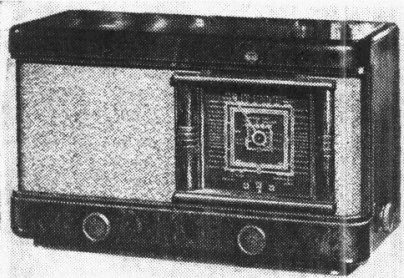


"TRADER" SERVICE SHEET

434

# MULLARD MBS23

## 3-BAND BATTERY SUPERHET



THE Mullard MBS23 is a five-valve 3-band battery superhet, in which separate valves are used for the frequency-changer and oscillator stages, while a quiescent push-pull double pentode is used in the output stage.

The SW range is 19-51 m, and there is provision for connection of a pick-up and for an extension speaker. A form of construction is employed whereby the receiver can be readily removed from the cabinet complete with the speaker, in one unit.

Release date: August, 1939.

### CIRCUIT DESCRIPTION

Aerial input on MW and LW via coupling coils L2, L3 and small "top" coupling C2 to mixed coupled band-pass filter. Primary coils L4, L5 are tuned by C36; secondaries L10, L11 by C38; coupling by coils L6, L7 and condensers C3, C4. IF filtering by L1, C34 across L2, L3. Image suppression by C1.

On SW, input is via coupling coil L8 to single tuned circuit L9, C38.

First valve (V1, Mullard metallised VP2B) is a hexode operating as frequency changer with suppressor grid injector coupling in conjunction with separate triode oscillator valve (V2, Mullard metallised PM2HL).

V2 anode coils L12 (SW), L13 (MW), plus L14 (LW) are tuned by C39; parallel trimming by C40 (MW) and C41 (LW); series tracking by C11 (SW), C14 (MW) and C13 (LW). Reaction by grid coils L15 (SW), L16 (MW) and L17 (LW) via C12 and CG condenser C16 (SW) and C15, C16 (MW and LW). Coupling between V2 CG and V1 injector grid via C15 (SW) and C15, C16 (MW and LW).

Third valve (V3, Mullard metallised VP2B) is an RF hexode with second and fourth grids strapped to operate as pentode intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings C42, C8, L18, L19, C9, C43 and C44, C20, L20, L21, C45.

### Intermediate frequency 128KC/S.

Diode second detector is part of double diode triode valve (V4, Mullard metallised TDD2A). Audio frequency component in rectified output is developed across manual volume control R12, which also operates as load resistance, and passed via AF coupling condenser C23, CG resistance R13, IF filter R15, C26 and grid stopper R16 to CG of triode section, which operates as AF amplifier.

Further IF filtering by C21 in diode circuit, and C27 in triode anode circuit. Provision for connection of gramophone pick-up across R12. Tone compensation by C22.

Second diode of V4, fed from V3

anode via C25, provides DC potential which is developed across load resistance R19 and fed back through decoupling circuit to EC valve, giving automatic volume control.

Parallel-fed transformer coupling by R17, C28 and T1, via stopper resistances R22, R23, between V4 triode and double pentode push-pull output valve (V5, Mullard QP22B). Fixed tone correction in anode circuit by C30 and C31 between anodes and chassis. Provision for connection of low impedance external speaker across secondary of output transformer T2.

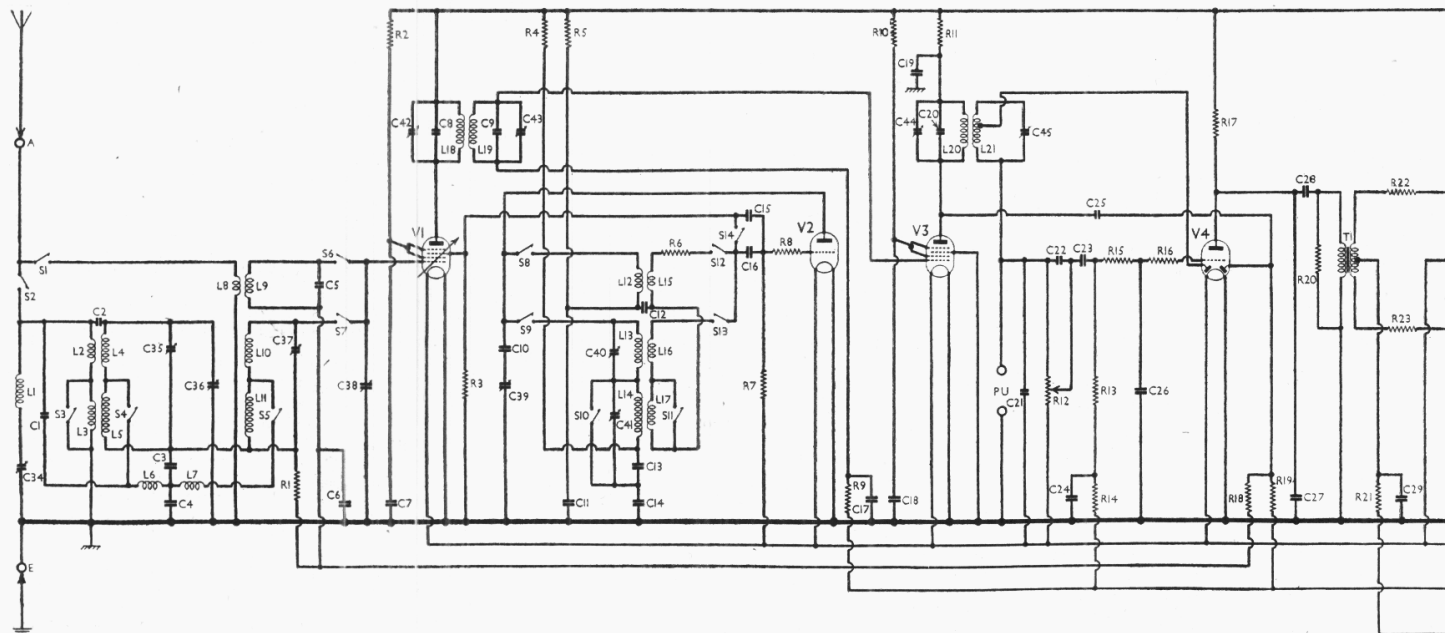
Fixed GB for V1 and GB for V3, V4 triode and V5 are obtained from drop along resistances R24, R25 which form a potential divider in negative HT lead to chassis.

### DISMANTLING THE SET

**Removing Chassis.**—Remove the two control knobs (grub screws) from the front of the cabinet, and a third from the side of the cabinet (grub screw inside cabinet).

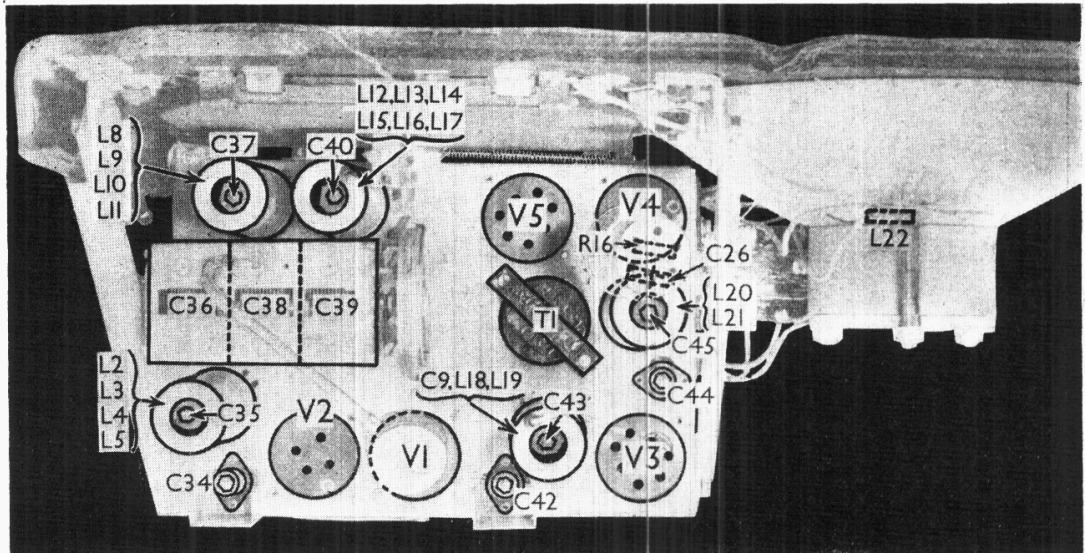
Then unsolder the bare earthing wire, which emerges from the rear of the chassis, from the tag on the bracket at the base of the rear of the cabinet, and remove the six cheese-head screws holding the sub-baffle, on which the entire receiver is mounted, to the front of the cabinet, when the whole assembly can be withdrawn as a single unit.

**When replacing,** note that a small metal plate goes under the head of the middle fixing screw at the top of the sub-baffle. Also, if difficulty should be experienced in inserting the two lower left-hand screws, which must be screwed into the front of the cabinet





Plan view of the chassis and speaker, removed from the cabinet in a single unit. R16 and C26 are inside the top cap connector of V4. Note that the L18, L19, IF transformer unit also contains C9. L22 is the speaker speech coil.



from beneath the chassis, this may be overcome by using a long screw-driver with either a magnetised blade or a piece of wax stuck to the end of the blade, to hold the screw in position.

**Removing Speaker.**—Unsolder the three leads from the connecting panel on the speaker, remove the set screw (with lock-washer) holding the swivel link support (between the top of the sub-baffle and the rear right-hand corner of the chassis) to the chassis, and free the clamp nuts (with washers and lock-nuts) holding the speaker to the sub-baffle when, if the clamps are swivelled round and the chassis supporting link is swung upwards out of the way, the speaker may be withdrawn.

**When replacing,** the connecting panel should be at the top; the lead from the left-hand connection on the output transformer should be connected to the right-hand tag on the speaker connecting panel; and the lead from the right-

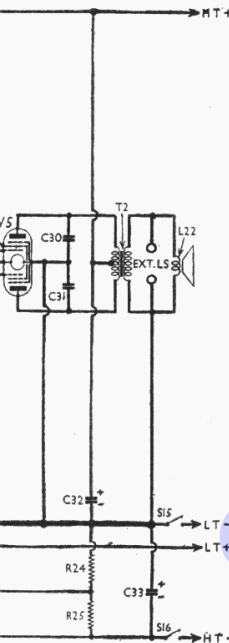
hand connection on the output transformer should be connected to the two tags on the left of the connecting panel, together with the earthing lead from the tuning scale backing.

**COMPONENTS AND VALUES**

RESISTANCES		Values (ohms)
R1	V1 CG decoupling ...	100,000
R2	V1 SG HT feed resistance	200,000
R3	V1 injector grid resistance	800,000
R4	V2 anode MW and LW HT feed ...	50,000
R5	V2 anode SW HT feed ...	20,000
R6	Osc. reaction SW damping	16
R7	V2 CG resistance ...	16,000
R8	V2 CG stabiliser ...	50
R9	V3 CG decoupling ...	1,000,000
R10	V3 SG HT feed ...	160,000
R11	V3 anode HT feed ...	5,000
R12	Manual volume control; V4 signal diode load ...	500,000
R13	V4 triode CG resistance ...	1,000,000
R14	V4 triode CG decoupling ...	200,000
R15	IF filter resistance ...	200,000
R16	V4 triode grid stopper ...	200,000
R17	V4 triode anode HT feed ...	50,000
R18	AVC line decoupling ...	1,000,000
R19	V4 AVC diode load ...	1,000,000
R20	T1 primary shunt ...	32,000
R21	V5 CG's decoupling ...	100,000
R22	V5 CG's stopper resistances ...	10,000
R23	...	10,000
R24	V1 fixed; V2, V3 triode and V4 auto GB resistances...	50
R25	...	1,000

CONDENSERS (Continued)		Values (μF)
C23	AF coupling to V4 triode...	0-01
C24	V4 triode CG decoupling ...	0-05
C25	Coupling to V4 AVC diode...	0-00001
C26	IF by-pass condensers ...	0-0001
C27	...	0-0005
C28	AF coupling to T1 ...	0-2
C29	V5 CG's decoupling...	0-1
C30	Fixed tone correctors ...	0-001
C31	...	0-001
C32*	HT reservoir condenser ...	8-0
C33*	Auto GB by-pass ...	50-0
C34†	Aerial IF filter tuning ...	0-0001
C35‡	Band-pass pri. MW trimmer ...	0-00008
C36†	Band-pass pri. tuning ...	0-00049
C37†	Band-pass sec. MW trimmer ...	0-00003
C38†	Band-pass sec. and aerial SW tuning ...	0-00049
C39†	Oscillator circuit tuning ...	0-00049
C40†	Osc. circuit MW trimmer...	0-00003
C41†	Osc. circuit LW trimmer...	0-00003
C42†	1st IF trans. pri. tuning ...	0-00003
C43†	1st IF trans. sec. tuning ...	0-00003
C44†	2nd IF trans. pri. tuning ...	0-00003
C45†	2nd IF trans. sec. tuning ...	0-0001

\* Electrolytic. † Variable. ‡ Pre-set.

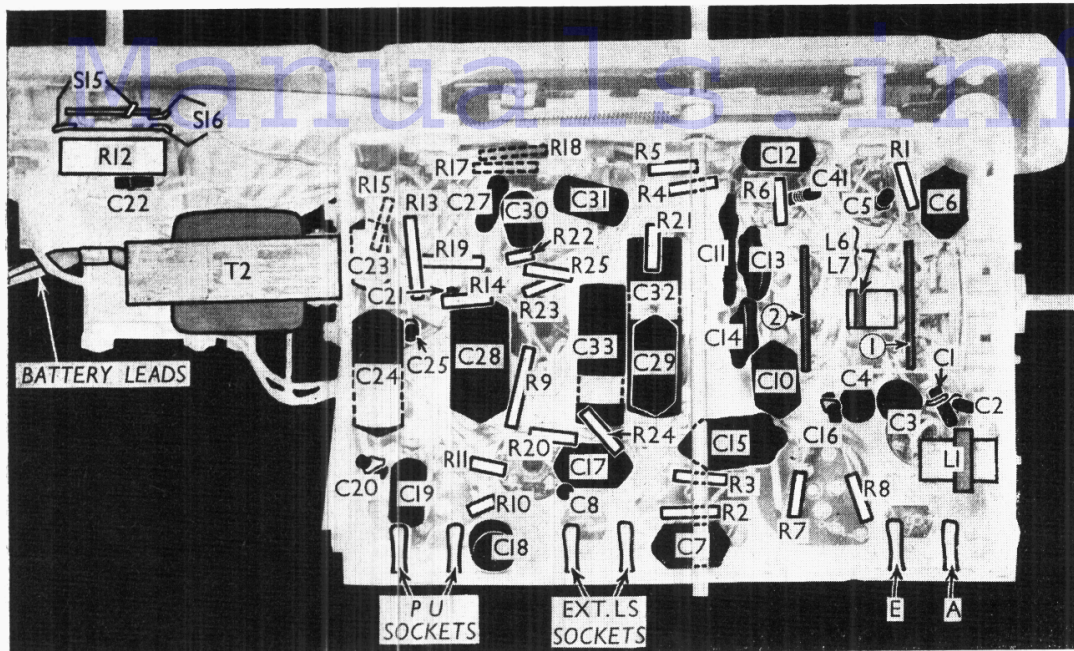


Circuit diagram of the Mullard MBS23 3 - band battery superhet. L1, C34 form an aerial IF filter. C1 acts as an image suppressor. V1 and V3 are both RF hexodes.

CONDENSERS		Values (μF)
C1	Image suppressor ...	0-00004
C2	MW coupling condenser ...	0-000016
C3	Band pass coupling condensers ...	0-016
C4	...	0-025
C5	Aerial SW trimmer ...	0-000027
C6	V1 CG SW decoupling ...	0-05
C7	V1 SG decoupling ...	0-05
C8	1st IF transformer fixed trimmer condensers ...	0-000064
C9	...	0-000064
C10	HT isolating condenser ...	0-05
C11	Osc. circuit SW tracker ...	0-0027
C12	Reaction coupling condenser ...	0-01
C13	Osc. circuit LW tracker ...	0-000725
C14	Osc. circuit MW tracker ...	0-001615
C15	V1 to V2 CG's SW coupling ...	0-0005
C16	V2 CG condenser ...	0-0001
C17	V3 CG decoupling ...	0-05
C18	V3 SG decoupling ...	0-05
C19	V3 anode decoupling ...	0-01
C20	2nd IF trans. pri. trimmer ...	0-00005
C21	IF by-pass ...	0-00005
C22	Tone compensator ...	0-00005

OTHER COMPONENTS		Approx values (ohms)
L1	Aerial IF filter coil ...	100-0
L2	Aerial MW coupling coil ...	25-0
L3	Aerial LW coupling coil ...	95-0
L4	Band-pass primary coils ...	4-0
L5	...	38-0
L6	Band-pass coupling coils ...	0-7
L7	...	0-7
L8	Aerial SW coupling coil ...	2-0
L9	Aerial SW tuning coil ...	0-1
L10	Band-pass secondary coils ...	4-0
L11	...	38-0
L12	Osc. circuit SW tuning coil...	0-2
L13	Osc. circuit MW tuning coil ...	10-0
L14	Osc. circuit LW tuning coil ...	28-0
L15	Oscillator SW reaction ...	0-1
L16	Oscillator MW reaction ...	4-0
L17	Oscillator LW reaction ...	8-0
L18	1st IF trans. (Pri. ...)	115-0
L19	...	115-0
L20	2nd IF trans. (Pri. ...)	115-0
L21	...	115-0
L22	Speaker speech coil ...	3-5
T1	Intervalve trans. (Pri. ...)	600-0
T2	Output trans. (Pri. total, Sec. ...)	3,000-0
S1-S14	Waveband switches ...	—
S15	LT circuit switch ganged	—
S16	HT circuit switch	—





Under-chassis view. The tags of S15, S16 are identified. Diagrams of the two wavechange switch units are in column 3. C41 is a wire-wound adjustable condenser.

**VALVE ANALYSIS**

Valve voltages and currents given in the table below are those measured in our receiver when it was operating with an HT battery reading 120 V 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 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 VP2B	110	0.45	30	0.3
V2 PM2HL	47	1.1	—	—
V3 VP2B	101	1.3	34	0.45
V4 TDD2A	72	0.7	—	—
V5 QP22B	107*	2.1*	110	0.6

\* Each anode.

**GENERAL NOTES**

**Switches.**—S1-S14 are the wavechange switches, in two rotary units beneath the chassis, indicated in our under-chassis view, and shown in detail in the diagrams in col. 3, where they are drawn as seen looking from the loud-speaker end of the chassis.

The table (col. 3) gives the switch positions for the three control sittings, starting from fully anti-clockwise. A dash indicates open, and C closed.

S15, S16 are the battery circuit switches, ganged with the volume control R12. Their tags are indicated in the under-chassis view.

**Coils.**—L1 and L6, L7 are in two unscreened units beneath the chassis. L2-L5; L8-L11; L12-L17 and the IF transformers L18, L19 and L20, L21 are in five screened units on the chassis deck. Each unit has one trimmer at its top. The L18, L19 unit also contains C9.

**External Speaker.**—Two sockets are provided at the rear of the chassis for

a low impedance (5-10 Ω) external speaker.

**Components R16, C26.**—These are mounted inside the top cap connector of V4.

**Batteries.**—LT, 2V 20-25AH accumulator cell; HT, 120V HT battery. GB is automatic.

**Battery Leads and Voltages.**—Lead with black spade tag, LT negative; lead with red spade tag, LT positive 2V; lead with green plug, HT negative; lead with blue plug, HT positive 120V.

**CIRCUIT ALIGNMENT**

**IF Stages.**—Switch set to LW, turn gang to minimum and volume control to maximum. Connect signal generator to control grid (top cap) of V3 (via a 0.032 μF condenser) and chassis, and feed in a 128 KC/S signal. Adjust C44 and C45 for maximum output.

Connect a 25,000 Ω resistor and 0.1 μF condenser in series between anode of V1 and chassis, and connect signal generator, via the 0.032 μF condenser to control grid (top cap) of V1 and chassis. Feed in a 128 KC/S signal, and adjust C43 for maximum output. Transfer series resistance and condenser from anode circuit of V1, and connect them from control grid of V3 to chassis. Adjust C42 for maximum output, then remove damping circuit.

**RF and Oscillator Stages.**—A Mullard 15 deg. jig must be used to obtain the correct gang setting for trimming at the lower ends of the wavebands. The volume control should be at maximum, and the signal generator must be connected via a standard dummy aerial to A and E sockets.

**MW.**—Fit 15 deg. jig, switch set to MW, and turn gang until it bears on jig. Connect a 25,000 Ω resistor and 0.1 μF condenser in series between anode of V1 and chassis. Feed in a 1.442 KC/S (208 m) signal, and adjust C40, C37, C35, then C37 and C40 again, for maximum output.

**LW.**—Switch set to LW, and set gang to jig. Keep the damping circuit connected to V1, feed in a 395 KC/S (760 m) signal, and adjust C41 for maximum output. Remove damping circuit.

**IF Filter.**—Switch set to LW, turn gang and volume control to maximum, feed in a strong 128 KC/S signal, and adjust C34 for minimum output.

**SWITCH TABLE AND DIAGRAMS**

Switch	SW	MW	LW
S1	C	—	—
S2	—	—	C
S3	—	—	—
S4	—	—	—
S5	—	—	—
S6	—	—	—
S7	—	—	—
S8	—	—	—
S9	—	—	—
S10	—	—	—
S11	—	—	—
S12	—	—	—
S13	—	—	—
S14	—	—	—

Diagrams of the wavechange switch units, as seen in the direction of the arrows in the under-chassis view.

