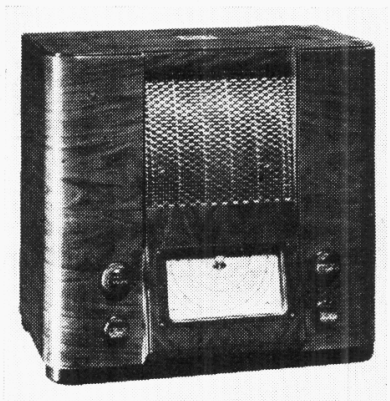
Supplement to The Wireless & Electrical Trader, December 31, 1938

"TRADER" SERVICE SHEET 375

H.M.V. 654 AND MARCONIPHONE 859



The H.M.V. 654 receiver. The Marconiphone 859 has a similar, but not identical, cabinet design.

SUITABLE for mains of 200-250 V (25-60 C/S in the case of AC), the H.M.V. 654 is a 4-valve (plus rectifier) AC/DC 3-band superhet covering a short-wave range of 13·8-50 m.

An identical chassis is fitted in the Marconiphone 859, which is also very similar in external appearance, but this *Service Sheet* was prepared on an H.M.V. 654.

Release date for both models: August, 1938.

CIRCUIT DESCRIPTION

Aerial input via mains isolating condenser **C1,** and via coupling condenser **C3** (SW), **L1** and coupling coil **L3** (MW) or **L1, L2** and coupling coil **L4** (LW) to single tuned circuits **L5, C36** (SW), **L6, C36** (MW) and **L7, C36** (LW). **L1, L2, C4, C5** form a filter circuit to provide IF and image rejection.

First valve (**V1, Marconi X63**) is a heptode operating as frequency changer with electron coupling. Oscillator grid coils **L8** (SW), **L9** (MW) and **L10** (LW) are tuned by **C37**; parallel trimming by **C38** (MW) and **C39** (LW); series tracking by **C9** (SW), **C10** (MW) and **C11** (LW). Reaction by direct coupling to grid coils on all bands via coupling condenser **C14** assisted on SW by reaction coil **L11.**

Second valve (**V2, Marconi KTW63**) is a RF tetrode operating as intermediate frequency amplifier with tuned-primary tuned-secondary iron-cored transformer couplings **C40, L12, L13, C41** and **C42, L14, L15, C43.**

Intermediate frequency 465 KC/S.

Diode second detector is part of double diode triode valve (**V3, Marconi DH63**). Audio frequency component in rectified output is developed across load resistance **R9** and passed via IF stopper **R10,** AF coupling condenser **C19** and manual volume control **R11** to CG of triode section, which operates as AF amplifier.

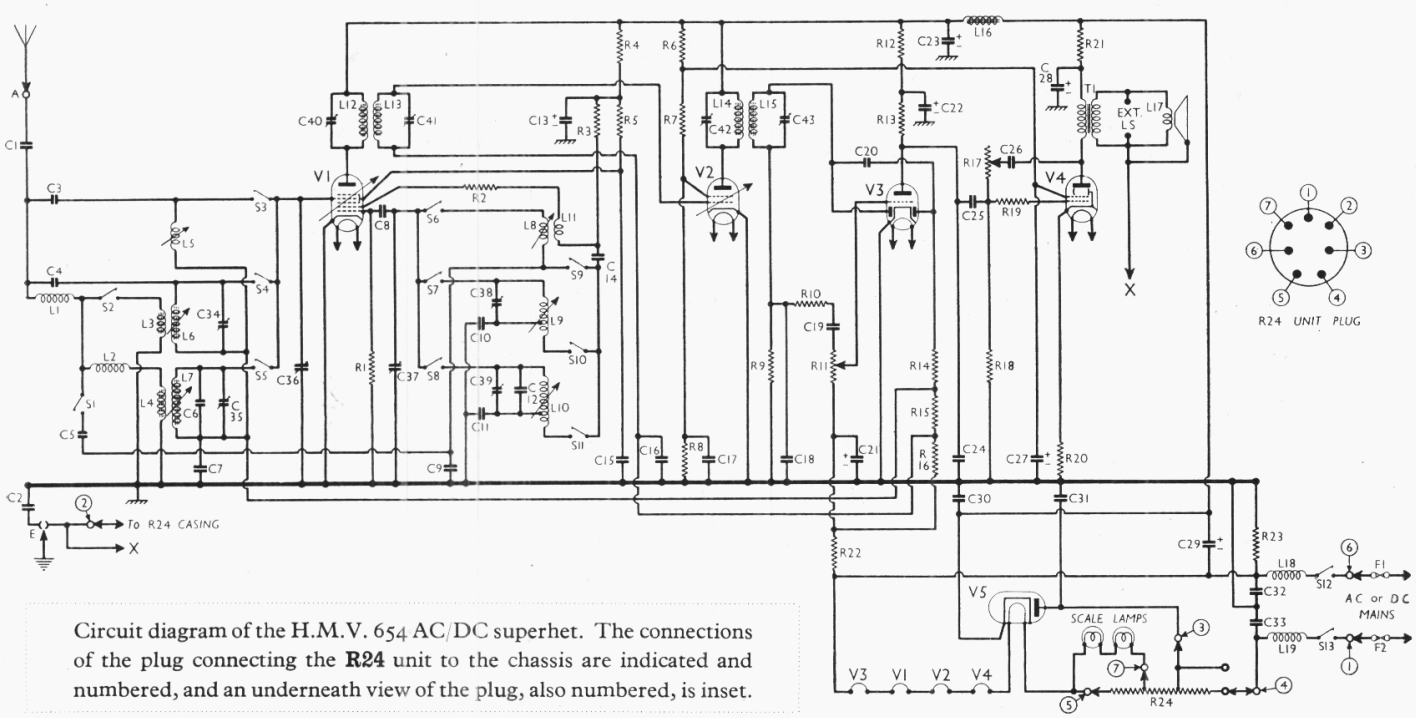
Second diode of **V3,** fed from **L15** via **C20,** provides DC potentials which are developed across load resistances **R14, R15, R16** and fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control.

Resistance-capacity coupling by **R13, C25** and **R18,** via grid stopper **R19** between **V3** triode and beam tetrode output valve (**V4, Marconi KT32**). Variable tone control by **R17, C26** between grid and anode circuits.

Fixed GB potential for **V1** and **V2,** GB for **V3** triode and AVC delay voltage are obtained automatically from drop along resistance **R23** in negative HT lead to chassis. GB for **V4** is obtained in the usual manner by **R20** in its cathode lead, and a measure of negative feed-back is introduced by the omission of the usual cathode by-pass condenser.

When the receiver is used with AC mains, HT current is supplied by IHC half-wave rectifying valve (**V5, Marconi U31**) which, with DC mains, behaves as a low resistance. Smoothing is effected by iron-cored choke **L16** and dry electrolytic condensers **C23, C29.** HT circuit RF filtering by **C30** and **C31.**

Valve heaters are connected in series, together with ballast resistance **R24,** across part of which are connected the scale lamps, across mains input. Filter comprising chokes **L18, L19** and condensers **C32, C33** in mains input circuit suppresses mains borne interference, while fuses **F1, F2** afford protection against accidental short-circuit.



Circuit diagram of the H.M.V. 654 AC/DC superhet. The connections of the plug connecting the **R24** unit to the chassis are indicated and numbered, and an underneath view of the plug, also numbered, is inset.

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Aerial isolating condenser	0·0001
C2	Earth isolating condenser	0·01
C3	Aerial SW coupling	0·000015
C4	Image rejector condensers	0·0000023
C5		0·00005
C6	Aerial LW fixed trimmer	0·00005
C7	V1 tetrode CG decoupling	0·05
C8	V1 osc. CG condenser	0·0001
C9	Osc. circuit SW tracker	0·005
C10	Osc. circuit MW tracker	0·00055
C11	Osc. circuit LW tracker	0·0003
C12	Osc. circ. LW fixed trimmer	0·000175
C13*	V1 osc. anode and SG decoupling	4·0
C14	V1 osc. anode coupling	0·005
C15	V1 SG RF by-pass	0·05
C16	V2 CG decoupling	0·05
C17	V2 SG RF by-pass	0·05
C18	IF by-pass	0·0001
C19	AF coupling to V3 triode	0·001
C20	Coupling to V3 AVC diode	0·000075
C21*	V3 triode CG decoupling	50·0
C22*	V3 triode anode decoupling	1·0
C23*	Part of HT smoothing	8·0
C24	IF by-pass	0·00035
C25	V3 triode to V4 AF coupling	0·023
C26	Part of variable tone control	0·0005
C27*	V4 SG decoupling	4·0
C28*	V4 anode decoupling	32·0
C29*	Part HT smoothing	16·0
C30	V5 cathode RF by-pass	0·05
C31	V5 anode RF by-pass	0·05
C32	Mains RF by-pass condensers	0·01
C33		0·01
C34‡	Aerial circuit MW trimmer	—
C35‡	Aerial circuit LW trimmer	—
C36†	Aerial circuit tuning	—
C37†	Oscillator circuit tuning	—
C38‡	Osc. circuit MW trimmer	—
C39‡	Osc. circuit LW trimmer	—
C40‡	1st IF trans. pri. tuning	—
C41‡	1st IF trans. sec. tuning	—
C42‡	2nd IF trans. pri. tuning	—
C43‡	2nd IF trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTANCES	Values (ohms)
R1	V1 osc. CG resistance	100,000
R2	V1 osc. anode stabiliser	150
R3	V1 oscillator anode and SG HT feed resistances	10,000
R4		3,500
R5		75,000
R6	V2 and V4 SG's HT feed potential divider resistances	5,000
R7		5,000
R8		15,000
R9	V3 signal diode load	500,000
R10	IF stopper	230,000
R11	Manual volume control	2,000,000
R12	V3 triode anode decoupling	35,000
R13	V3 triode anode load	75,000
R14	V3 AVC diode load resistances	1,000,000
R15		500,000
R16		2,300,000
R17	Variable tone control	2,000,000
R18	V4 CG resistance	350,000
R19	V4 grid stopper	50,000
R20	V4 GB resistance	100
R21	V4 anode HT feed	1,000
R22	V3 CG decoupling	100,000
R23	V1, V2 fixed GB; V3 triode GB; AVC delay resistance	23
R24	Heater circuit ballast resistance, total	496*

* 64 Ω + 370 Ω + 62 Ω from 5 V heater.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Parts of IF and image rejector circuit	9·5
L2		33·0
L3	Aerial MW coupling coil	0·4
L4	Aerial LW coupling coil	1·6
L5	Aerial SW tuning coil	Very low
L6	Aerial MW tuning coil	2·0

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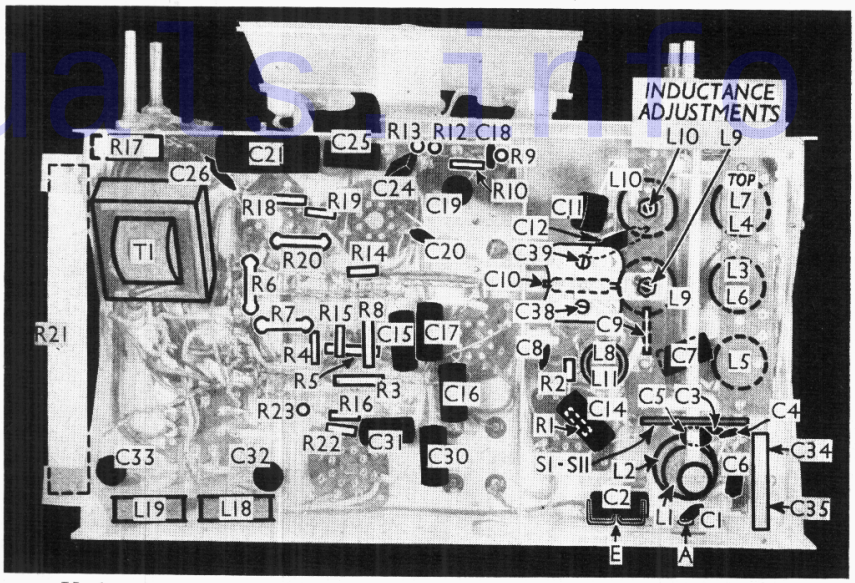

Under-chassis view. Note the inductance adjustments for **L9** and **L10.**

	OTHER COMPONENTS (*Continued*)	Approx. Values (ohms)
L7	Aerial LW tuning coil	9·0
L8	Osc. circuit SW tuning coil	very low
L9	Osc. circuit MW coil, total	2·8
L10	Osc. circuit LW coil, total	3·6
L11	Oscillator SW reaction	1·2
L12	1st IF trans. Pri.	4·0
L13	1st IF trans. Sec.	4·0
L14	2nd IF trans. Pri.	4·0
L15	2nd IF trans. Sec.	4·0
L16	HT smoothing choke	550·0
L17	Speaker speech coil	3·0
L18	Mains filter chokes	3·0
L19		3·0
T1	Output trans. Pri.	146·0
	Output trans. Sec.	0·7
SI-SII	Waveband switches	—
S12,13	Mains switches, ganged R11	—
F1,F2	Mains circuit fuses	—

DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, first remove the tuning knob (recessed grub screw covered with wax) and the other three knobs (recessed self-tapping screws covered with wax), and then the two wooden cross-bars on the bottom of the cabinet (four countersunk-head wood screws).

Next remove the four bolts (with washers and spring washers) thus exposed and free the speaker leads from the cleat on the sub-baffle. After unplugging the mains input unit lead from the socket on the chassis, the chassis can be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

Before access can be gained to the underneath of the frequency changer section of the chassis, the screen must be removed (three self-tapping screws) and if it is desired to operate the chassis, the mains input unit must be removed from the brackets on the side of the cabinet (four screws with washers) and connected up.

When replacing, see that there is a washer for each of the fixing bolts, between the chassis and the bottom of the cabinet, and cover the heads of the screws in the control knobs with wax. If the valves have been removed, note that the screening caps go on **V1** and **V3.**

To free the chassis entirely, unsolder the speaker leads and *when replacing*, take the black lead to the right-hand tag on the panel.

Removing Speaker.—The speaker can be removed from the cabinet by unsoldering the leads and removing the nuts and washers from the three screws holding it to the sub-baffle. *When replacing*, see that the terminal panel is at the top, do not forget to replace the earthing lead on the top right-hand screw and take the black lead to the right-hand tag.

VALVE ANALYSIS

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 X63	166	2·2	60	1·3
	Oscillator			
	118	2·4		
V2 KTW63	166	6·1	75	1·5
V3 DH63	98	0·4	—	—
V4 KT32	118	51·0	108	5·0
V5 U31†	—	—	—	—

† Cathode to chassis 182 V DC.

Valve voltages and currents given in the table above are those measured in our receiver when it was operating on AC mains of 225 V, using the 223-250 V tapping on the mains resistance. 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.

If, as in our case, **V1** should become unstable when its anode current is being measured, it can be stabilised by connecting a non-inductive condenser of about 0·1 μF from control grid (top cap) to chassis.

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GENERAL NOTES

Switches.—**S1-S11** are the waveband switches, in a single rotary unit beneath the chassis, indicated in our under-chassis view, and shown in detail in the diagram 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.

S12 and **S13** are the QMB mains switches, ganged with the volume control **R11.**

Coils.—**L1, L2**; **L3, L6**; **L4, L7**; **L5**; **L8, L11**; **L9**; and **L10** are in seven unscreened units beneath the chassis. **L3, L6** and **L4, L7** are iron-cored, the cores of **L6** and **L7** being adjustable. The inductances of **L5** and **L8** are adjustable by wire loops inside the coil formers. **L9** and **L10** are also adjustable in inductance by metal "spade" trimmers, whose positions are varied by means of screw adjusters, indicated in our under-chassis view.

L12, L13 and **L14, L15** are the IF transformers, in two screened units on the chassis deck, with their trimmers.

L16 is the HT smoothing choke, on the chassis deck, while **L18, L19** are the mains filter chokes, beneath the chassis.

Scale Lamps.—These are two Bulgin MES types, rated at 8 V, 0·15 A, and fitted with frosted bulbs.

External Speaker.—No sockets are provided for this, but a low impedance (3·75 O) type can be connected across the speech coil of the internal speaker.

Condenser Block.—This is in a rectangular metal case, on the chassis deck, with the connecting leads emerging beneath the chassis. It includes the dry electrolytic condensers **C13, C22, C23** and **C27** to **C29.** The coding of the leads is: Brown, negative of **C29** (16μF); yellow, positive of **C29**; black, negative of all the other condensers; red, positive of **C28** (32μF); green, positive of **C23** (8μF); blue lead to junction of **R3, R4, R5,** positive of **C13** (4μF); blue lead to junction of **R6, R7,** positive of **C27** (4μF); white, positive of **C22** (1μF). The case is isolated. The unit is a Dubilier type 3241.

Valve Connections.—Base connections for the octal valves used were given on page 1 of *Radio Maintenance* for November 13, 1937.

Fuses.—These are two 1¼ in. glass tubular types, rated at 1·25 A (yellow spot coding). They fit into clips on the mains input unit, on either side of the mains connector.

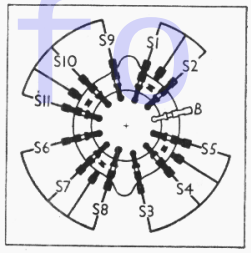
R24 Unit.—This is fitted to the inside of the cabinet, and is not shown in our chassis illustrations. It contains the tapped ballast resistor **R24,** the voltage adjustment lead and terminals, the two fuses, and the mains input connector. From it emerges a 7-pin plug, which fits into a socket on the chassis deck.

The individual pins and sockets are shown by numbered arrows and circles on the circuit diagram, which also contains a diagram of the base of the plug, looking at the free ends of the pins, with the pins numbered.

TABLE AND DIAGRAM OF THE SWITCH UNIT

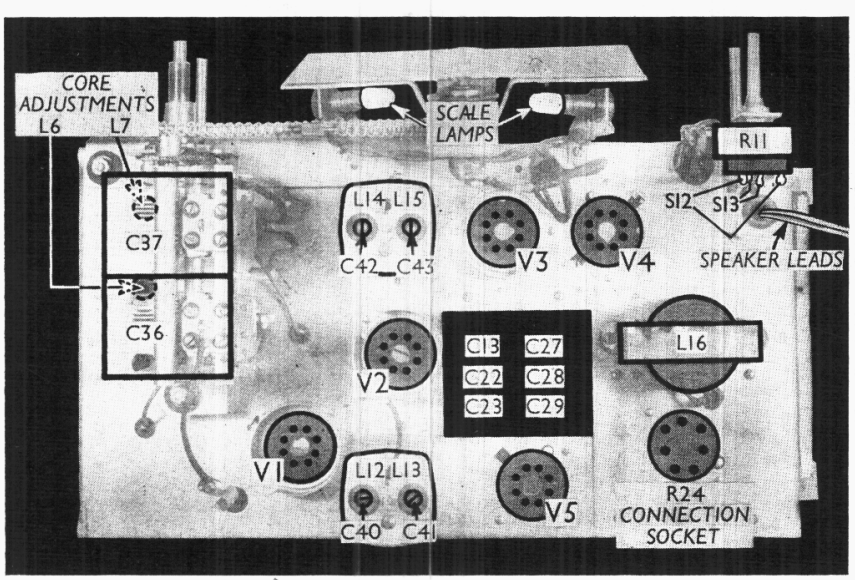
Switch	SW	MW	LW
S1	—	—	C
S2	—	C	—
S3	C	—	—
S4	—	C	—
S5	—	—	C
S6	C	—	—
S7	—	C	—
S8	—	—	C
S9	C	—	—
S10	—	C	—
S11	—	—	C

Switch diagram, drawn as seen from the underside of the chassis.



CIRCUIT ALIGNMENT

IF Stages.—Switch set to LW, turn gang to maximum, volume control to maximum and tone control fully anti-clockwise. Connect signal generator via a 0·1 μF condenser to fixed vane tag of **C36** and chassis, leaving top cap connection of **V1** in place. Feed in a 465 KC/S signal, and adjust **C40, C41, C42** and **C43** in that order for maximum output. Check these adjustments.



Plan view of the chassis. Note the holes through which **L6** and **L7** can be adjusted.

RF and Oscillator Stages—The scale must be positioned so that the pointer spindle hole is exactly concentric with the spindle, and the scale is square in its frame. With gang at maximum, pointer must coincide exactly with the small black spot at the top right-hand corner of the scale.

Turn volume control to maximum, and tone control fully anti-clockwise, and connect signal generator to **A** and **E** sockets.

MW.—Switch set to MW, and tune to 225 m on scale (black spot). Feed in a 225 m (1,333 KC/S) signal and adjust **C38** for maximum output. Tune to 530 m on scale (black spot) and feed in a 530 m (566 KC/S) signal. Adjust inductance ("spade" trimmer) of **L9** (screw on paxolin coil mounting strip) for maximum output. Repeat these operations until no further improvement results. Return to 225 m and adjust **C34** for maximum output.

Return to 530 m, and rotate upper core of **L6** for maximum output. This is reached through a hole in the chassis deck by means of a special tool (EMI Service, Part No. 20730A) which consists of a pointed rod of insulating material with a rubber bush. It should be inserted through the hole in the chassis, the point located in the hole in the paxolin coil mounting strip, and the rubber bush bearing on the core. The core may now be rotated by turning the tool.

Repeat the adjustments of **C34** and **L6.**

LW.—Switch set to LW, tune to 1,100 m on scale, and feed in a 1,100 m (272·7 KC/S) signal. Adjust **C39** for maximum output. Tune to 1,900 m on scale, feed in a 1,900 m (158 KC/S) signal, and adjust inductance ("spade" trimmer) of **L10** (screw on paxolin coil mounting strip) for maximum output. Repeat these adjustments.

Return to 1,100 m and adjust **C35** for maximum output. Return to 1,900 m and adjust hexagonal-headed screw core of **L7** (through hole in chassis deck) for maximum output. Re-adjust **C35** at 1,100 m, then tune to 1,400 m on scale, feed in a 1,400 m (214 KC/S) signal, and re-adjust **C35** if necessary.

SW.—Switch set to SW, tune to 50 m on scale, feed in a 50 m (6 MC/S) signal and adjust loop of **L8** (inside its coil former) for maximum output. This can be reached through a hole in the shield. A strip of insulating material with a slot in it should be used to move the wire up or down. Then adjust loop of **L5** (through hole in chassis deck) for maximum output in the same way.

Do not alter the position of the pointer, after ganging, or rock the gang while aligning.