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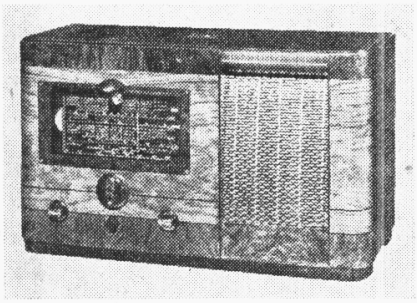
Supplement to The Wireless & Electrical Trader, April 8, 1939

"TRADER" SERVICE SHEET

396

H.M.V. 656, 657, 668
MARCONIPHONE 858, 853 AND 871



The H.M.V. 656 table receiver.

THE H.M.V.656 (and Marconiphone 858) is a table model 5-valve plus rectifier AC receiver, incorporating four wavebands, the SW ranges being 13-30 m and 30 to 90 m. The first of these is called SW1 in this *Service Sheet* and corresponds with the makers' SW2, and vice-versa.

The H.M.V.657 (and Marconiphone 871) is identical with the above, except that a motor-driven automatic tuning system is incorporated, and the divergencies are given under "H.M.V.657 and Marconi 853 Modifications."

The H.M.V.668 (and Marconiphone 871) is an auto-radiogram with a similar chassis, also incorporating the motor-driven auto-tuning system. Divergencies are given under "H.M.V.668 and Marconi 871 Modifications."

All table models are suitable for 195-255 V, 50-60 C/S AC mains; the radiograms are for 50 C/S mains only.

This *Service Sheet* was prepared on an H.M.V.656.

Release dates: H.M.V. 656 and Marconi 858, July, 1938; H.M.V. 657 and Marconi 853, August, 1938; H.M.V. 668 and Marconi 871, October, 1938.

CIRCUIT DESCRIPTION

Aerial input is loosely coupled via small condenser **C2** directly to tuning coils **L1** (SW1), **L2** (SW2), **L3** (MW) and **L4** (LW) which are tuned by **C46.**

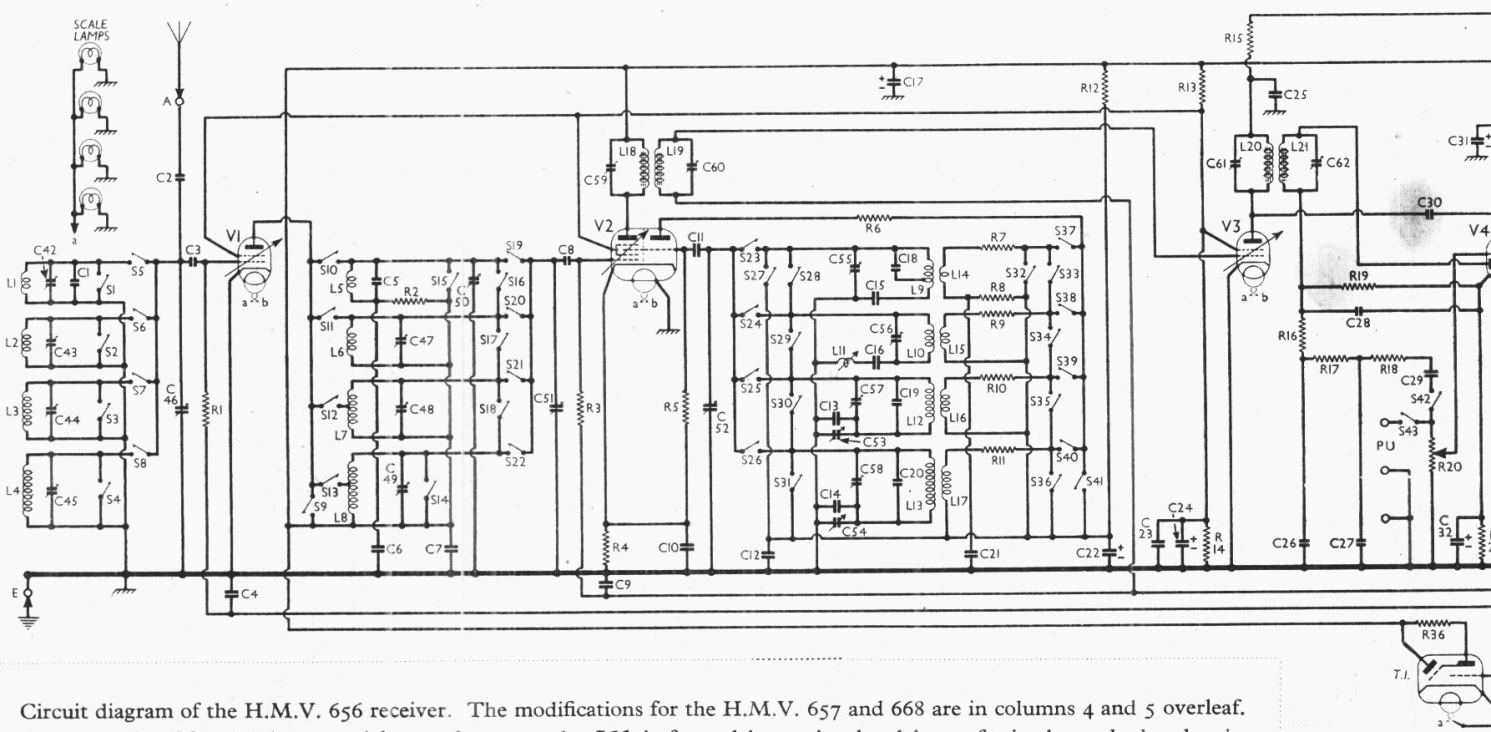
First valve (**V1, Marconi KTW63**) is a variable-mu tetrode operating as RF amplifier. Tuned-anode coupling by **L5, C51** (SW1), **L6, C51** (SW2), **L7, C51** (MW) and **L8, C51** (LW) is used between **V1** and second valve (**V2, Marconi X65**) a triode hexode operating as frequency changer with internal coupling. Triode oscillator grid coils **L9** (SW1), **L10** (SW2), **L12** (MW) and **L13** (LW) are tuned by **C52;** parallel trimming by **C18, C55** (SW1), **C56** (SW2), **C19, C57** (MW) and **C20, C58** (LW); series tracking by **C15** (SW1), **C16, L11** (SW2), **C13, C53** (MW) and **C14, C54** (LW). Reaction by coils **L14** (SW1), **L15** (SW2), **L16** (MW) and **L17** (LW). The damping resistances maintain a constant output.

Third valve (**V3, Marconi KTW63**) is a variable-mu RF tetrode operating as intermediate frequency amplifier with tuned-primary tuned-secondary iron-cored transformer couplings **C59, L18, L19, C60** and **C61, L20, L21, C62.**

Intermediate frequency 465KC/S.

Diode second detector is part of double diode triode valve (**V4, Marconi DH63**). Audio frequency component in rectified output is developed across load resistance **R19** and passed via IF filter **C28, R16, C26, R17, C27, R18,** AF coupling condenser **C29** and manual volume control **R20** to CG of triode section, which operates as AF amplifier. Provision for connection of gramophone pick-up, via **S43,** across **R20.** When the control switch is turned to "Gram," **S43** closes, while **S42** opens to mute radio.

Second diode of **V4,** fed from **V3** anode via **C30,** provides DC potentials which are developed across load resistances **R24, R25, R26** and **R27** and fed back through decoupling circuits as GB to RF, FC and IF valves, giving automatic volume control. Delay voltage is obtained from drop along **R21** in cathode lead



Circuit diagram of the H.M.V. 656 receiver. The modifications for the H.M.V. 657 and 668 are in columns 4 and 5 overleaf. Corresponding Marconiphone models are also covered. **L11** is formed by an insulated loop of wire beneath the chassis.

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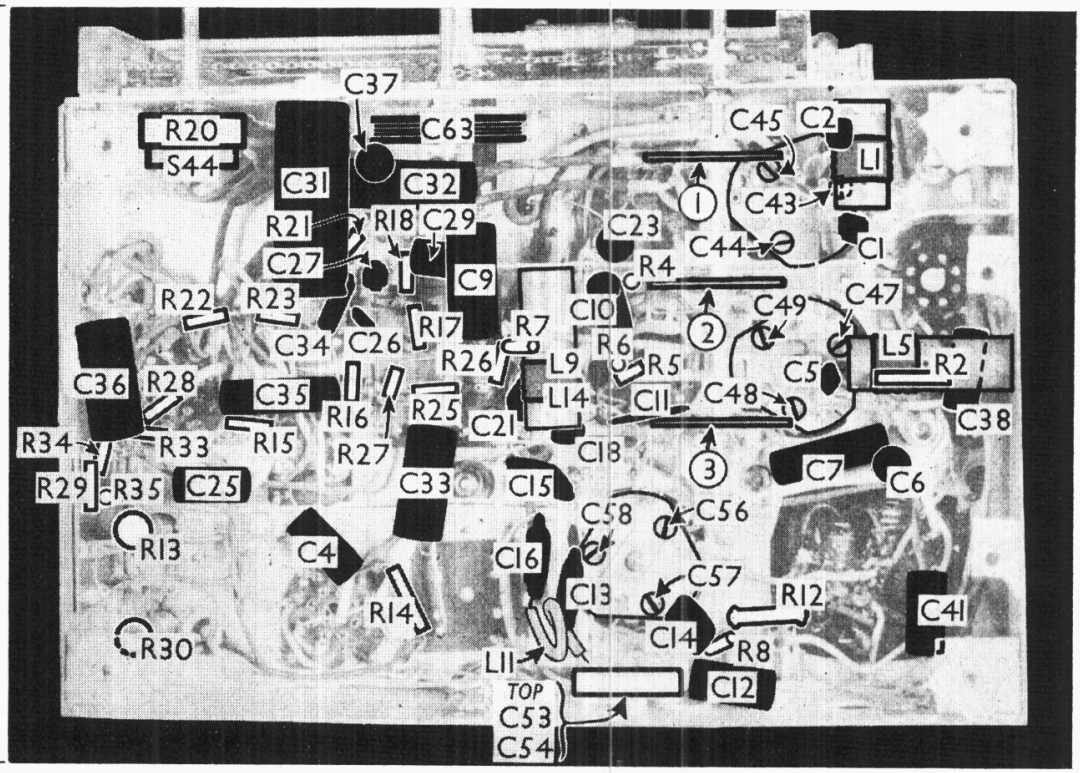
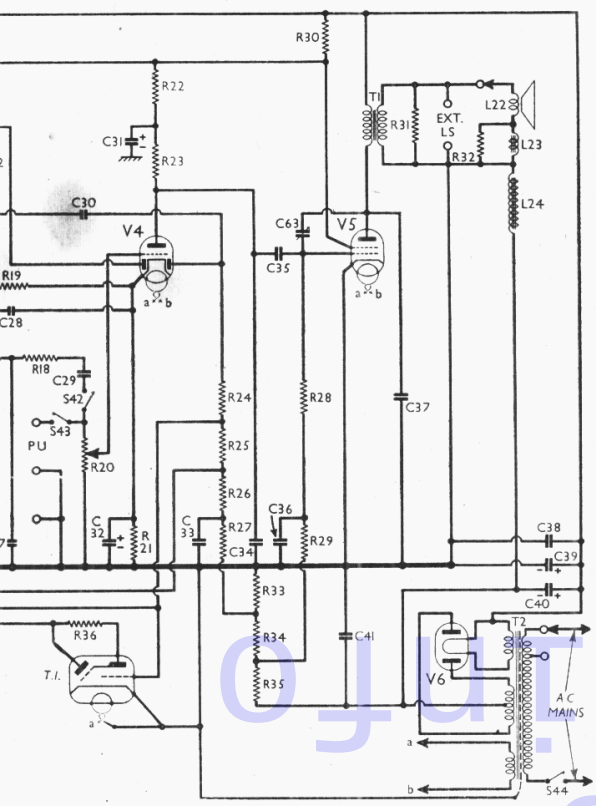


Under-chassis view. Note the small inductance **L11**. **C53, C54** are adjusted through holes in the rear member of the chassis deck. There are also nine other pre-set condensers reached from beneath the chassis, and indicated here.

to chassis, operating potential for cathode ray tuning (**T.I. Marconi TI65** or **Y63**) is obtained from junction of **R24** and **R25.**

Resistance-capacity coupling by **R23, C35** and **R28** between **V4** triode and tetrode output valve (**V5, Marconi KT63**).



Fixed tone correction in anode circuit by **C37.** Variable tone control by **C63** between anode and control grid. Provision for connection of low impedance external speaker across secondary of output transformer **T1.** A plug and socket device permits the internal speaker to be muted.

HT current is supplied by full-wave rectifying valve (**V6, Marconi U50**). Smoothing by speaker field **L24** (in negative HT lead to chassis) and dry electrolytic condensers **C39, C40.** Voltage developed across **L24** is used to provide fixed initial GB potential for **V1, V2** (in addition to that across **R4**) and **V3,** and GB for **V5.** These voltages are tapped off at the junctions of resistances **R33, R34** and **R35** which form a potential divider across **L24.** The voltage across **R33,** besides providing GB for the early valves, also provides AVC delay in addition to that developed across **R21.**

DISMANTLING THE SET

Removing Chassis.—A detachable bottom is fitted to the cabinet, and upon removal access can be gained to the components beneath the chassis. If it is necessary to remove the chassis, first remove the four control knobs, the three transit bolts (if still in position) and the four bolts (with washers and lock-washers) which hold the chassis to the bottom of the cabinet. Then loosen the cleat holding the mains lead to the bottom of the cabinet and slip the speaker leads from two further cleats beneath the top of the cabinet, when the chassis can be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free the chassis entirely, remove the external speaker panel (two round-head wood screws) and unsolder the leads from the speaker. *When replacing*, connect the leads to the tags which are numbered as follows: 2, yellow; 3, two black leads; 7, yellow/black.

Removing Speaker.—If it is necessary to remove the speaker, unsolder the four leads and remove the four round-head bolts (with washers). *When replacing*, the small panel carrying the speech coil tags should be on the right and the leads connected as above.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 CG resistance	500,000
R2	V1 anode SW1 damping	1,000
R3	V2 hexode CG resistance	500,000
R4	Part V2 fixed GB	150
R5	V2 osc. CG resistance	100,000
R6	V2 osc. anode stabiliser	75
R7	Osc. SW1 reaction damping	50
R8	V2 osc. anode SW1 HT feed	150
R9	Osc. SW2 reaction damping	350
R10	Osc. MW reaction damping	500
R11	Osc. LW reaction damping	1,000
R12	V1 osc. anode HT feed	35,000
R13	V1, V2, V3 SG's HT feed potential divider	10,000
R14		23,000
R15	V3 anode HT feed	10,000
R16	IF stopper resistances	50,000
R17		50,000
R18		50,000
R19	V4 signal diode load	350,000
R20	Manual volume control	2,000,000
R21	V4 triode GB; AVC delay	750
R22	V4 triode anode decoupling	23,000
R23	V4 triode anode load	50,000
R24	V4 AVC diode load resistances	500,000
R25		500,000
R26		500,000
R27		100,000
R28	V5 CG resistance	150,000
R29	V5 CG decoupling	350,000
R30	V5 SG, V1, V2, V3, V4 HT feed	1,000
R31	T1 sec. artificial loading	50
R32	Hum neut. coil shunt	0·6
R33	V1, part V2 hex. and V3 fixed GB pot. divider.	1,000
R34		7,500
R35	Speaker field coil shunt	50,000
R36	T.I. anode HT feed	1,000,000

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Condensers C42, C50, C55.—These SW trimmers are of the tubular air dielectric type, and are adjusted from the deck of the chassis by sliding their plungers in or out, and then locking them. See plan chassis view.

Inductance L11.—See under "Coils."

Resistance R32.—This is a length of resistance wire, inside insulating sleeving, connected between tags 3 and 4 on the speaker unit.

Trackers C53, C54.—These are in a twin unit, and are adjustable through holes in the rear member of the chassis.

H.M.V. 657 AND MARCONI 853 MODIFICATIONS

These two models are almost identical with the H.M.V.656 and Marconi 858 as far as the main chassis is concerned, but in addition they include a motor-driven automatic tuning system.

The system uses a special reversible induction motor and a split selector drum with eight adjustable contacts. The system is of the "direct homing" type (see *Radio Maintenance* for July 23, 1938, or *The A.B.C. of Automatic Tuning*, pages 17 and 18).

The contacts are switched into circuit by eight press-button switches, each of which is associated with one contact. The ninth button is marked "manual," and when depressed it releases any automatic button that may be depressed.

The circuit of the auto-mechanism starts at a chassis connection which goes to one end of the common motor winding via a built-in thermal switch (normally closed). The free ends of the two reversing windings of the motor each go (via sliding contacts) to one of the sectors of the split selector drum. Each selector contact goes to one side of its associated press-button switch. The other side of each switch is common, and goes to one end of an extra secondary winding on **T2,** the other end of which goes to chassis, and thus completes the circuit.

When a contact is switched into circuit, the motor is energised, its automatic clutch operates, and drives the gang one way or the other until the contact reaches the gap in the split selector drum, when the motor (and gang) stops.

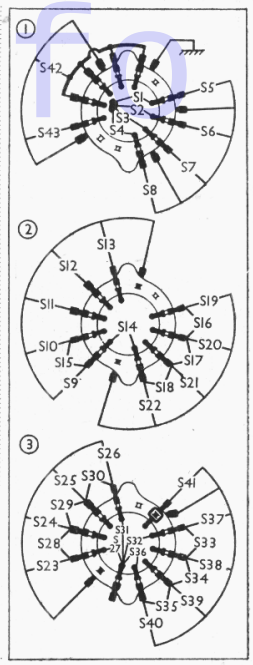
While the motor is running, a switch mounted on its casing closes, and as this switch is connected across the secondary of **T1,** it temporarily mutes the speaker.

Another subsidiary circuit is that incorporating the selector adjustment lamp. A tag on a flying lead (which can be connected to any adjustable contact) goes, via the lamp, and a 15 O resistance, to the side of the heater secondary of **T2** which is not connected to chassis. This lamp lights when the tag is connected to a contact resting on the selector drum, but goes out when the contact is adjusted so that it is over the gap in the selector drum, and this serves as a visual means of adjusting the contact to the correct position for any station which has previously been tuned in manually.

The tuning motor operates on 17·6 V, 30 W. The resistance across the two tags connected to the selector drum is 5 O, and from each tag to chassis tag, 5·5 O. The resistance of the motor secondary on **T2** is 0·3 O.

TABLE AND DIAGRAMS OF SWITCH UNITS

Switch	LW	MW	SW2	SW1	Gram.
S1	—	—	—	—	C
S2	—	—	—	C	C
S3	—	—	C	C	—
S4	—	C	C	—	—
S5	—	—	—	C	—
S6	—	—	C	—	—
S7	—	C	—	—	—
S8	C	—	—	—	—
S9	—	—	—	—	C
S10	—	—	—	C	—
S11	—	—	C	—	—
S12	—	C	—	—	—
S13	C	—	—	—	—
S14	—	C	—	—	—
S15	C	—	—	—	—
S16	—	—	—	—	C
S17	—	—	—	C	C
S18	—	—	C	C	—
S19	—	—	—	C	—
S20	—	—	C	—	—
S21	—	C	—	—	—
S22	C	—	—	—	—
S23	—	—	—	C	—
S24	—	—	C	—	—
S25	—	C	—	—	—
S26	C	—	—	—	—
S27	C	—	—	—	—
S28	—	—	—	—	C
S29	—	—	—	C	C
S30	—	—	C	C	—
S31	—	C	—	—	—
S32	C	—	—	—	—
S33	—	—	—	—	C
S34	—	—	—	C	C
S35	—	—	C	C	—
S36	—	C	C	—	—
S37	—	—	—	C	—
S38	—	—	C	—	—
S39	—	C	—	—	—
S40	C	—	—	—	—
S41	—	—	—	—	C
S42	C	C	C	C	—
S43	—	—	—	—	C



Diagrams of the three switch units, as seen from the rear of the underside of the chassis.

H.M.V. 668 AND MARCONI 871 MODIFICATIONS

These are auto-radiogram models of the 657 and 853 respectively, and incorporate the auto-tuning mechanism. In addition they include, of course, a hysteresis type of motor, wired to the 224/255 V tapping on the primary of **T2,** and an 8-record changer with pick-up. The pick-up resistance is 6 O, and the pick-up is connected via an auto-transformer (primary, 0·18 O, secondary 600 O) to the pick-up sockets as shown in our circuit of the H.M.V. 656. In addition, however, there is a filter circuit, consisting of a 0·02 μF condenser and a 50,000 O resistance in series, across the upper and lower pick-up sockets. In early models, these values may be 0·01 μF and 100,000 O.

CIRCUIT ALIGNMENT

NOTE :—Our **SW1** is the lowest wavelength range, and corresponds to makers' SW2, and *vice-versa*.

IF Stages.—Switch set to LW, turn gang to maximum, volume control to maximum and tone control fully clockwise, and short circuit **C52.** Connect signal generator to chassis and to control grid (top cap) of **V2,** via a 0·1 μF condenser, leaving the existing connection in place. Feed in a 465 KC/S signal, and adjust **C59, C60, C61** and **C62,** in that order, for maximum output. Re-check, then remove short from **C52.**

RF and Oscillator Stages.—With gang at maximum, pointer should cover small vertical white line below the LW calibration line, on the right. Connect signal generator, via a suitable dummy aerial, to **A** and **E** sockets.

LW.—Switch set to LW, turn gang to minimum, and feed in a 725 m (413·8 KC/S) signal. Adjust **C58** for maximum output. Feed in an 850 m (353 KC/S) signal, tune it in, and adjust **C45** and **C49** for maximum output. Feed in a 1,900 m (158 KC/S) signal, tune it in, and adjust **C54** for maximum output, while rocking the gang for optimum results. Re-check all settings.

MW.—Switch set to MW, turn gang to minimum, and feed in a 195 m (1,538 KC/S) signal. Adjust **C57** for maximum output. Feed in a 210 m (1,429 KC/S) signal, tune it in, and adjust **C44** and **C48** for maximum output. Feed in a 530 m (566 KC/S) signal, tune it in, and adjust **C53** for maximum output, while rocking the gang for optimum results. Re-check all settings.

SW2.—Switch set to this band (H.M.V. SW1), and turn gang to minimum. Feed in a 30 m (10MC/S) signal, and adjust **C56** for maximum output. Feed in a 32m (9·38 MC/S) signal, and tune it in. Adjust **C43** and **C47** for maximum output. Feed in an 86 m (3·88 MC/S) signal, tune it in, and adjust **L11** (loop of wire joining **C16** to chassis), while rocking the gang, for maximum output. Adjustment is by opening out, or pinching in, the loop. Re-check all settings.

SW1.—Switch set to this band (H.M.V. SW2), and turn gang to minimum. Feed in a 13 m (23·08 MC/S) signal, and adjust **C55** (by sliding plunger, and then locking), for maximum output. Feed in a 14 m (21·43 MC/S) signal, and tune it in. Adjust **C42** and **C50** for maximum output (as **C55**) while rocking the gang. Feed in a 30 m (10 MC/S) signal, tune it in, and adjust loop at **C15** end of **L9** for maximum output, while rocking gang. Re-check all settings.

NOTE.—The adjustments to **L11** and the loop of **L9** will not be necessary unless the wiring has been seriously disarranged, or **L10** or **L9** have been replaced.

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	CONDENSERS	Values (μF)
C1	Aerial SW1 fixed trimmer	0·000035
C2	Aerial series condenser	0·000075
C3	V1 CG condenser	0·000035
C4	V1 and T.I. CG's decoupling	0·05
C5	V1 anode SW1 fixed trimmer	0·000015
C6	V1 anode SW1 decoupling	0·01
C7	V1, V2, V4 anodes RF by-pass	0·1
C8	V2 hexode CG condenser	0·000035
C9	V2 hex. and V3 CG's decoupling	0·23
C10	V2 cathode by-pass	0·1
C11	V2 osc. CG condenser	0·0001
C12	V2 osc. anode RF by-pass	0·005
C13	Osc. circuit MW fixed tracker	0·00035
C14	Osc. circuit LW fixed tracker	0·00015
C15	Osc. circuit SW1 tracker	0·0035
C16	Osc. circuit SW2 tracker	0·0023
C17*	HT line decoupling	4·0
C18	Osc. circuit SW1 fixed trimmer	0·000005
C19	Osc. circuit MW fixed trimmer	0·00001 5
C20	Osc. circuit LW fixed trimmer	0·00035
C21	V2 osc. anode SW1 decoupling	0·0023
C22*	V2 osc. anode decoupling	4·0
C23	V1, V2, V3 SG's RF by-pass	0·1
C24*	V1, V2, V3 SG's decoupling	4·0
C25	V3 anode decoupling	0·05
C26	IF by-pass condensers	0·00005
C27	IF by-pass condensers	0·00005
C28	IF by-pass condensers	0·00005
C29	AF coupling to V4 triode	0·01
C30	Coupling to V4 AVC diode	0·000075
C31*	V4 triode anode decoupling	2·0
C32*	V4 cathode by-pass	25·0
C33	V4 AVC diode decoupling	0·23
C34	IF by-pass	0·00035
C35	V4 triode to V5 AF coupling	0·05
C36	V5 CG decoupling	0·23
C37	Fixed tone corrector	0·0023
C38	HT circuit RF by-pass	0·015
C39*	HT smoothing condensers	4·0
C40*	HT smoothing condensers	8·0
C41	Auto GB and L24 by-pass	0·05
C42‡	Aerial SW1 trimmer	—
C43‡	Aerial SW2 trimmer	—
C44‡	Aerial MW trimmer	—
C45‡	Aerial LW trimmer	—
C46†	Aerial circuit tuning	—
C47‡	V1 anode SW2 trimmer	—
C48‡	V1 anode MW trimmer	—
C49‡	V1 anode LW trimmer	—
C50‡	V1 anode SW1 trimmer	—
C51†	V1 anode circuit tuning	—
C52†	Oscillator circuit tuning	—
C53‡	Osc. circuit MW tracker	—
C54‡	Osc. circuit LW tracker	—
C55‡	Osc. circuit SW1 trimmer	—
C56‡	Osc. circuit SW2 trimmer	—
C57‡	Osc. circuit MW trimmer	—

	CONDENSERS (*Continued*)	Values (μF)
C58‡	Osc. circuit LW trimmer	—
C59‡	1st IF trans. pri. tuning	—
C60‡	1st IF trans. sec. tuning	—
C61‡	2nd IF trans. pri. tuning	—
C62‡	2nd IF trans. sec. tuning	—
C63†	Variable tone control	0·0005

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial SW1 tuning coil	Very low
L2	Aerial SW2 tuning coil	0·1
L3	Aerial MW tuning coil	5·5
L4	Aerial LW tuning coil	16·0
L5	V1 anode SW1 tuning	Very low
L6	V1 anode SW2 tuning	0·1
L7	V1 anode MW tuning, total	5·5
L8	V1 anode LW tuning, total	16·0
L9	Osc. circuit SW1 tuning coil	Very low
L10	Osc. circuit SW2 tuning coil	Very low
L11	Osc. SW2 tracking coil	Very low
L12	Osc. circuit MW tuning coil	5·2
L13	Osc. circuit LW tuning coil	5·5
L14	Oscillator SW1 reaction	0·2
L15	Oscillator SW2 reaction	1·4
L16	Oscillator MW reaction	1·8
L17	Oscillator LW reaction	4·5
L18	1st IF trans. Pri.	4·0
L19	1st IF trans. Sec.	4·0
L20	2nd IF trans. Pri.	4·0
L21	2nd IF trans. Sec.	4·0
L22	Speaker speech coil	4·0
L23	Hum neutralising coil	0·6
L24	Speaker field coil	1600·0
T1	Output trans. Pri.	450·0
T1	Output trans. Sec.	0·8
T2	Mains trans. Pri., total	30·0
T2	Mains trans. Heater sec.	0·1
T2	Mains trans. Rect. heat. sec.	0·1
T2	Mains trans. HT sec., total	690·0
S1-S41	Waveband switches	—
S42, S43	Radio/gram change switches	—
S44	Mains switch, ganged R20	—

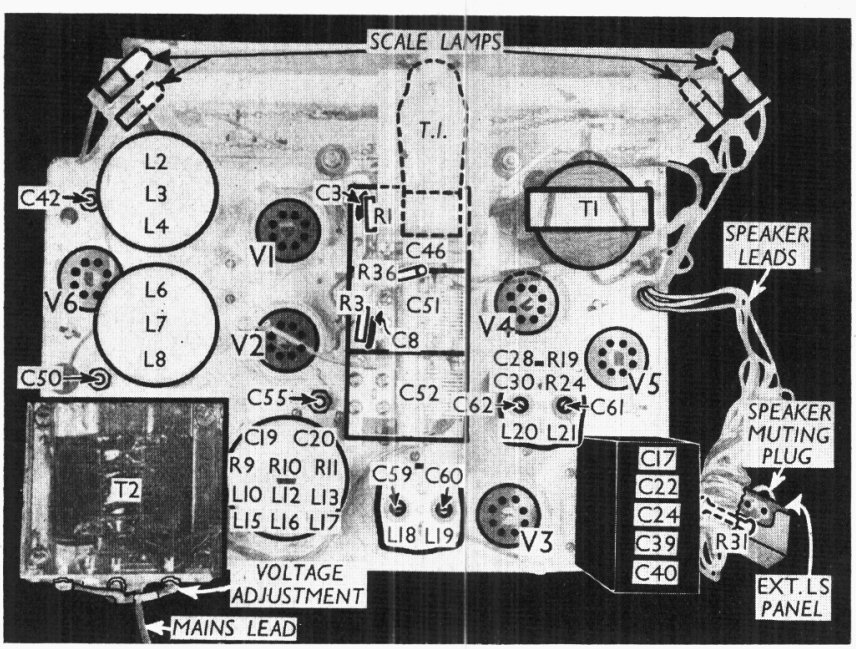
VALVE ANALYSIS

Valve voltages and currents in the table (col. 3) are those measured in our receiver when it was operating on mains of 233 V, using the 224-255 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the MW 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 KTW63	215	8·2	96	2·0
V2 X65	215	1·3	96	3·65
	oscillator			
	92	3·5		
V3 KTW63	145	8·0	96	2·1
V4 DH63	108	1·0	—	—
V5 KT63	230	25·0	215	4·0
V6 U50	332†	—	—	—
T.I. TI65	25	0·2	—	—
	Target			
	230	0·02		

† Each anode, AC.



Plan view of the chassis. Note the special trimmers, **C42, C50, C55.**

GENERAL NOTES

Switches.—**S1-S41** are the waveband, and **S42, S43** the radio/gram switches, ganged in three rotary units beneath the chassis. The units are indicated in our under-chassis view, and shown in detail in the diagrams in col. 6, where they are drawn as seen looking from the rear of the underside of the chassis. The table (col. 5) gives switch positions for the five settings, starting from fully anti-clockwise. A dash indicates open; **C,** closed.

It should be noted that the shorting switches on the oscillator switch unit (**S27-S36**) operate not only as shown, but also, since the two shorting plates on the rotor are joined together, the top ends of the tuning and reaction coils are joined together as well.

S44 is the QMB mains switch, ganged with the volume control **R20.**

Coils.—**L1 ; L5 ;** and **L9, L14** are in three unscreened tubular units beneath the chassis. In the **L9, L14** unit, **L9** is the thick wire winding. **L11** is a single turn of insulated wire connected between **C16** and chassis, and adjustable in inductance for alignment.

L2-L4 ; L6-L8 ; L10, L12, L13, L15-L17 ; and the IF transformers **L18, L19,** and **L20, L21,** are in five screened units on the chassis deck. The third and fifth of these also contain other components.

Scale Lamps.—These are four Osram MES types, with tubular bulbs. They are all rated at 6·5 V, 0·3 A.

External Speaker.—There are three sockets on a panel at the rear of the cabinet, two being provided for a low impedance (5 Ω) external speaker. The third socket normally has a plug attached to a flying lead inserted in it. On removal of the plug, the internal speaker is muted. **R31** is a safety load resistance, which is always in circuit. It is wired behind the external speaker panel.

Condensers C17, C22, C24, C39, C40.—These are five dry electrolytics in a unit (Dubilier 3221) on the chassis deck, the case being isolated. The brown lead is the negative, and the red the positive, of **C40** (8 μF, 570 V DC peak). The black lead is the common negative of the other four condensers. The green lead is the positive of **C24** (4μF, 300 V DC peak). The remaining three condensers are all 4 μF, 570 V DC peak, and have yellow positive leads. That to the junction of **R13** and **R30** is the positive of **C17 ;** that to **R12, C12** is the positive of **C22 ;** and that to the same tag as the red lead is the positive of **C39.** The unit is a Dubilier type 3221.

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