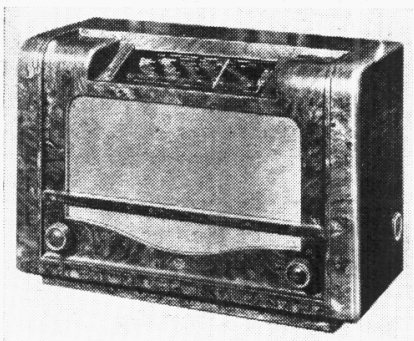
Supplement to The Wireless & Electrical Trader, December 17, 1938

"TRADER" SERVICE SHEET

373

MULLARD MBS6
REFLEX BATTERY SUPERHET



AN interesting point in the design of the Mullard MBS6 5-valve battery 3-band superhet is the fact that the IF amplifier is used in a reflex circuit so that it operates as an AF amplifier as well. Another point is the employment of a 2-valve frequency changer circuit.

The receiver has a short-wave range of 19-51 m and the scale lamps are arranged so that they can be switched on by pressing the tuning knob.

Release date: August, 1938.

CIRCUIT DESCRIPTION

Aerial input on MW and LW via coupling coils **L2, L3** and small condenser **C3** to capacity coupled band-pass filter. Primary coils **L4, L5** are tuned by **C32**; secondaries **L7, L8** by **C34**; coupling by **C4, C5.** IF filter **L1, C29** is connected across **L2, L3.** Image suppression by **C1, C30.** On SW, input is via coupling condenser **C2** to aperiodic coil **L6.**

First valve (**V1, Mullard metallised VP2B**) is a variable-mu hexode operating as frequency changer with suppressor grid injection in conjunction with separate oscillator valve (**V2, Mullard metallised PM2HL**). Oscillator anode coils **L9** (SW), **L10** (MW) and **L11** (LW) are tuned by **C35**; parallel trimming by **C36** (MW) and **C37** (LW); series tracking by **C9** (SW), **C12** (MW) and **C11** (LW). Reaction by grid coils **L12** (SW), **L13** (MW) and **L14** (LW).

Third valve (**V3, Mullard metallised VP2B**) is a variable-mu hexode operating as intermediate frequency amplifier and reflex audio frequency amplifier. The IF couplings **C38, L15, L16, C39** and **C40, L17, L18, C41** are tuned-primary tuned-secondary transformers connected in the normal manner.

Intermediate frequency 128KC/S.

Diode second detector is part of separate indirectly-heated cathode double diode valve (**V4, Mullard metallised 2D2**). Audio frequency component in rectified output is developed across load resistance **R15** and passed via AF coupling condenser **C19,** CG resistance **R14** and IF filter **C18, R13** to third grid, operating as AF control grid, of **V3.**

Second diode of **V4,** fed from tapping on **L17** via **C17,** provides DC potentials which are developed across load resistances **R18, R19** and fed back through decoupling circuits as grid bias to FC and IF valves, giving automatic volume control.

Resistance-capacity AF coupling by **R12, C23** and manual volume control **R21,** between **V3** and pentode output valve (**V5, Mullard PM22D**). Filter circuit **C22, R22, C26, R23** suppresses residue of IF. Tone compensation by **C25.** Fixed tone correction by **C27** in anode circuit.

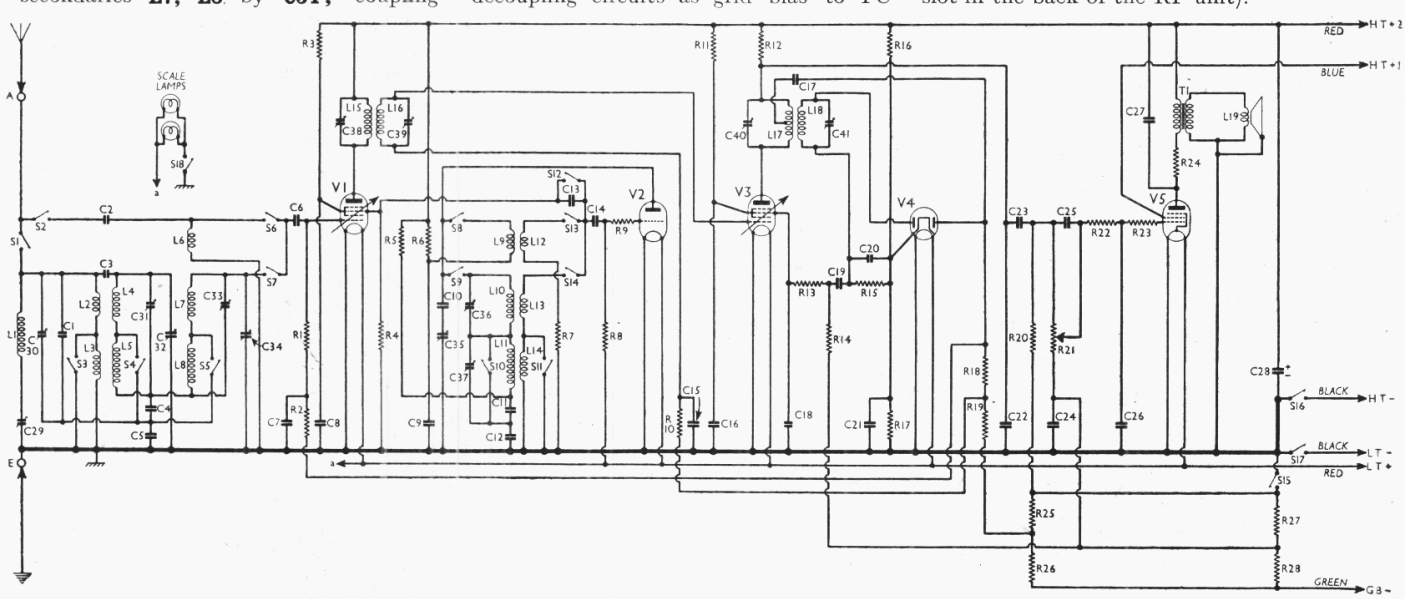
Common GB potential for AF section of **V3** and for **V5** is obtained from potential divider **R27, R28** connected across GB section of HT battery. Fixed GB potential for **V1** and **V3** is obtained from potential divider **R27, R28,** also across GB section, and is added to the potential of **V4** cathode, which is connected to junction of **R16** and **R17,** to provide AVC delay.

DISMANTLING THE SET

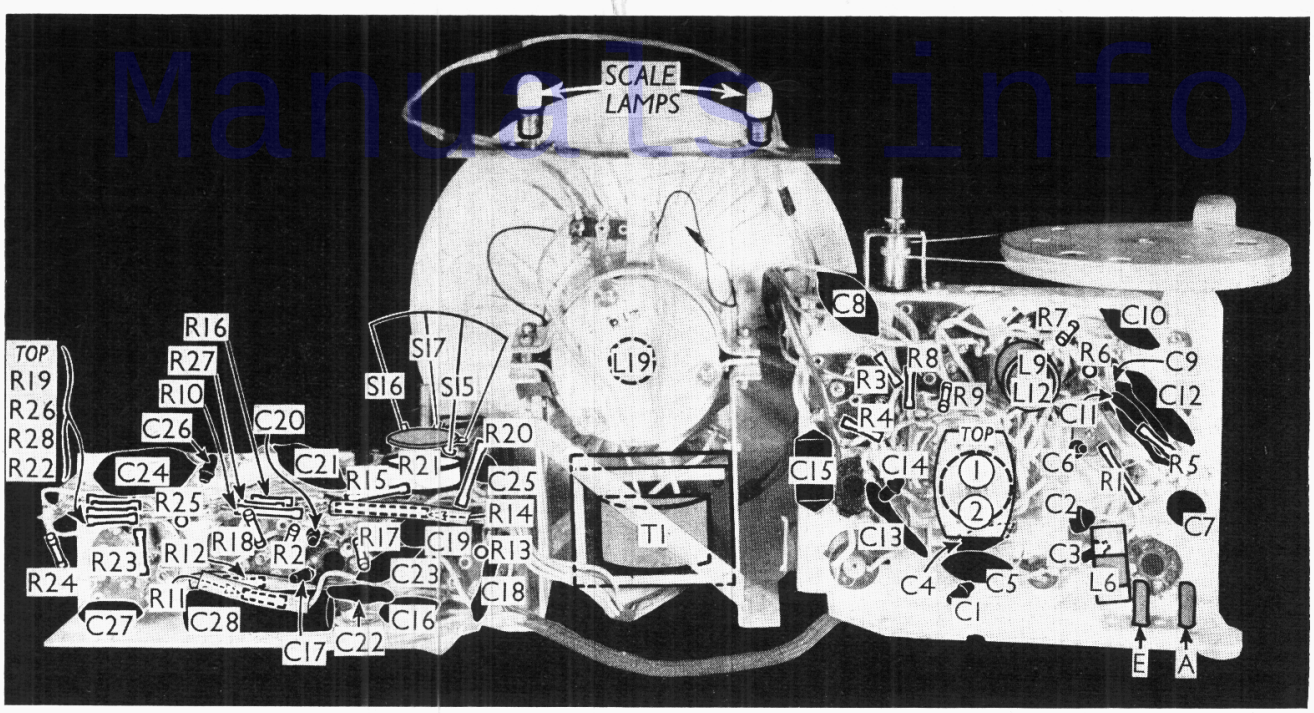
NOTE.—In these paragraphs the term "FC Unit" is used to indicate the left-hand unit in the cabinet (when the set is viewed from the back), "baseboard" is used to describe the wooden bottom of the cabinet and "cabinet" to indicate the moulded part.

It is not possible to remove either of the units separately until the whole assembly has been withdrawn from the cabinet.

Removing Assembly.—To remove the assembly first remove the two knobs at the front of the cabinet (two recessed grub screws in each accessible through holes in the baseboard) and the switch knob at the side of the cabinet (two recessed grub screws accessible through a slot in the back of the RF unit).



Circuit diagram of the Mullard MBS6 battery superhet. Note that the AF output from the second detector is passed back to **V3,** which therefore amplifies both at IF and AF.



Underneath views of the two chassis and speaker. The two switch units are shown in detail in col. 3 overleaf.

Now loosen the two cleats holding the speaker to the sub-baffle and swivel them out of the way, and unsolder the earthing lead from each unit. Free the bowden cable from the wave-change switch indicator.

Free the pointer drive wire from the pointer carriage (screw), clip the wire to the drum with crocodile clips, slacken the right-hand pulley (two screws) and remove the wire from the other three pulleys.

Next remove the two screws (with washers) holding the two units to the cabinet and the wood screw(with washer) holding the bracket on the gang condenser to the sub-baffle.

Finally, remove the two screws (with washers) holding the front of the baseboard to the cabinet and the two screws securing the clamps holding the back of the baseboard to the cabinet, when the assembly can be withdrawn. A careful note should be made of the position of the pointer drive wire on the drive drum so that it can be replaced correctly.

When replacing, do not forget to pull the earthing leads out to the back of the cabinet and push the right-hand pulley over to the right to such an extent that the drive wire pulls the spring almost on to its stop. Note that the smallest knob goes on the wave-change switch.

Removing Speaker.—To remove the speaker from the cabinet, unsolder from the panel on the speaker the two leads which go to the output transformer, slacken the two cleats holding the speaker to the sub-baffle and swivel them out of the way, and slacken the clamp holding the speaker to its support (four screws).

When replacing, see that the terminal panel is at the top and take the left-hand lead to the two left-hand tags on the panel.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 CG resistance	1,000,000
R2	V1 CG decoupling	1,000,000
R3	V1 SG HT feed	200,000
R4	V1 mixing grid resistance	100,000
R5	V2 anode MW and LW HT feed	64,000
R6	V2 anode SW HT feed	32,000
R7	Osc. reaction SW damping	10
R8	V2 CG resistance	16,000
R9	V2 CG stabiliser	64
R10	V3 CG decoupling	1,000,000
R11	V3 SG HT feed	160,000
R12	V3 anode AF load	64,000
R13	IF stopper	200,000
R14	V3 AF CG resistance	2,000,000
R15	V4 signal diode load	1,000,000
R16, R17	AVC delay potential divider	500,000 / 10,000
R18, R19	V4 AVC diode load resistances	800,000 / 160,000
R20	Part V5 GB pot. divider	1,000,000
R21	Manual volume control	500,000
R22, R23	Parts of IF filter	100,000 / 100,000
R24	V5 anode stabiliser	250
R25, R26	V1, V3 fixed GB potential divider	3,200 / 50,000
R27, R28	V3 AF section and V5 GB potential divider	8,000 / 10,000

	CONDENSERS	Values (μF)
C1	Image suppressor (fixed)	0·00004
C2	Aerial SW coupling condenser	0·00005
C3	MW and LW aerial coupling	0·00002
C4, C5	Band-pass bottom coupling condensers	0·016 / 0·025
C6	V1 CG condenser	0·0001
C7	V1 CG decoupling	0·1
C8	V1 SG decoupling	0·1
C9	Osc. circuit SW tracker	0·02
C10	HT blocking condenser	0·02
C11	Osc. circuit LW tracker	0·000764
C12	Osc. circuit MW tracker	0·001615
C13	V2 to V1 SW osc. coupling	0·0005
C14	V2 CG condenser	0·0001
C15	V3 CG decoupling	0·1
C16	V3 SG decoupling	0·01
C17	Coupling to V4 AVC diode	0·0001
C18	IF by-pass	0·00005
C19	AF coupling to V3	0·0005
C20	IF by-pass	0·00005

Continued in next column.

	CONDENSERS (*Continued*)	Values (μF)
C21	V4 cathode by-pass	0·1
C22	V3 anode RF decoupling	0·0005
C23	V3 to V5 AF coupling	0·005
C24	V3 AF and V5 CG's decoupling	0·5
C25	Tone compensator	0·0001
C26	Part of IF filter	0·0001
C27	Fixed tone corrector.	0·002
C28*	HT reservoir condenser	8·0
C29‡	Aerial IF filter tuning	0·00003
C30‡	Image suppressor tuning	0·00003
C31‡	Band-pass pri. MW trimmer	0·00003
C32†	Band-pass primary tuning	0·00049
C33‡	Band-pass sec. MW trimmer	0·00003
C34‡	Band-pass secondary tuning	0·00049
C35†	Oscillator circuit tuning	0·00049
C36‡	Osc. circuit MW trimmer	0·00003
C37‡	Osc. circuit LW trimmer	0·00003
C38‡	1st IF trans. pri. tuning	0·00017
C39‡	1st IF trans. sec. tuning	0·00017
C40‡	2nd IF trans. pri. tuning	0·00017
C41‡	2nd IF trans. sec. tuning	0·00017

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial IF filter coil	130·0
L2, L3	Aerial MW and LW coupling coils	30·0 / 100·0
L4, L5	Band-pass primary coils	4·5 / 45·0
L6	Aperiodic SW aerial coil	0·5
L7, L8	Band-pass secondary coils	4·5 / 45·0
L9	Osc. circuit SW tuning coil	0·1
L10	Osc. circuit MW tuning coil	10·0
L11	Osc. circuit LW tuning coil	32·0
L12	Oscillator SW reaction	1·0
L13	Oscillator MW reaction	3·2
L14	Oscillator LW reaction	9·0
L15	1st IF trans. Pri.	130·0
L16	1st IF trans. Sec.	130·0
L17	2nd IF trans. Pri., total	130·0
L18	2nd IF trans. Sec.	130·0
L19	Speaker speech coil	4·0
T1	Output trans. Pri.	2,000·0
	Output trans. Sec.	0·2
S1-S14	Waveband switches	—
S15	GB circuit switch (ganged R21)	—
S16	HT circuit switch (ganged R21)	—
S17	LT circuit switch (ganged R21)	—
S18	Scale lamps switch	—

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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 134 V on the HT 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 400 V scale of a model 7 Universal Avometer, chassis being negative.

In our receiver **V5** was graded " A."

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 VP2B	134	0·6	34	0·5
V2 PM2HL	45	1·2	—	—
V3 VP2B	70	0·8	34	0·6
V4 2D2	—	—	—	—
V5 PM22D	122	4·8	134	0·8

GENERAL NOTES

Switches.—**S1-S14** are the waveband switches, in two rotary units beneath the frequency changer chassis. They are placed close together and screened, and cannot easily be reached without partial dismantling. The nearer unit, looking at the underside of the chassis is number 1, and the further, number 2. Diagrams of the units, as seen from the underside of the chassis, are in col. 3.

The table (col. 2) gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates open, and **C** closed.

S15-S17 are the battery circuit switches, ganged in a rotary unit with the volume control **R21.** Their position is indicated in the plan view of the two chassis. One side of each switch is common, and is connected to chassis.

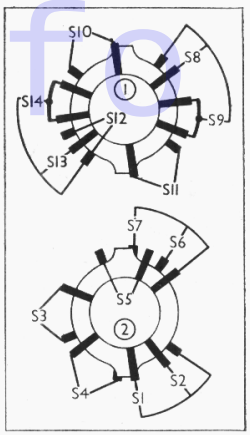
S18 is the scale lamps switch, shown in the plan view of the receiver. It is associated with the tuning control spindle, and when this is pushed in, **S18** closes.

Coils.—**L1 ; L2-L5 ; L7, L8 ; L10, L11, L13, L14** and the first IF unit, **L15, L16,** are in five screened units on the FC chassis deck, while the **L17, L18** unit is on the deck of the other chassis. **L6** and **L9, L12** are in two unscreened units beneath the FC chassis.

TABLE AND DIAGRAMS OF THE SWITCH UNITS

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

Switch diagrams, showing the two units as seen from the underside of the chassis, when the assembly is partially dismantled.



Scale Lamps.—These are two Philips MES types, No. 8017/07. They are only in circuit when **S18** is closed by pushing in the tuning knob.

External Speaker.—No provision is made for this, but a low resistance type could be connected across **T1** secondary in parallel with **L19.**

Batteries.—LT, 2 V 20 AH accumulator cell ; HT and GB, 135 V plus 9 V combined HT and GB dry battery.

Battery Leads and Voltages.—Black lead, spade tag, LT negative ; red lead, spade tag, LT positive 2 V ; black lead and plug, HT negative and GB positive ; green lead and plug, GB negative −7·5 V ; red lead and plug, HT positive 2, +135 V ; blue lead and plug, HT positive 1, +135 V (in socket in red plug) if **V5** is coded " A," and +120 V if **V5** is coded " B."

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 **C40** and **C41** 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 **C39** for maximum output. Transfer series resistance and condenser from anode circuit of **V1,** and connect them from control grid of **V3** to chassis. Adjust **C38** for maximum output, then remove damping circuit.

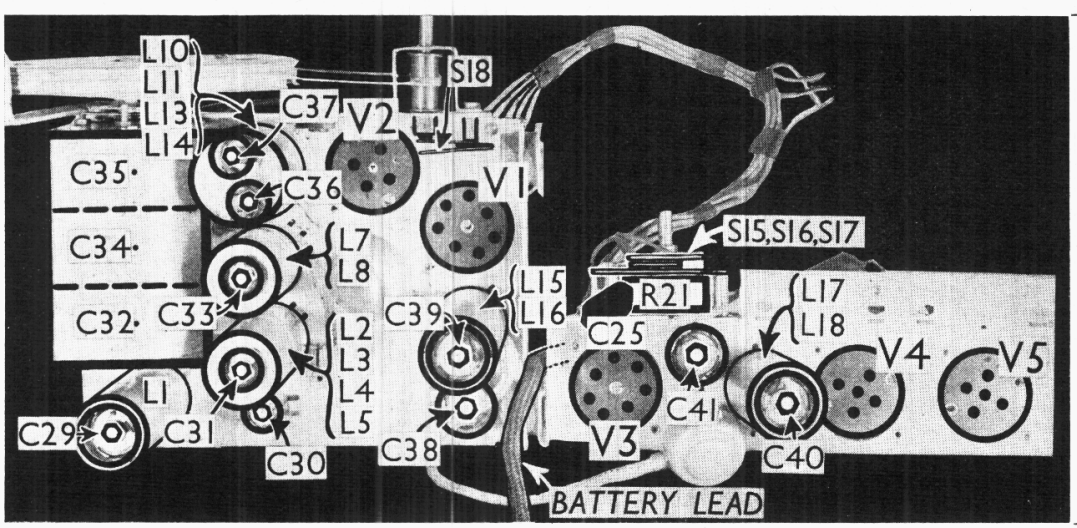
RF and Oscillator Stages.—A Mullard 15 degree jig must be used to obtain the correct gang setting for trimming at the lower ends of the wavebands. The volume control should be at maximum, and the signal generator must be connected via a standard dummy aerial to **A** and **E** sockets.

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 **C36, C33, C31,** then **C33** and **C36** 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 **C37** 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 **C29** for *minimum* output.

Image Suppressor.—Switch set to MW, turn volume control to maximum, and feed in a strong 300 m (1,000 KC/S) signal. Tune set to the image (about 403 m), and adjust **C30** for *minimum* output.



Plan view of the two chassis, showing all the trimmers. The frequency-changer chassis is on the left. **S15-S17** are the battery circuit switches, ganged with **R21.** **S18** is the scale lamps switch, operated by pressing the tuning knob.