NUMBER 124 **'TRADER' SERVICE SHEETS**

BUSH BP5

BATTERY SUPERHET

A FRAME aerial is incorporated in the Bush BP5 battery operated transportable superhet. The circuit employs a variable-mu pentode signal frequency amplifier, an octode frequency changer, a variable-mu pentode I.F. stage, a double diode triode and a pentode output valve. Provision is made for connecting an external aerial and earth, an extension speaker and a gramophone pick-up.

CIRCUIT DESCRIPTION

Tuned frame aerial input **L1, L2, C25** to variable-mu pentode signal frequency amplifier (**V1, Mullard metallised VP2**).

Tuned-secondary transformer coupling by **L3, L4, L5, L6** and **C28** to octode frequency changer (**V2, Mullard metallised FC2**) operating with electron coupling. Oscillator grid coils **L7, L8** tuned by **C30**; anode reaction coils **L9, L10**; tracking by **C8, C33** (M.W.) and **C9, C34.**

Single variable-mu H.F. pentode intermediate frequency amplifier (**V3, Mullard metallised VP2**) operating with tuned-primary tuned-secondary transformer couplings **L11, L12** and **L13, L14.**

Intermediate frequency 123 KC/S.

Diode second detector forms part of double diode triode valve (**V4, Mullard metallised TDD2A**). Audio-frequency component in rectified output is developed across manual volume control **R14** and passed via coupling condenser **C15** and I.F. stopper **R16** to grid of triode section which operates as L.F. amplifier. Provision for connection of gramophone pick-up across volume control. Variable tone control by R.C. network **R20, C19** in triode anode circuit.

Second diode of **V4,** fed from **V3** anode via **C17** provides D.C. potential which is developed across load resistance **R19** and fed back through decoupling circuits as G.B. to H.F., F.C., and I.F. valves, giving automatic volume control.

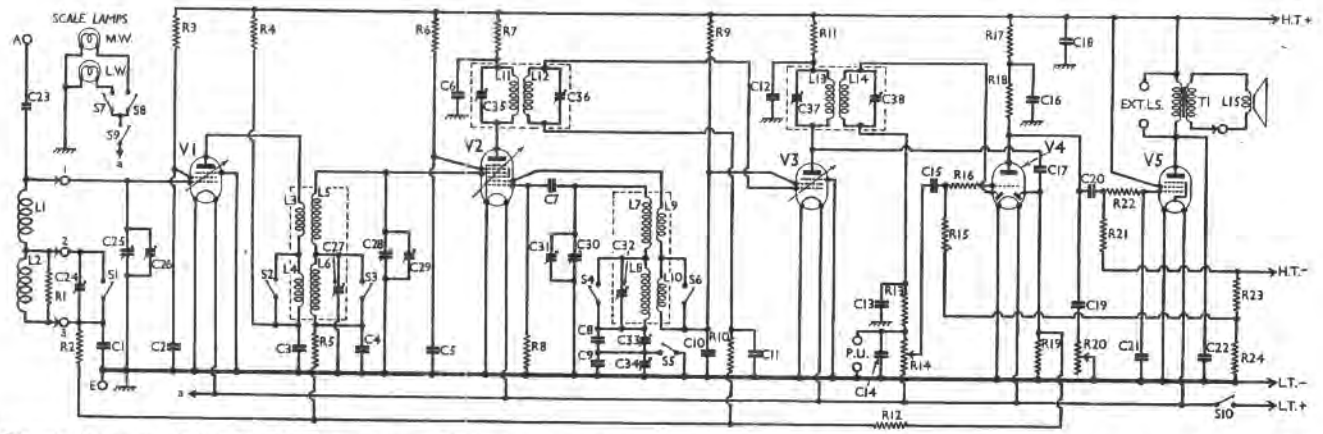
Resistance-capacity coupling by **R18, C20** and **R21** between **V4** triode and output pentode (**V5, Mullard PM22A**). I.F. filtering in C.G. circuit by **R22** and **C21.** Fixed tone correction in anode circuit by **C22.** Provision for connection of high-resistance external speaker. Plug and socket device enables speech coil circuit of internal speaker to be broken.

G.B. for **V4** and **V5** is obtained automatically from drop along resistances **R23, R24** in common H.T. negative line.

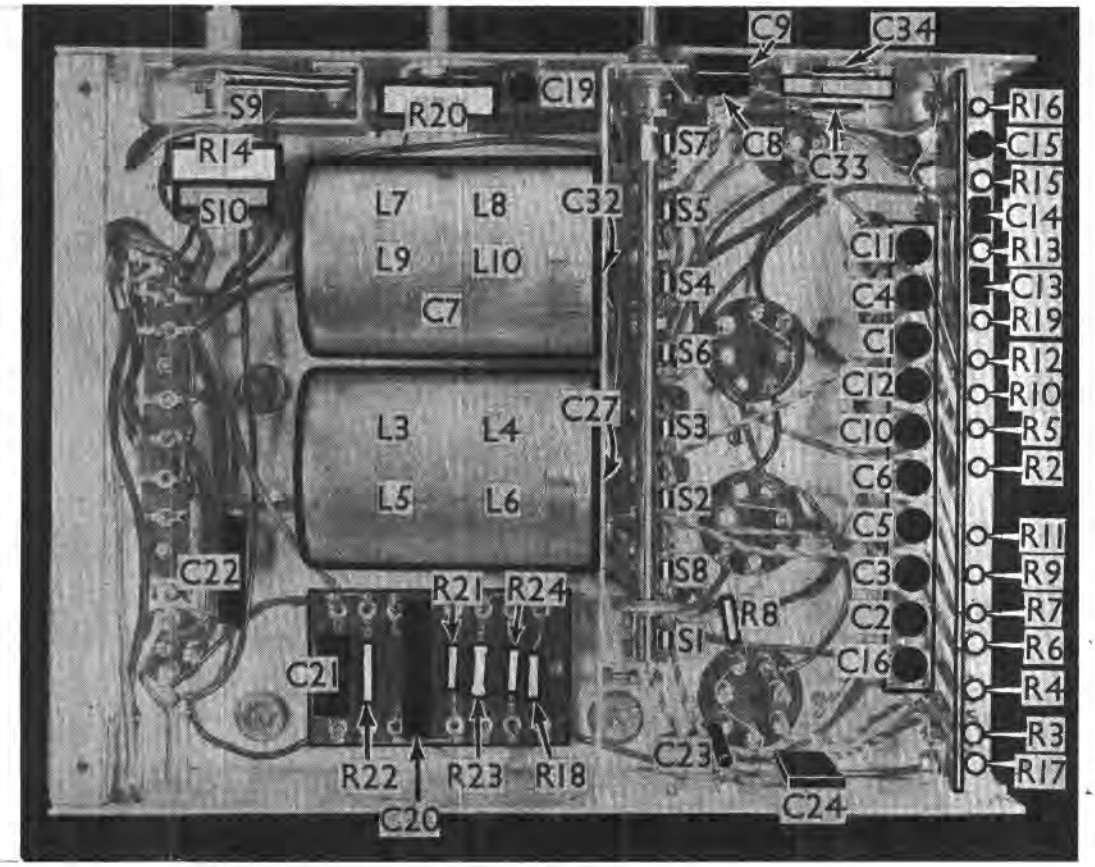
COMPONENTS AND VALUES

	Resistances	Values (ohms)
R1	L.W. frame shunt	100,000
R2	V1 C.G. decoupling	1,000,000
R3	V1 S.G. H.T. feed	100,000
R4	V1 anode decoupling	10,000
R5	V2 pentode C.G. decoupling	1,000,000
R6	V2 S.G.'s H.T. feed	100,000
R7	V2 pent. anode decoupling	10,000
R8	V2 osc. C.G. resistance	70,000
R9	V2 osc. anode decoupling and V3 S.G. H.T. feed	10,000
R10	V3 C.G. decoupling	1,000,000
R11	V3 anode decoupling	10,000
R12	A.V.C. line decoupling	1,000,000
R13	I.F. stopper	50,000
R14	V4 signal diode load; vol. control	500,000
R15	V4 triode C.G. resistance	5,000,000
R16	V4 triode C.G. I.F. stopper	500,000
R17	V4 triode anode decoupling	20,000
R18	V4 triode anode load	20,000
R19	V4 A.V.C. diode load	1,000,000
R20	Variable tone control	50,000
R21	V5 C.G. resistance	500,000
R22	V5 C.G. I.F. stopper	100,000
R23	Automatic G.B. resistances	350
R24		250

	Condensers	Values (μF)
C1	V1 C.G. decoupling	0·1
C2	V1 S.G. by-pass	0·1
C3	V1 anode decoupling	0·1
C4	V2 pentode C.G. decoupling	0·1
C5	V2 S.G.'s by-pass	0·1
C6	V2 pent. anode decoupling	0·1
C7	V2 osc. C.G. condenser	0·0005
C8	Oscillator M.W. tracker	0·002
C9	Oscillator L.W. tracker	0·0018
C10	V2 osc. anode decoupling and V3 S.G. by-pass	0·1
C11	V3 C.G. decoupling	0·1
C12	V3 anode decoupling	0·1
C13	I.F. by-passes	0·0001
C14		0·0001
C15	L.F. coupling to V4 triode	0·02
C16	V4 triode anode decoupling	0·1
C17	Coupling to V4 A.V.C. diode	0·0001
C18	H.T. supply reservoir	2·0
C19	Part of tone control circuit	0·02
C20	V4 to V5 L.F. coupling	0·03
C21	V5 C.G. I.F. by-pass	0·0003
C22	Fixed tone corrector	0·001
C23	External aerial coupling	Very low
C24‡	Frame aerial L.W. trimmer	—
C25†	Frame aerial tuning	—
C26‡	Frame aerial trimmer	—
C27‡	H.F. trans. L.W. trimmer	—
C28†	H.F. trans. tuning	—
C29‡	H.F. trans. trimmer	—
C30†	Oscillator tuning	—
C31‡	Oscillator trimmer	—
C32§	Oscillator L.W. trimmer	—



Circuit diagram of the Bush BP5 transportable battery superhet. Note the scale lamp switching. L1 and L2 are the frame aerial windings. The circles indicated by the figures 1, 2 and 3 show the points of connection between the frame aerials and the chassis wiring.



Under-chassis view. The ten condensers in a row towards the right each have one common connection to chassis. C23 is a very small fixed condenser. C24, and C33, C34 are adjusted through holes in the back and front of the chassis. S9 only closes when the volume control knob is pushed in. The L7-L10 unit contains, besides C7, another small fixed condenser in parallel with C32.

Condensers (continued)		Values (μF)
C33‡	Oscillator M.W. tracker ..	—
C34‡	Oscillator L.W. tracker ..	—
C35‡	1st I.F. trans. pri. tuning ..	—
C36‡	1st I.F. trans. sec. tuning ..	—
C37‡	2nd I.F. trans. pri. tuning ..	—
C38‡	2nd I.F. trans. sec. tuning ..	—

† Variable. ‡ Pre-set.
§ One pre-set and one 0·00003 μF fixed condenser in parallel.

Other Components		Approx. Values (ohms)
L1	Frame aerial windings	1·3
L2	Frame aerial windings	3·8
L3	H.F. transformer primary	3·3
L4	H.F. transformer primary	8·0
L5	H.F. transformer secondary	3·3
L6	H.F. transformer secondary	14·0
L7	Oscillator grid tuning coils	4·0
L8	Oscillator grid tuning coils	8·0
L9	Oscillator anode reaction coils	2·0
L10	Oscillator anode reaction coils	2·6
L11	1st I.F. trans. Pri. ..	65·0
L12	1st I.F. trans. Sec. ..	65·0
L13	2nd I.F. trans. Pri. ..	65·0
L14	2nd I.F. trans. Sec. ..	65·0
L15	Speaker speech coil	2·0
T1	Speaker input trans. Pri. ..	700·0
T1	Speaker input trans. Sec. ..	0·25
S1-S6	Waveband switches	—
S7-S9	Scale lamp switches	—
S10	L.T. switch, ganged R14 ..	—

DISMANTLING THE SET

Removing Chassis.—In order to remove the chassis from the cabinet, it is first necessary to open the back (two knurled head screws) and remove the batteries. Now remove the four control knobs (recessed grub screws) and the four bolts (with washers) holding the chassis to the bottom of the cabinet. Then free the speaker leads from the cleat holding them to the sub-baffle and the frame leads from the two cleats holding them to the side of the cabinet, and remove the back from the cabinet by lifting it off its hinges. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

When replacing, note that the wave-change switch knob is marked and must therefore, be placed on the correct spindle, and also that the large knob goes on the spindle of the tuning dial.

To free the chassis entirely, unplug the frame leads and unsolder the speaker leads. *When replacing frame leads*, no difficulty will be experienced as they are colour-coded in accordance with the sockets. *When replacing speaker leads*, connect as follow:—4, red; 3, black; 2, green; 1, yellow.

Removing Speaker.—If it is desired to remove the speaker from the cabinet, remove the nuts and washers from the four bolts holding it to the sub-baffle. *When replacing*, see that the transformer is at the bottom.

Removing Frame Aerial.—Access to the frame assembly can be obtained by removing the nuts and washers from the four bolts holding it to the back of the cabinet. *When replacing*, do not forget to replace the distance pieces, and see that the leads to the chassis are at the bottom.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating from a new H.T. battery reading 150 V. The volume control was at maximum and the receiver was tuned to the lowest wavelength on the medium band but there was no signal input as the frame connections were shorted together.

Voltages were measured on the 1,200 V scale of an Avometer, with chassis as negative.

Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 VP2	125	1·0	80	0·4
V2 FC2*	130	0·6	55	0·8
V3 VP2	115	2·4	120	0·7
V4 TDD2A	108	0·5	—	—
V5 PM22A	138	2·8	140	0·9

* Osc. anode (G2) 120 V, 0·8 mA.

GENERAL NOTES

Switches.—**S1-S8** are in a single unit beneath the chassis, seen in our under-chassis view. All the switches, except **S7** (nearest the control knob) are closed on the M.W. band and open on the L.W.

(*Continued overleaf*)

BUSH BP5 (continued)

band. **S7** is open on the M.W. band and closed on the L.W. band.

S9 is the scale lamp master switch, which closes when the volume control and battery switch knob is pushed in. **S10** is the Q.M.B. L.T. battery switch, ganged with the volume control **R14.**

Coils.—**L1** and **L2,** the frame aerials, are mounted on the inside of the hinged back of the cabinet, and are connected to the chassis by plugs and sockets which are colour-coded. The points at which the connections are made are indicated in our circuit diagram by the figures 1, 2 and 3, and the sockets seen in the plan chassis view are similarly marked.

L3-L6 and **L7-L10** are in two screened units beneath the chassis. These units also contain the pre-set condensers **C27** and **C32,** which are adjustable through holes in the vertical partition carrying the coil units. The coil screens are held in position by bayonet fittings, but that belonging to the **L7-L10** unit is only removable if the volume control and battery switch assembly is first detached from the front of the chassis, where it is held by two screws. This coil unit also contains the fixed condenser **C7,** and another small fixed condenser (·00003 μF) wired in parallel with the pre-set condenser **C32.**

The I.F. transformers are in two screened units on the chassis deck, and the trimmers are of the dual type, the hexagonal nuts adjusting the primary trimmers, and the central grub screws the secondaries. The **L13, L14** transformer also contains the fixed condenser **C17.**

Scale Lamps.—These are two Osram M.E.S. types, rated at 2.5 V, 0.3 A. They are individually switched on the M.W. and L.W. bands, and neither of them lights until the master control **S9** is closed by pushing in the volume control.

Batteries.—L.T., Exide celluloid-cased 2 V 30 AH cell, type CZH3. H.T., Drydex 144 V battery. Grid bias is automatic.

Battery Leads and Voltages.—Black lead, spade tag, L.T. negative; Brown lead, spade tag, L.T. positive 2 V; Green lead, black plug, H.T. negative; Red lead, red plug, H.T. positive 144 V.

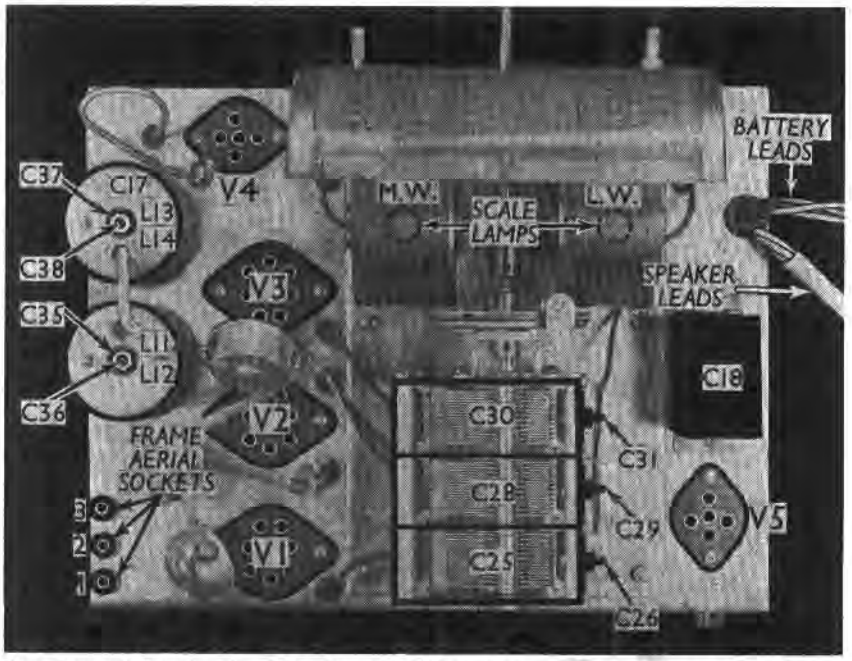
Resistance R1. — This is connected across the L.W. aerial winding, and is mounted on the frame itself.

Condenser Block.—This contains ten 0.1 μF paper condensers, all having one common connection, taken to the metal case.

Condensers C33, C34.—The oscillator M.W. and L.W. trackers are in a single unit at the front of the chassis. **C33** is adjusted by the central screw, and **C34** by the hexagonal nut.

Condenser C24. — This is adjusted through a hole in the back of the chassis.

Condenser C23.—This is a small fixed condenser formed of a length of wire spiralled round an insulated wire, the whole being enclosed in insulated sleeving.



Plan view of the chassis. The frame aerial sockets are numbered as in the circuit diagram. The I.F. trimmers are of the dual type.

External Speaker.—Two sockets are provided at the rear of the chassis for a high impedance (20,000 Ω) speaker. A plug and socket device is also fitted to cut out the speech coil of the internal speaker, but this must only be done after the external speaker has been connected.

CIRCUIT ALIGNMENT

Adjusting Tuning Scale.—With the wavechange switch in the M.W. position, and the variable condenser at minimum capacity, the beam of light should be at the bottom of the right-hand column of names, and the centre of the beam should approximately coincide with the termination of the vertical wavelength line. At maximum capacity the beam of light should coincide with the 550 m. mark at the top of the left-hand column of the M.W. band. The adjustment for this is a screw clamping the cord on the long-wave drum, which is accessible at the maximum capacity position of the variable condenser. Great care should be taken not to push the cord off the drum while making adjustment here.

If there is overlapping, i.e., if R and K are both indicated together, the scale should be pushed forward slightly. This is only likely to occur if the chassis has been removed from the cabinet and the scale carrier has been bent backwards.

Aligning I.F. Stages.—Inject a signal of 123 KC/S into the pentode control grid circuit of **V2,** and adjust **C38** (screw), **C37** (nut), **C36** (screw) and **C35** (nut) for maximum output.

Aligning H.F. and Oscillator Stages.—Inject a signal of about 250 m. into the frame aerial (by means of a coil loosely coupled), tune to this wavelength on the M.W. scale, and adjust **C31, C29** and **C26** for maximum output. Inject a signal of a wavelength near the top of the M.W. scale, tune to this, and adjust **C33** (screw) for maximum.

Switch set to L.W., inject a signal of wavelength near the bottom of this band, tune set to this wavelength and adjust **C32, C27** and **C24** for maximum. Inject a signal of wavelength near the top of the L.W. band, tune to this signal and adjust **C34** (nut) for maximum output.

It is unlikely that any adjustment will be necessary other than the screw clamping the cord on the long-wave drum, or possibly **C31.** The pilot lamps inside the drums should be tight in their screw adaptors.