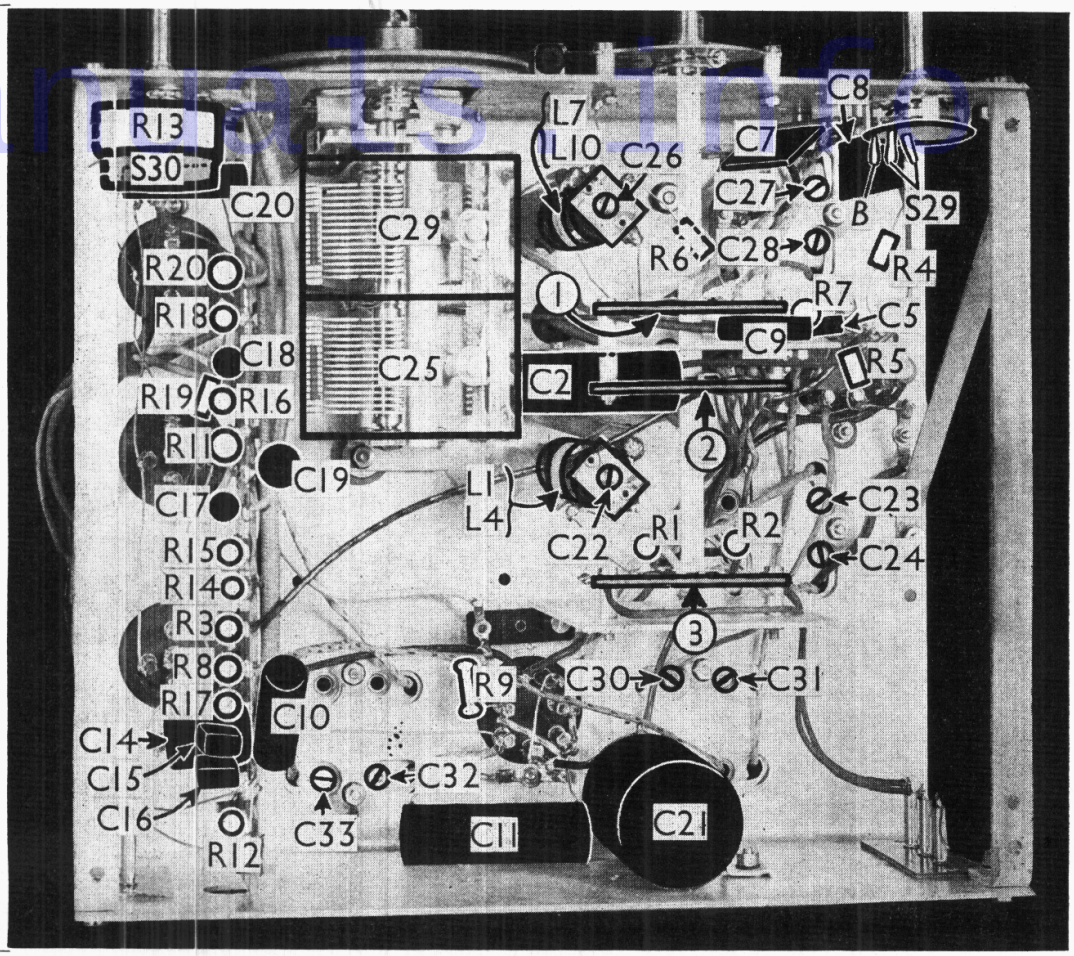
	RESISTANCES	Values (ohms)
R1	A2 MW aerial series	1,000
R2	A2 LW aerial series	10,000
R3	V1 pentode CG decoupling	1,000,000
R4	Aerial circuit "Local" damping	10,000
R5	V1 osc. CG resistance	40,000
R6	Osc. circuit SW stabiliser	50
R7	V1 osc. anode HT feed	40,000
R8	V2 CG decoupling	1,000,000
R9	V1, V2 SG's HT feed	15,000
R10	V2 CG stabiliser	50
R11	V2 anode, V4 SG HT feed	10,000
R12	IF stopper	50,000
R13	V3 signal diode load: manual volume control	500,000
R14	V3 triode CG IF stopper	100,000
R15	V3 triode CG resistance	5,000,000
R16	V3 triode anode load	100,000
R17	V3 AVC diode load	1,000,000
R18	V4 CG resistance	500,000
R19	V4 CG IF stopper	100,000
R20	V4 auto GB resistance	400

	CONDENSERS	Values (μF)
C1	Aerial circuit LW shunt	0·0008
C2	V1 pentode CG decoupling	0·5
C3	1st IF trans. pri. trimmer	0·00018
C4	1st IF trans. sec. trimmer	0·00018
C5	V1 osc. CG condenser	0·0004
C6	Osc. circuit LW fixed trimmer	0·0001
C7	Osc. circuit MW tracker	0·000556
C8	Osc. circuit LW tracker	0·000316
C9	V1 osc. anode coupling	0·0001
C10	V2 CG decoupling	0·1
C11	V1, V2 SG's decoupling	0·5
C12	2nd IF trans. pri. trimmer	0·00018
C13	2nd IF trans. sec. trimmer	0·00018
C14	Coupling to V3 AVC diode	0·0001
C15	IF by-pass condensers	0·0001
C16		0·0001
C17	AF coupling to V3 triode	0·005
C18	V3 to V4 AF coupling	0·03
C19	V2 anode, V4 screen decoupling	0·1
C20	Fixed tone corrector	0·003
C21	HT circuit reservoir	2·0
C22‡	Aerial circuit SW trimmer	0·00003

‡ Pre-set.



Circuit diagram of the Bush BA51. Note the alternative aerial arrangements. Inset on the right is an underneath view of the speaker plug.



Under-chassis view. There are eight trimmers at the bases of the coil units on the chassis deck, which are adjustable by screws beneath the chassis, and these screws are all identified in this illustration. Diagrams of the three wave-change switch units are given overleaf.

	CONDENSERS (*Continued*)	Values (μF)
C23‡	Aerial circuit MW trimmer	0·00006
C24‡	Aerial circuit LW trimmer	0·00006
C25†	Aerial circuit tuning	—
C26‡	Osc. circuit SW trimmer	0·00003
C27‡	Osc. circuit MW trimmer	0·00006
C28‡	Osc. circuit LW trimmer	0·00006
C29†	Osc. circuit tuning	—
C30‡	1st IF trans. pri. tuning	0·00006
C31‡	1st IF trans. sec. tuning	0·00006
C32‡	2nd IF trans. pri. tuning	0·00006
C33‡	2nd IF trans. sec. tuning	0·00006

† Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial SW coupling coil	0·2
L2	Aerial MW coupling coil	1·7
L3	Aerial LW coupling coil	32·0
L4	Aerial SW tuning coil	0·05
L5	Aerial MW tuning coil	1·4
L6	Aerial LW tuning coil	14·0
L7	Osc. SW grid reaction coil	0·2
L8	Osc. MW grid reaction coil	2·7
L9	Osc. LW grid reaction coil	6·0
L10	Osc. circuit SW tuning coil	0·05
L11	Osc. circuit MW tuning coil	1·7
L12	Osc. circuit LW tuning coil	3·0
L13	1st IF trans. Pri.	4·0
L14	1st IF trans. Sec.	4·0
L15	2nd IF trans. Pri.	4·0
L16	2nd IF trans. Sec.	4·0
L17	Speaker speech coil	2·5
T1	Speaker input trans. Pri.	800·0
	Speaker input trans. Sec.	0·3
S1-S24	Waveband switches	—
S25-28	Scale lamp switches	—
S29	Local-distant switch	—
S30	LT circuit switch, ganged R13	—

DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, remove the knobs (recessed screws) and the felt washers from the four control spindles, and the four bolts (with washers) holding the chassis to the bottom of the cabinet. Then free the battery and speaker leads from the four cleats holding them to the cabinet, when the chassis can be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free the chassis entirely, unplug the speaker leads from the socket on the chassis deck.

Removing Speaker.—To remove the speaker from the cabinet, unsolder the leads and remove the nuts and washers from the four screws holding it to the sub-baffle. *When replacing*, see that the transformer is on the right, and connect the leads as follows, numbering the tags from bottom to top:—Left-hand row, 1, red to chassis; 2, green to chassis,; 3, black to extension speaker panel; 4, green to extension speaker panel. The brown lead from the extension speaker panel goes to the top tag on the right and the black lead goes to the bottom rivet holding the terminal panel to the transformer.

VALVE ANALYSIS

Valve voltages and currents given in the table (col. 3) are those measured in our receiver when it was operating with a new HT battery reading 145 V on load. The receiver was tuned to the lowest wavelength on the medium band and both the volume and sensitivity controls were at maximum (both fully clockwise), but there was no signal input.

Voltages were measured on the 400 V scale of a model 7 Universal Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TP23	142	0·3	43	0·7
	Oscillator			
	53	1·9		
V2 VP2B	112	2·0	43	0·6
V3 TDD2A	55	0·8	—	—
V4 PM22B	139	3·3	112	0·5

GENERAL NOTES

Switches.—S1-S24 are the waveband switches, and **S25-S28** the scale lamp switches, ganged together in three rotary units beneath the chassis. They are indicated in our under-chassis view, and shown in detail in the diagrams on page VIII. The table (page VIII) gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates *open*, and **C** *closed*.

S29 is the rotary local-distant switch, fitted at the front of the chassis. In the anti-clockwise position it is *closed* (local)

Continued overleaf

BUSH BA5I—*Continued*

and in the clockwise position it is *open* (distant).

S30 is the QMB LT circuit switch, ganged with the volume control **R13**.

Coils.—**L1, L4** and **L7, L10** are in two unscreened tubular units beneath the chassis, the thick wire windings being **L4** and **L10** respectively. **L2, L3, L5, L6**; **L8, L9, L11, L12** and the IF transformers **L13, L14** and **L15, L16** are in four screened units on the chassis deck. These units also contain their associated trimmers (adjustable by screws beneath the chassis) and several other components.

Scale Lamps.—These are three Osram MES types, rated at 3·5 V, 0·15 A. They are switched by **S25-S28.** Actually **S25** is an "accidental" switch, and is not really necessary.

External Speaker.—Two sockets are provided on a panel at the rear of the cabinet for a low impedance (2O) external speaker. A plug and socket arrangement permits the internal speaker speech coil to be disconnected when desired.

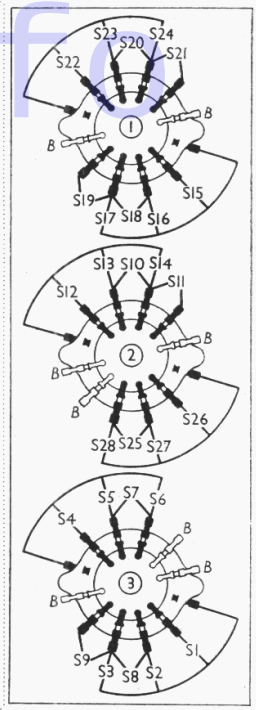
Speaker Plug and Socket.—A 4-pin plug and socket arrangement is used for connecting the speaker to the chassis, the "grid" pin connection being blank. The socket is mounted on the chassis deck. The individual connections are indicated by numbered arrows and circles in the circuit diagram, and an underneath view of the plug, with the individual pins numbered, is inset to the right of the diagram.

Aerial Sockets.—**A1** in our diagram gives maximum sensitivity, and **A2,** maximum selectivity, and they are thus indicated by the makers on the back of the receiver. They both have the same effect on SW, however.

Batteries.—LT, Exide type CZH2B 2 V 20 AH celluloid-cased cell. HT, Drydex 144 V dry battery, tapped at 72 V, type S6o. GB is automatic.

TABLE AND DIAGRAMS OF THE SWITCH UNIT

SWITCH	LW	MW	SW
S1	—	—	C
S2	—	C	—
S3	C	—	—
S4	—	—	C
S5	—	C	—
S6	C	—	—
S7	—	—	C
S8	—	—	C
S9	—	C	—
S10	—	—	C
S11	—	C	—
S12	—	—	C
S13	—	C	—
S14	C	—	—
S15	—	—	C
S16	—	C	—
S17	C	—	—
S18	—	—	C
S19	—	C	—
S20	—	—	C
S21	—	C	—
S22	—	—	C
S23	—	C	—
S24	C	—	—
S25	—	—	C
S26	—	—	C
S27	—	C	—
S28	C	—	—



Diagrams of the waveband and scale lamp switch units, as seen from the rear of the underside of the chassis.

Battery Leads and Voltages.—Black lead, spade tag, LT negative; brown lead, spade tag, LT positive 2 V; blue lead, black plug, HT negative; yellow lead and plug, HT positive 1, +72V; red lead and plug, HT positive 2, +144V.

Condenser C5.—This is given as 0·0005 μF by the makers, but was 0·0004 μF in our chassis.

CIRCUIT ALIGNMENT

When aligning, the volume control must be at maximum, and the tone control at "low."

IF Stages.—A damping circuit of a 30,000 O resistor in series with a 0·05 μF condenser must be used where indicated. Switch set to MW, and turn gang to 300 m.

Connect signal generator between control grid (top cap) of **V2** and chassis, and damping circuit from AVC diode of **V3** to chassis. Feed in a 465 KC/S signal, and adjust **C33** for maximum output. Connect damping circuit to signal diode of **V3** (pin to which is connected the green lead from second IF transformer) and chassis. Adjust **C32** for maximum output.

Connect signal generator to control grid (top cap) of **V1** and chassis, connect damping circuit from anode of **V1** to chassis. Feed in a 465 KC/S signal, and adjust **C31** for maximum output. Connect damping circuit from control grid of **V2** to chassis, and adjust **C30** for maximum output.

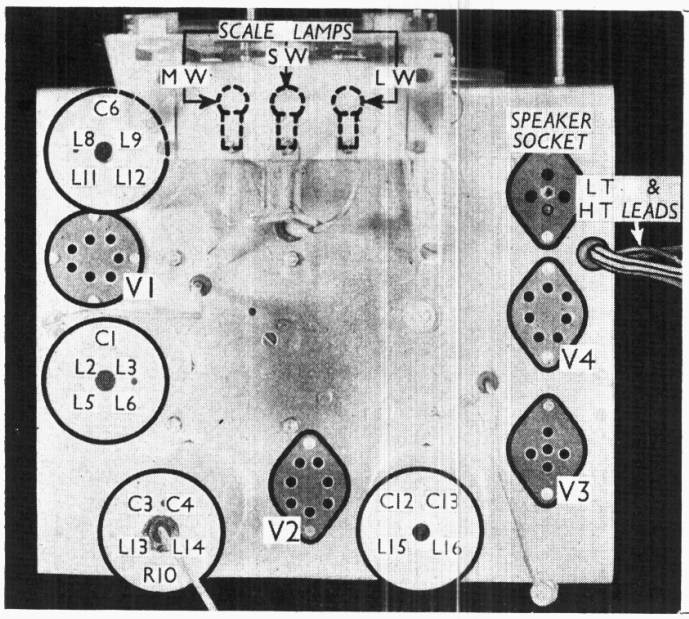
RF and Oscillator Stages.—With the gang fully meshed, the black line on the pointer should coincide with the top lines of the wavelength scales.

SW.—Connect signal generator to **A1** and **E** sockets, and switch set to SW. Tune to 18 m on scale, feed in an 18 m (16·67 MC/S) signal, and adjust **C26,** then **C22** for maximum output. Check calibration at 50 m.

MW.—When adjusting on MW and LW, connect a 1 MO damping resistance between LT+ and the junction of **R8, C10,** and a similar resistance between LT+ and the junction of **R12** and **C16.**

Connect signal generator to control grid (top cap) of **V1** and **E**; switch set to MW, tune to 300 m on scale, and feed in a 300 m (1,000 KC/S) signal. Adjust **C27** for maximum output. Transfer generator to **A1** socket, via a dummy aerial, and adjust **C23,** also at 300 m. Check calibration at 500 m.

LW.—Connect generator to top cap of **V1** and **E** again, switch set to LW, and tune to 1,400 m on scale. Feed in a 1,400 m (214 KC/S) signal, and adjust **C28** for maximum output. Transfer generator to **A1** socket (via dummy aerial), and adjust **C24** for maximum output, at 1,400 m. Check calibration at 1,900 m.



Plan view of the chassis. Note the socket which takes the speaker plug. The trimmers of the coil units are reached from beneath the chassis.

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