'TRADER' SERVICE SHEET 218

MULLARD MBS4

5-VALVE BATTERY SUPERHET

A TWO-VALVE frequency changer is employed in the Mullard MBS4 5-valve battery operated 3-band receiver, which also has a double pentode Q.P.P. output valve. The short-wave band covered is 16·7-51 metres and the receiver has an internal plate aerial, and provision for both a gramophone pick-up and an extension speaker.

CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. via coupling coils **L2, L3** and small condenser **C2** to capacity-coupled band-pass filter. Primary **L4, L5,** is tuned by **C30**; secondary **L8, L9** is tuned by **C33**; coupling by **C3, C4.** I.F. filter **L1, C28** shunts aerial-earth circuit. Image suppression by **C1, C29.** On S.W. band aerial input is via coupling coil **L6** to single-tuned circuit comprising **L7** and **C33.**

First valve (**V1, Mullard metallised VP2**) is a variable-mu R.F. pentode operating as frequency changer with suppressor grid injection in conjunction with separate triode oscillator valve (**V2, Mullard metallised PMIHL**). Oscillator anode coils **L10** (S.W.), **L12, L13** (M.W. and L.W.) are tuned by **C34**; parallel trimming by **C35** (M.W.) and **C36** (L.W.); series tracking by **C9** (S.W.), **C10** (L.W.) and **C11** (M.W.). Oscillator grid coils **L11** (S.W.), **L14, L15** (M.W. and L.W.)

Third valve (**V3, Mullard metallised VP2**) is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C37, L16, L17, C38** and **C39, L18, L19, C40.**

Intermediate frequency 128 KC/S.

Diode second detector is part of double diode triode valve (**V4, Mullard TDD2A**). Audio-frequency component in rectified output is developed across manual volume control **R10** and passed via **C19** and **R11, R12** to C.G. of triode section. Tone correction by **C18**; muting by **C17** and **S22** operated by pressure on volume control knob. Provision for connection of gramophone pick-up across **R10** via switch **S21**; when this is closed **S23** opens and breaks the H.T. supply to **V1, V2** and **V3,** thus muting radio.

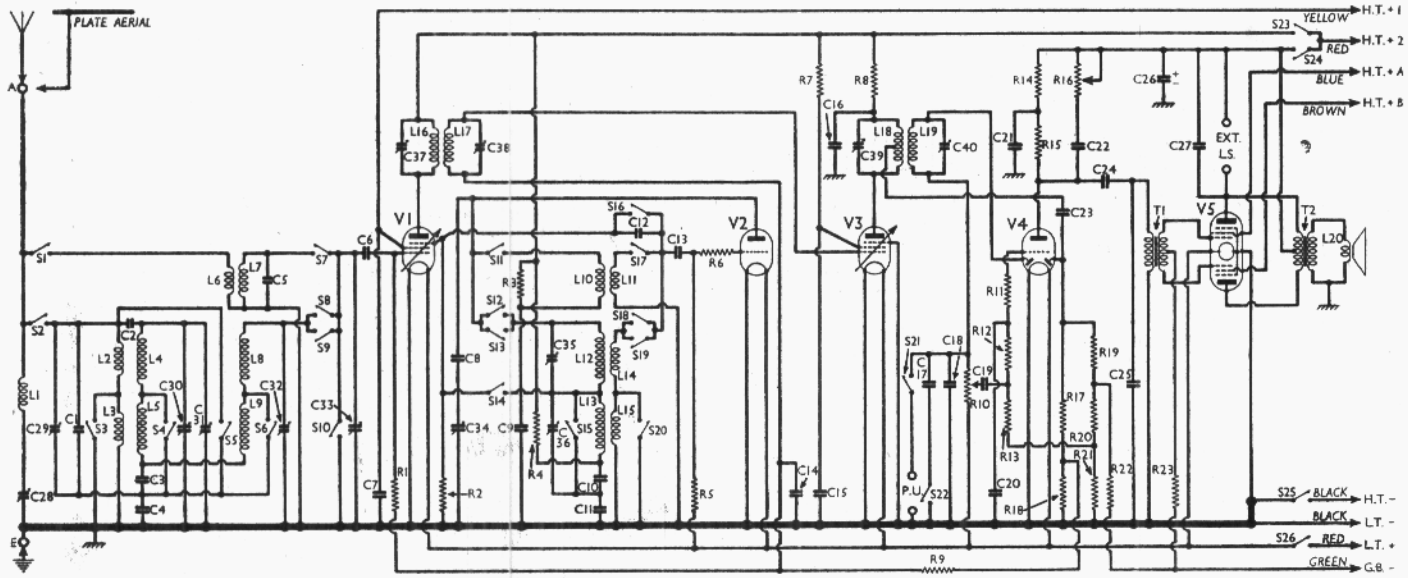
Second diode of **V4,** fed from tapping on **L18** via **C23** provides D.C. potential which is developed across **R17** and **R18,** part being fed back from junction of **R17, R18** through decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic volume control. A.V.C. delay voltage and G.B. for C.G. of triode section of **V4** are developed across potentiometer **R20, R21** from single G.B. tapping on battery. Variable tone control by **R16, C22** in triode anode circuit.

Parallel-fed transformer coupling by **R15, C24,** and **T1** to quiescent push-pull output stage, comprising a double-pentode valve (**V5, Mullard QP22A**). Fixed tone corrector **C25.** Provision for connection of high impedence external speaker across one-half of primary of **T2.** I.F. filter condenser **C27** is connected across one-half of **T2** primary to reduce the high note loss caused by it.

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Image suppressor	0.000025
C2	Aerial M.W., L.W. coupling	0·00001
C3	Band pass coupling	0·016
C4	Band pass coupling	0·025
C5	Aerial S.W. fixed trimmer	0·00002
C6	V1 C.G. condenser	0·0001
C7	V1 S.G. decoupling	0·1
C8	Osc. fixed tracker	0·02
C9	Osc. fixed S.W. tracker	0·02
C10	Osc. fixed L.W. tracker	0·000764
C11	Osc. fixed M.W. tracker	0·001615
C12	Osc. S.W. coupling to V1	0·00002
C13	V2 C.G. condenser	0·0001
C14	V1, V3 C.G. decoupling	0·1
C15	V3 S.G. decoupling	0·008
C16	V3 anode decoupling	0·008
C17	Muting condenser	0·01
C18	Fixed tone corrector	0·0001
C19	A.F. coupling to V4 triode	0·001
C20	V4 triode C.G. decoupling	0·0001
C21	V4 triode anode decoupling	0·5
C22	Tone control condenser	0·05
C23	V4 A.V.C. diode feed	0·0001
C24	A.F. coupling to T1	0·05
C25	Fixed tone corrector	0·001
C26*	H.T. reservoir	8·0
C27	I.F. by-pass	0·001
C28‡	Aerial circuit I.F. filter tuning	0·00017
C29‡	Image suppressor	0·000025
C30†	Band-pass primary tuning	0·000488
C31‡	Band-pass primary trimmer	0·00003
C32‡	Band-pass secondary trimmer	0·00003
C33†	Band-pass sec. and S.W. tuning	0·000488
C34†	Osc. circuit tuning	0·000488
C35‡	Osc. circuit M.W. trimmer	0·00003
C36‡	Osc. circuit L.W. trimmer	0·00003
C37‡	1st I.F. trans. pri. tuning	0·00017
C38‡	1st I.F. trans. sec. tuning	0·00017
C39‡	2nd I.F. trans. pri. tuning	0·00017
C40‡	2nd I.F. trans. sec. tuning	0·00017

* Electrolytic. † Variable. ‡ Pre-set.



Circuit diagram of the Mullard MBS4 3-band battery superhet. A plate aerial is incorporated.

	RESISTANCES	Values (ohms)
R1	V1 C.G. decoupling	1,250,000
R2	V1 supp. grid resistance	50,000
R3	V2 anode S.W. decoupling	32,000
R4	V2 anode M.W. and L.W. decoupling	32,000
R5	V2 C.G. resistance	16,000
R6	V2 C.G. stopper	40
R7	V3 S.G. decoupling	20,000
R8	V3 anode decoupling	4,000
R9	V3 C.G. decoupling	500,000
R10	Manual vol. control	500,000
R11	I.F. stopper	200,000
R12	V4 triode C.G. resistances	200,000
R13		1,000,000
R14	V4 triode anode decoupling	8,000
R15	V4 triode anode load	25,000
R16	Variable tone control	50,000
R17	V4 A.V.C. diode load resistances	1,000,000
R18		320,000
R19	V4 A.V.C. diode G.B. decoupling	1,000,000
R20	V4 triode C.G. G.B. and A.V.C. delay pot.	20,000
R21		5,000
R22	G.B. line decoupling	10,000
R23	V5 grid circuit stabiliser	200,000

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial I.F. filter coil	120·0
L2	Aerial M.W. and L.W. coupling coils	24·0
L3		90·0
L4	Band-pass primary coils	5·0
L5		43·0
L6	Aerial S.W. coupling coil	0·05
L7	Aerial S.W. tuning coil	0·05
L8	Band-pass secondary coils	4·5
L9		40·0
L10	Osc. S.W. tuning coil	0·05
L11	Osc. S.W. reaction coil	0·8
L12	Osc. M.W. and L.W. tuning coils	10·0
L13		25·0
L14	Osc. M.W. and L.W. reaction coils	4·0
L15		8·0
L16	1st I.F. trans. Primary	130·0
L17	1st I.F. trans. Secondary	130·0
L18	2nd I.F. trans. Primary, total	130·0
L19	2nd I.F. trans. Secondary	130·0
L20	Speaker speech coil	3·5
T1	Intervalve trans. Pri.	320·0
	Intervalve trans. Sec. total	18,600·0
T2	Output transformer Pri. total	1,320·0
	Output transformer Sec.	0·1
S1-S20	Waveband switches	—
S21	Radio-Gram. change switch	—
S22	Muting switch	—
S23 S24	H.T. +2 switches	—
S25	H.T. negative line switch	—
S26	L.T. switch	—

DISMANTLING THE SET

A detachable bottom is fitted to the cabinet and upon removal (four screws and washers) gives access to most of the under-chassis components.

Removing Chassis.—If it should be necessary to remove the chassis from the cabinet, remove the four control knobs (recessed grub screws, two in each of the large knobs), free the Bowden cable from the switch indicator, loosen the lock nut and remove the cable.

Next free the scale pointer by loosening the small screw (with washer) holding it to the Bowden cable and remove the nuts from the two screws holding the pointer drive bridge. Remove the bridge.

Now unsolder the speaker leads and the earthing lead to the screen on the bottom of the cabinet. The chassis can now be withdrawn.

When replacing, connect the yellow lead to the bottom tag and the white lead to the top two. Also make sure that the pointer is fixed so that the calibration is correct.

Removing Speaker.—To remove the speaker from the cabinet, slacken the three clamps holding it to the sub-baffle (nuts and lock nuts). *When replacing*, see that the terminal panel is on the left.

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 battery reading 152 V on the H.T. section, on load. The receiver was tuned to the lowest wavelength on the medium band and the volume control was at maximum, but there was no signal input.

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

In our receiver **V5** was marked with two letters R.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 VP2	152	0·8	125	0·2
V2 PM1HL	75	1·8	—	—
V3 VP2	145	1·1	125	0·3
V4 TDD2A	110	1·0	—	—
V5 QP22A	151†	1·2†	125‡	0·1‡

† Each anode. ‡ Each screen.

GENERAL NOTES

Switches.—**S1** to **S21** and **S23, S24** are the wavechange and radio-gram switches, in four ganged units beneath the chassis, arranged in one group of three, with the fourth at one side, link operated from the main spindle. Diagrams of these switches, looking in the direction of the arrows in the under-chassis view are on page VIII. The table (p. VIII) gives the switch positions for the four "on" settings. The order from fully anti-clockwise is "off," S.W., M.W., L.W. and gram. O indicates open, and **C** closed.

S22 is the muting switch, beneath the chassis, operated by pushing in the volume control knob.

S25 and **S26** are the Q.M.B. battery circuit switches in a rotary unit at the front of the chassis, ganged with the wavechange switch units. They are open in the fully anti-clockwise position of the control knob.

Coils.—L1; **L2-L5**; **L8, L9**; **L12-L15**; **L16, L17** and **L18, L19** are in six tubular screened units on the chassis deck, the last two being I.F. transformers. All the units, except **L12-L15,** have single trimmers at their tops; the **L12-L15** unit has two trimmers.

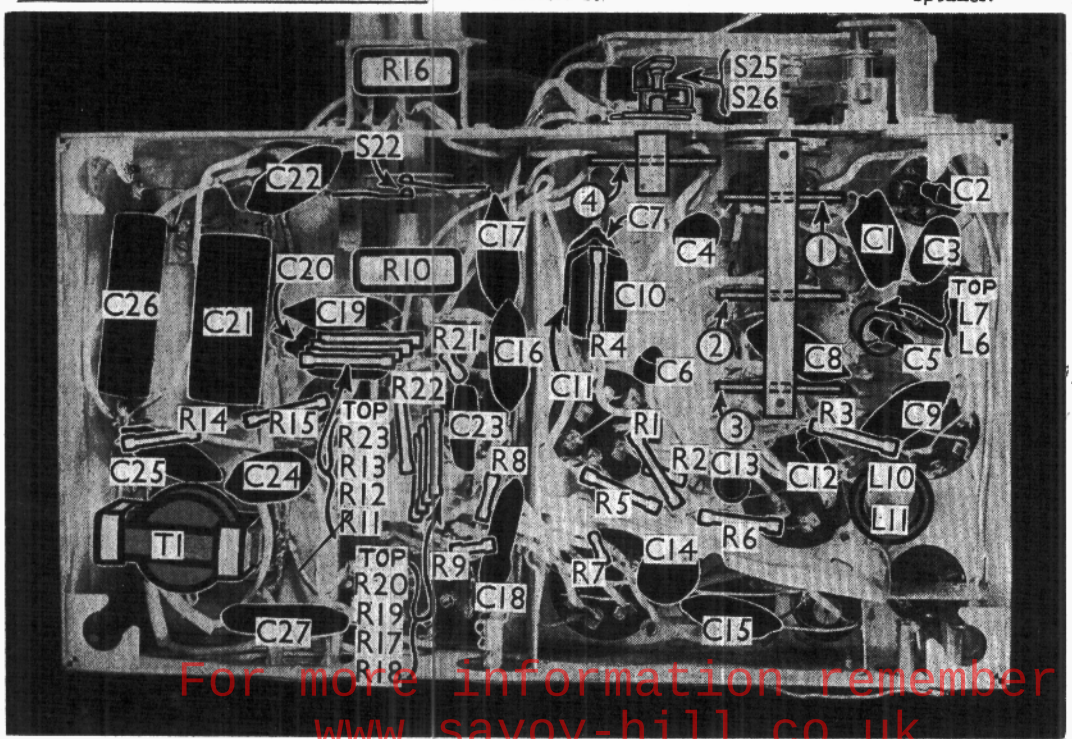
L6, L7 and **L10, L11** are on two small unscreened tubular units beneath the chassis.

External Speaker.—Two sockets are provided at the rear of the chassis for a high impedance (16,000 O) external speaker.

Batteries.—L.T., Oldham ZLG3 2 V 24 AH glass cell. H.T. and G.B., Ever Ready Type Portable 59, 145·5 V H.T. + 10·5 V G.B. battery.

Battery Leads and Voltages.—Black lead, spade tag, L.T. negative; Red lead, spade tag, L.T. positive 2 V; Black lead and plug, H.T. negative, G.B. positive;

Continued overleaf



Under-chassis view. The two resistance banks are numbered from top to bottom. **S22** is a muting switch. Note the small condensers **C2, C5** and **C12.**

MULLARD MBS4—*Continued*

Green lead and plug, G.B. negative 10·5 V; yellow lead and plug, H.T. positive 1, 120 V; Red lead and plug, H.T. positive 2, 145·5 V; Blue lead and plug marked A, and brown lead and plug marked B, to tappings depending on the grading of **V5.**

The letters A and B are stamped on the moulded base, and above them, on the glass bulb, are the grading letters P to T. The corresponding H.T. voltages are: P, 103·5 V; Q, 111·0 V; R, 118·5 V; S, 126·0 V; T, 133·5 V. If A and B both have the same grading letter, the leads can be plugged together, since the brown plug is socketed to receive the blue one where necessary.

CIRCUIT ALIGNMENT

In addition to the usual equipment, a 15 degree jig (Code No. 09991741) is necessary for adjusting the gang to the correct checking point.

I.F. Stages.—When adjusting one winding of an I.F. transformer, the other winding must be shunted with a damping resistance. If the two ends of the circuit to be damped are not accessible, damping may be applied between the anode or grid side of the circuit and chassis, but with a 0·1 μF condenser in series with the resistance, on the chassis side of it.

Turn volume control and gang condenser to maximum, and switch set to L.W.

Short-circuit **C34,** and feed a 128 KC/S signal to control grid of **V3** via a 0·032 μF condenser, and chassis. Shunt **L17** with a 0·01 μF condenser, and adjust **C39** and **C40** for maximum output. Remove shunt. Shunt **L17** with a 10,000 Ω resistance, and apply signal to control grid of **V1.** Adjust **C37** for maximum output. Remove shunt. Shunt **L16** with a 10,000 Ω resistance and 0·1 μF condenser in series, and adjust **C38** for maximum output. Remove shunt. If necessary, re-adjust **C37** and **C39.** Remove short across **C34.**

R.F. and Oscillator Stages.—The receiver must be re-aligned if **V2** is replaced.

Fit the 15 degree jig by slipping the boss over the locating pin above the condenser spindle. The jig ensures that when the condenser is turned so that it bears upon it, the vanes are advanced exactly 15 degrees, which is the standard trimming position.

M.W.—Switch set the M.W., turn volume control to maximum, and rotate gang until it bears on jig.

Apply a 1,442 KC/S (208 m.) signal to **A** and **E** sockets via a standard artificial aerial, and adjust **C35, C32** and **C31** for maximum output, then repeat with greater accuracy.

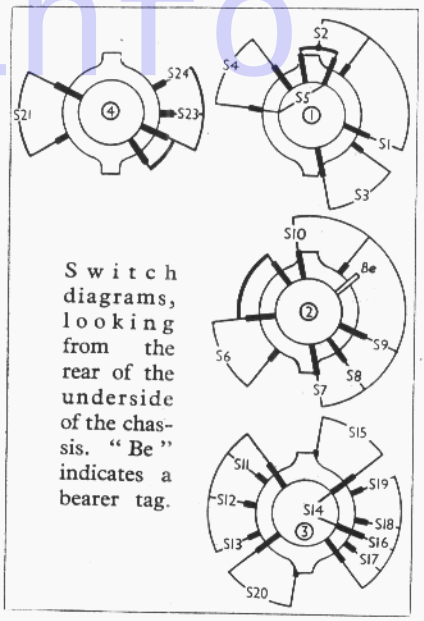
L.W.—Switch to L.W., with gang bearing on jig. Apply a 395 KC/S (760 m.) signal, and adjust **C36** for maximum output.

There are no S.W. adjustments.

TABLE AND DIAGRAM OF SWITCH UNIT

Switch	S.W.	M.W.	L.W.	Gram.
S1	C	O	O	O
S2	O	C	O	C
S3	O	C	O	O
S4	O	C	O	C
S5	O	O	O	C
S6	O	C	O	O
S7	C	O	O	O
S8	O	C	C	O
S9	O	C	C	O
S10	O	O	O	C
S11	C	O	O	O
S12	O	C	C	O
S13	O	C	C	O
S14	O	O	O	C
S15	O	C	C	O
S16	O	C	C	O
S17	C	O	O	O
S18	O	C	C	O
S19	O	C	C	O
S20	O	C	O	O
S21	O	O	O	C
S22*	—	—	—	—
S23	C	C	C	O
S24	C	C	C	C

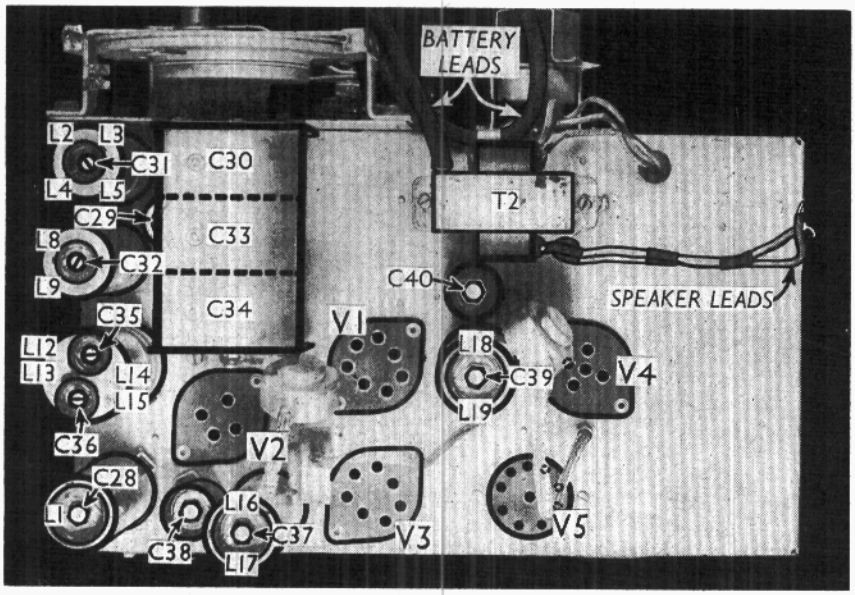
* Not in ganged switch units.



Switch diagrams, looking from the rear of the underside of the chassis. "Be" indicates a bearer tag.

I.F. Filter.—Switch set to L.W., and turn gang to maximum (2,000 m.). Apply a strong 128 KC/S signal to **A** and **E** sockets, and adjust **C28** for *minimum* output.

Image Suppressor.—Switch set to M.W., apply a 744 KC/S (403 m.) signal and tune it in. Without altering receiver tuning, feed in a 1,000 KC/S (300 m.) and adjust **C29** for *minimum* output.



Plan view of the chassis. Each I.F. transformer has its primary trimmer at the top of its screen, and its secondary trimmer on the chassis deck.

SERVICE PSYCHOLOGY

YOUR reputation as a smart, clean-working engineer will be further enhanced by the addition of a few small but worth-while refinements to your usual procedure when working at a client's home. The "lady of the house" is usually present during some period of your operations and she will be keenly observant, particularly if it is your first call.

I have found two pieces of felt cut to approximately 30 by 15 in. each are invaluable; one piece for the protection of cabinet work when the receiver is laid on its side for under-chassis inspection and removal of fixing bolts, the other being placed on a table to receive tools, meters and other gear. The lady will appreciate this thought on your part.

In conjunction with these an "outside" kit of pliers, screwdrivers and other tools in bright polished or plated finish look smart and efficient when laid out for use, and create a very good impression as against a "plumber's" outfit.

Finally, a small bottle or tin of suitable polish, together with soft cloth for its application, enables you to leave the cabinet free from disfiguring—in the lady's eyes—finger marks.

If these tips are followed, you quit the house having found her favour and certain recommendation.—F. T. DUCKETT, NEWCASTLE-ON-TYNE.

Printed in Great Britain as a supplement to *The Wireless Trader* for the proprietors and publishers, *The Trader Publishing Co., Ltd.*, Dorset House, Stamford Street, London, S.E.1, by Sanders, Phillips & Co., Ltd., The Baynard Press, Chryssell Road, London, S.W.9. Every Saturday.