'TRADER' SERVICE SHEET 1290

MULLARD MAS8

3-BAND A.C. SUPERHET

THE MULLARD MAS8 is a 4-valve (plus rectifier) A.C. 3-band superhet with a short-wave range of 16.7-51 metres and a valve arrangement comprising an octode frequency changer, a variable-mu pentode I.F. amplifier with variable selectivity, a double-diode triode and a double diode output pentode, one of the diodes being used to provide delay on the A.V.C. system.

The receiver is suitable for mains of 100-250 V, 50-80 C/S, and has provision for a gramophone pick-up, an extension speaker and for using the mains as an aerial.

An outstanding feature is that the set is arranged so that a vibrator unit can be connected without any alteration, so that the receiver can be operated from D.C. mains.

This *Service Sheet* was prepared on an A.C. model without the vibrator.

CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. via coupling coils **L2, L3** and condenser **C3** to mixed coupled band-pass filter. Primary coils **L4, L5** are tuned by **C37**; secondaries **L10, L11** by **C39**. Coupling is effected by condensers **C5** (M.W.), **C4** (L.W.) and coils **L6, L7** which also form part of a selectivity circuit. On S.W., input is via coupling coil **L8** to single-tuned circuit **L9, C39**. I.F. filtering by **L1, C34** across aerial circuit. Image suppression by **C2, C35**.

First valve (**V1, Mullard metallised FC4**) is an octode operating as frequency changer with electron coupling. Oscillator grid coils **L12** (S.W.), **L13** (M.W.) and **L14** (L.W.) are tuned by **C40**; parallel trimming by **C41** (S.W.), **C42** (M.W.) and **C43** (L.W.); series tracking by **C12, C45** (M.W.) and **C11, C44** (L.W.). Reaction by coils **L15** (S.W.), **L16** (M.W.) and **L17** (L.W.).

Second valve (**V2, Mullard metallised VP4B**) is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C46, L18, L19, C47** and **C48, L20, L21, C49**.

Intermediate frequency 128 KC/S.

Diode second detector is not part of **V3** but is part of double diode pentode output valve (**V4, Mullard Pen4DD**). Audio frequency component in rectified output is developed across load resistances **R13, R16** and passed via manual volume control **R17**, coupling condenser **C20**, variable R.C. tone filter **R18, R19, C21, C22** and **R20** to C.G. of triode section of double diode triode valve (**V3, Mullard metallised TDD4**). Bass compensation by **C19** via **S23** across **C20**. Operating potential for cathode-ray tuning indicator (**T.I., Mullard TV4**) is obtained from potential divider **R14, R15** across **R16**.

One diode of **V3** is strapped to the cathode; the second, fed from **V2** anode via **C17**, provides D.C. potential which is developed across load resistance **R25** and fed back through decoupling circuit as G.B. to I.F. valve, to provide undelayed automatic volume control for this stage. A.V.C. to **V1** is delayed, however, by a rather complicated system. The controlling G.B. potential is that at the second (delay) diode of **V4** which is positively biased via its load resistance **R32**. While no signal is being received a very small voltage drop will occur, due to the diode current, as the internal resistance of the diode is low compared with **R32**.

This condition is maintained until the negative potential of **V3** A.V.C. diode rises, due to the strength of an incoming signal, to a value sufficient to neutralise, via **R27**, the opposite polarity of **V4** delay diode, after which normal A.V.C. action will occur in proportion to the strength of the signal. On S.W., **V1** is not controlled. Resistance-capacity coupling by **R24, C26** and **R28**, via stopper **R31**, between **V3** triode and pentode section of **V4**. G.B. for **V4** is obtained from drop along **R34** in H.T. negative lead to chassis. Fixed tone correction in anode circuit by **C28**. Provision for connection of low impedance external speaker across secondary of output transformer **T1**.

Negative feed-back circuit **L22, L23, C29, R33** is coupled (except on S.W. and gram.) by **R22**; **R26**, ganged with tone control potentiometer **R19**, operates as a quality control.

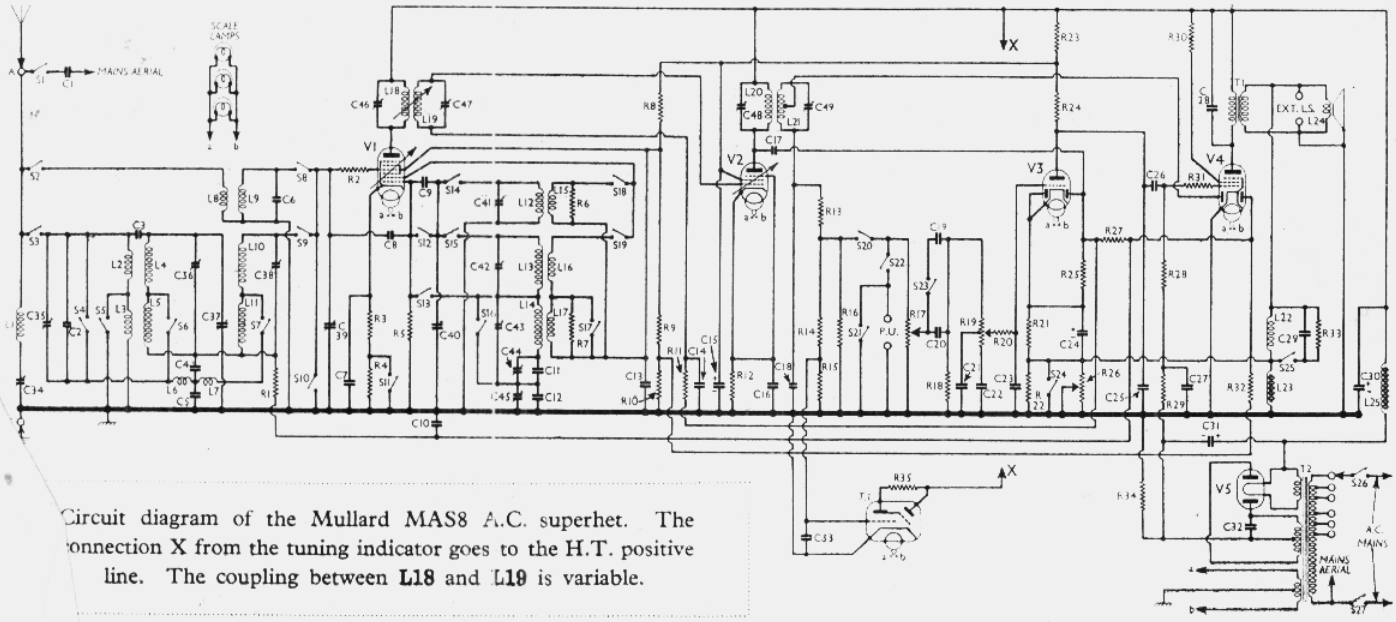
H.T. current is supplied by full-wave rectifying valve (**V5, Mullard DW2**). Smoothing by iron-cored choke **L25** and large capacity electrolytic condensers **C30, C31**.

Mains aerial coupling by **C1** via switch **S1**.

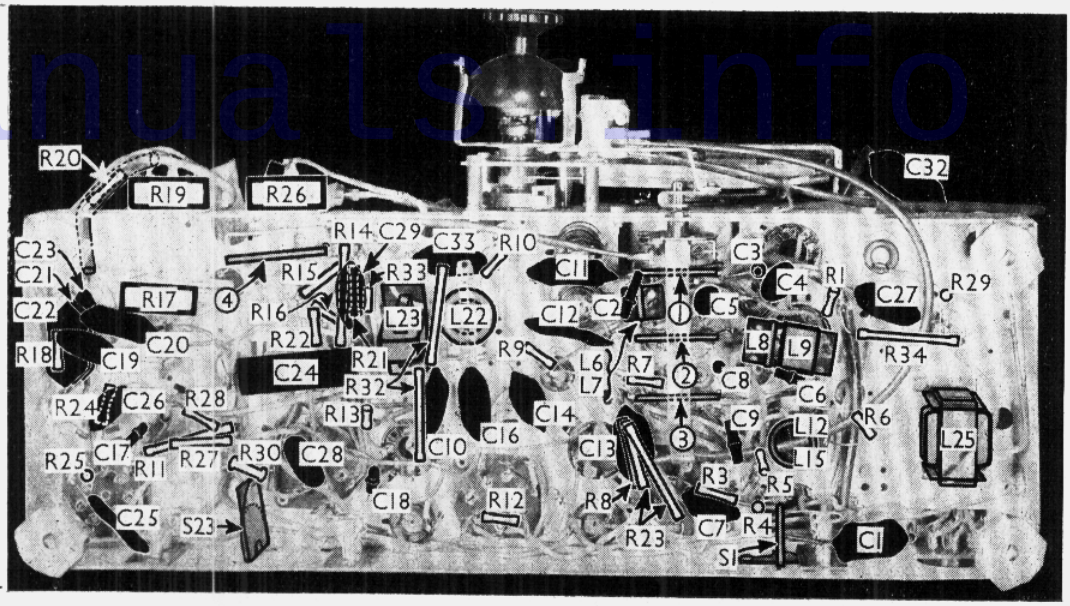
COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Mains aerial condenser	0·0005
C2	Image suppresser (fixed)	0·00002
C3	M.W. and L.W. aerial coupling	0·00001
C4, C5	Parts band-pass coupling	0·016, 0·025
C6	Aerial circuit S.W. trimmer	0·000004
C7	V1 cathode by-pass	0·05
C8	Small coupling	0·000002
C9	V1 osc. C.G. condenser	0·0001
C10	A.V.C. line decoupling	0·1
C11	Osc. circuit L.W. fixed tracker	0·00065
C12	Osc. circuit M.W. fixed tracker	0·001375
C13	V1 osc. anode decoupling	0·1
C14	V2 C.G. decoupling	0·05
C15*	V2 S.G. and V3 triode anode decoupling	32·0
C16	V2 cathode by-pass	0·1
C17	Coupling to V3 A.V.C. diode	0·00002
C18	I.F. by-pass	0·00005
C19	Bass compensating condenser	0·004
C20	A.F. coupling to V3 triode	0·0005
C21, C22	Parts of variable tone control filter	0·0004, 0·0004
C23	I.F. by-pass	0·0001
C24*	V3 cathode by-pass	50·0
C25	I.F. by-pass	0·0004
C26	V3 triode to V4 A.F. coupling	0·008
C27	V4 C.G. decoupling	0·1
C28	Fixed tone corrector	0·002
C29	Part of neg. feed-back circuit	0·05
C30*, C31*	H.T. smoothing	32·0, 32·0
C32	V5 anode R.F. by-pass	0·02
C33	T.I. C.G. decoupling	0·05
C34‡	Aerial I.F. filter tuning	0·0001
C35‡	Image suppression adjuster	0·00003
C36‡	Band-pass pri. M.W. trimmer	0·00003
C37†	Band-pass primary tuning	0·00049
C38‡	Band-pass sec. M.W. trimmer	0·00003
C39†	Band-pass secondary and S.W. aerial tuning	0·00049
C40†	Oscillator circuit tuning	0·00049
C41‡	Osc. circuit S.W. trimmer	0·00003
C42‡	Osc. circuit M.W. trimmer	0·00003
C43‡	Osc. circuit L.W. trimmer	0·00003
C44‡	Osc. circuit L.W. tracker	0·00017
C45‡	Osc. circuit M.W. tracker	0·00017
C46†	1st I.F. trans. pri. tuning	0·00017
C47†	1st I.F. trans. sec. tuning	0·00017
C48‡	2nd I.F. trans. pri. tuning	0·00017
C49‡	2nd I.F. trans. sec. tuning	0·00017

* Electrolytic. † Variable. ‡ Pre-set.



Circuit diagram of the Mullard MAS8 A.C. superhet. The connection X from the tuning indicator goes to the H.T. positive line. The coupling between **L18** and **L19** is variable.



Under-chassis view. Note the four switch units, three together, and the fourth just behind **R26**. They are all ganged. **S1** and **S23** are operated by levers at the rear of the chassis.

	RESISTANCES	Values (ohms)
R1	V1 pent. C.G. decoupling	100,000
R2	V1 pent. C.G. stopper	32
R3	V1 fixed G.B. resistance	250
R4	Radio muting on gram.	2,500
R5	V1 osc. C.G. resistance	50,000
R6	Osc. circuit S.W. reaction damping	10,000
R7	Osc. circuit L.W. reaction damping	10,000
R8	Parts V1, V2 S.G.'s, V1 osc. anode, V3 triode anode H.T. feed; V4 A.V.C. delay diode pos. bias pot.	25,000 / 32,000 / 50,000
R9		
R10		
R11	V2 C.G. decoupling	2,000,000
R12	V2 fixed G.B. resistance	250
R13	Part V4 signal diode load	250,000
R14	T.I. C.G. feed potentiometer	5,000,000
R15		1,600,000
R16	Part V4 signal diode load	600,000
R17	Manual volume control	350,000
R18	V3 triode C.G. and parts variable tone control	800,000 / 320,000 / 160,000
R19		
R20		
R21	V3 G.B. resistance	3,200
R22	Neg. feed-back coupling	20
R23	Part of pot. with R8, R9, R10	12,300*
R24	V3 triode anode load	100,000
R25	V3 A.V.C. diode load	500,000
R26	Variable neg. feed-back control, ganged R19	200
R27	V3 A.V.C. diode to V4 delay diode coupling	1,000,000
R28	V4 C.G. resistance	400,000
R29	V4 C.G. decoupling	320,000
R30	V4 S.G. H.T. feed resistance	50
R31	V4 grid stopper	1,000
R32	V4 delay diode load	9,000,000†
R33	Part neg. feed-back circuit	800
R34	V4 auto-G.B. resistance	125
R35	T.I. anode H.T. feed	2,000,000

* Approx. value. One 20,000 Ω and one 32,000 Ω in parallel.
† One 5 MΩ and one 4 MΩ in series.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial I.F. filter coil	125·0
L2	Aerial band-pass coupling coils	27·0 / 110·0
L3		
L4	Band-pass primary coils	6·0 / 23·0
L5		
L6	Band-pass coupling coils	1·5 / 1·5
L7		
L8	Aerial S.W. coupling coil	3·0
L9	Aerial S.W. tuning coil	0·05
L10	Band-pass secondary coils	6·0 / 23·0
L11		
L12	Osc. circuit S.W. tuning coil	0·05

	OTHER COMPONENTS (*Continued*)	Approx. Values (ohms)
L13	Osc. circuit M.W. tuning coil	11·0
L14	Osc. circuit L.W. tuning coil	30·0
L15	Oscillator S.W. reaction	0·75
L16	Oscillator M.W. reaction	3·5
L17	Oscillator L.W. reaction	8·0
L18	1st I.F. trans. Pri.	130·0
L19	1st I.F. trans. Sec.	130·0
L20	2nd I.F. trans. Pri.	130·0
L21	2nd I.F. trans. Sec., total	180·0
L22	Parts of negative feed-back circuit	150·0
L23		2·5
L24	Speaker speech coil	3·5
L25	H.T. smoothing choke	350·0
T1	Output transformer Pri.	400·0
	Output transformer Sec.	0·6
T2	Mains trans. Pri., total	34·0
	Mains trans. Heater sec.	0·05
	Mains trans. Rect. heat. sec.	0·175
	Mains trans. H.T. sec., total	330·0
S1	Mains aerial switch	—
S2-S19	Waveband switches	—
S20-22	Radio-gram change switches	—
S23	Bass compensator switch	—
S24, 25	Negative feed-back switches	—
S26, 27	Ganged mains switches	—

DISMANTLING THE SET

A detachable bottom is fitted to the cabinet and upon removal (four screws, with washers) gives access to most of the components beneath the chassis. If the chassis is removed from the cabinet care should be taken not to kink the bowden cables.

Removing Chassis.—To remove the chassis from the cabinet, remove the switch knob (two recessed grub screws) and the two countersunk-head screws holding the mains switch to the escutcheon on the side of the cabinet. Now remove the four hollow bolts (with washers) holding the chassis to the bottom of the cabinet and unsolder the leads from the speaker and the lead earthing the plate on the bottom of the cabinet.

Next remove the two bolts (with lock nuts and washers) holding the scale assembly, remove the assembly and carefully remove the two moulded cups (each containing three washers, a felt washer and a spring.)

The chassis and scale assembly can now be withdrawn.

Mullard recommend that the scale assembly should be secured to the chassis with the aid of a special bracket (Code No. M0099213).

When replacing, connect the speaker leads as follows, numbering the tags from bottom to top:—1, lead from bottom stud on transformer; 2 and 3 joined together, lead from the other stud on the transformer and earthing lead to the plate carrying the tuning indicator.

Removing Speaker.—To remove the speaker from the cabinet, first remove the chassis, then slacken the three clamps (nuts and lock nuts) holding it to the sub-baffle. *When replacing*, see that the terminal panel is on the right and connect the leads as above.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 223 V, using the 220 V tapping on the mains transformer. 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 FC4	248 Oscillator 50	0·6 / 1·2	50	2·8
V2 VP4B	248	8·0	150	2·7
V3 TDD4	62	0·7	—	—
V4 Pen4DD	237	29·0	248	8·2
V5 DW2	260†	—	—	—
T.I. TV4	18 Target 248	0·1 / 0·5	—	—

† Each anode, A.C.

GENERAL NOTES

Switches.—**S1** is the mains aerial switch, operated by a lever mounted at the rear of the chassis near the aerial and earth sockets. With the switch lever up, one side of **C1** is connected to the aerial circuit. With the lever down, **C1** is disconnected. In addition, the rotor contact of the switch is earthed in this position (not shown in our circuit diagram).

S2-S22 and **S24, S25** are the waveband and radio-gram switches, ganged in four rotary units beneath the chassis. Three of these are operated by a common shaft, while the fourth is controlled by a flexible cable linked up with the other three units. They are all indicated in our under-chassis view, and shown in detail in the diagrams on page VIII, where they are as seen looking from the rear of the underside of the chassis.

The table (page VIII) gives the switch positions for the four control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed. The fourth unit really only has three positions, as it does not move when the control is rotated from M.W. to L.W. or vice-versa.

S23 is the bass compensator switch, operated by a lever at the rear of the chassis. When the lever is up, **S23** is closed, and when it is down it is open.

S26, S27 are the Q.M.B. mains switches, ganged in a rotary unit and normally operated by a knob at the right hand side of the cabinet. They are therefore not shown in our chassis illustrations.

Coils.—**L1; L2-L5; L10, L11; L13, L14, L16, L17**

(*Continued overleaf*)

MULLARD MAS8—*Continued*

and the I.F. transformers **L18, L19** and **L20, L21** are in six screened units on the chassis deck. All but the fourth of these have a trimmer at the top of their cans; the fourth has two trimmers. The **L20, L21** unit has a shielding cap over its trimmer.

L6, L7; L8, L9 and **L12, L15** are on three small unscreened tubular formers beneath the chassis.

L22, L23 and **L25** are also beneath the chassis.

Scale Lamps. These are three Philips M.E.S. types with frosted tubular bulbs, type 8042-07.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (5-10 O) external speaker.

Resistances R23, R32.—R23 consists of a 20,000 O and a 32,000 O resistance in parallel. **R32** consists of a 5 MO and a 4 MO resistance in series.

Resistances R2, R31.—R2 is inside the top cap connector of **V1**, and **R31** is inside the top cap connector of **V4**.

T.I. Connections.—The TV4 is fitted with a side contact base, with two contacts blank. Starting with the blank contact in the group of four close together, and proceeding anti-clockwise, looking at the underside of the holder, the connections are: 1, blank; 2 and 3, heater; 4, cathode; 5, blank; 6, grid; 7, target; 8, anode.

R35 is connected directly across contacts 7 and 8 on the holder.

V4 Connections. The Pen4DD has a 7-pin base with connections differing from usual. The anode and cathode are interchanged, so that pin 2 is cathode and pin 6 is anode.

CIRCUIT ALIGNMENT

I.F. Stages.—Adjust band-width and volume controls to maximum (knob in upper right hand corner), and switch set to L.W. Short-circuit **R5, C10, C14** and **L23**, which puts the oscillator, A.V.C. and feed-back circuits out of action.

Connect signal generator to control grid (top cap) of **V1**, via a 0·32 μF condenser, and chassis, and feed in a 128 KC/S signal. Shunt **L18** with a 10,000 O resistor and a 0·1 μF condenser connected in series from anode of **V1** to chassis. Shunt **L21** with a 25,000 O resistor. Adjust **C48** and **C47**, then **C48** again, for maximum output. Remove damping.

Shunt **L19** with a 10,000 O resistor and a 0·1 μF condenser connected in series from the grid of **V2** to chassis. Shunt **L20** with a 25,000 O resistance and a 0·1 μF condenser in series from the anode of **V2** to chassis.

Adjust **C49** and **C46**, then **C49** again, for maximum output. Remove damping and the short circuits across **R5, C10, C14** and **L23**. Seal the trimmers.

R.F. and Oscillator Stages.—Earth the chassis, and adjust volume control to maximum and band-width to minimum (knob in upper left hand corner). Fit a 15 degree jig (No. M.09991741) by slipping its boss over the locating pin just above the condenser spindle. When the condenser is turned so that it bears on the jig the vanes are advanced exactly 15 degrees, which is the standard alignment position.

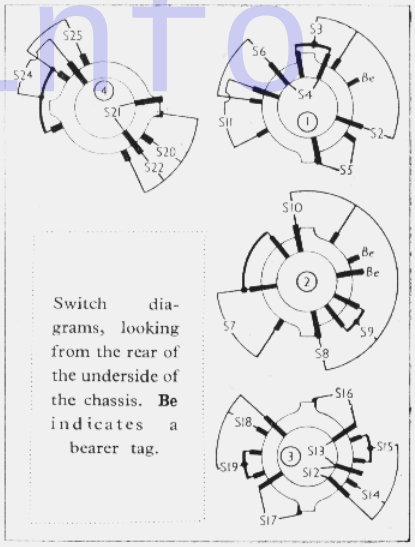
M.W.—Switch to M.W. and turn condenser until it bears on the jig. Connect signal generator to **A** and **E** sockets via a standard dummy aerial. Feed in a 1,442 KC/S (208 m.) signal, and adjust **C42, C38, C36**, then **C38** and **C42** again, for maximum output.

Connect a 0·1 μF condenser from oscillator grid of **V1** to chassis. Connect the anode of **V1** to the aerial socket of an auxiliary receiver or aperiodic amplifier via a 25 $\mu\mu$F condenser. Connect the output meter to the auxiliary receiver. Feed a 550 KC/S (545 m.) signal to the set being aligned, and tune for maximum output. If any difficulty is experienced in tuning, turn the condenser to the right and then to the left of the position for maximum output until the meter reading is one third of the maximum. Mark the two condenser positions, and the correct tuning point will be mid-way between them. If this position differs greatly from the original, repeat the process.

Disconnect the aux. receiver, remove the 0·1 μF condenser from oscillator grid of **V1**, and re-connect output meter to set being aligned. Without altering position of tuning condenser, adjust **C45** for maximum output. Feed in a 1,442 KC/S signal again, turn condenser to bear on jig, and re-adjust **C42** for maximum output.

TABLE AND DIAGRAMS OF THE SWITCH UNITS

Switch	S.W.	M.W.	L.W.	Gram.
S2	C	—	—	—
S3	—	C	C	—
S4	—	—	—	C
S5	—	C	—	—
S6	C	C	—	C
S7	—	C	—	C
S8	C	—	—	—
S9	—	C	C	—
S10	—	—	—	C
S11	C	C	C	—
S12	—	C	C	—
S13	—	—	—	C
S14	C	—	—	—
S15	—	C	C	—
S16	—	C	—	—
S17	—	C	—	—
S18	C	—	—	—
S19	—	C	C	—
S20	C	C	C	—
S21	C	C	C	—
S22	—	—	—	C
S24	C	—	—	C
S25	—	C	C	—



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

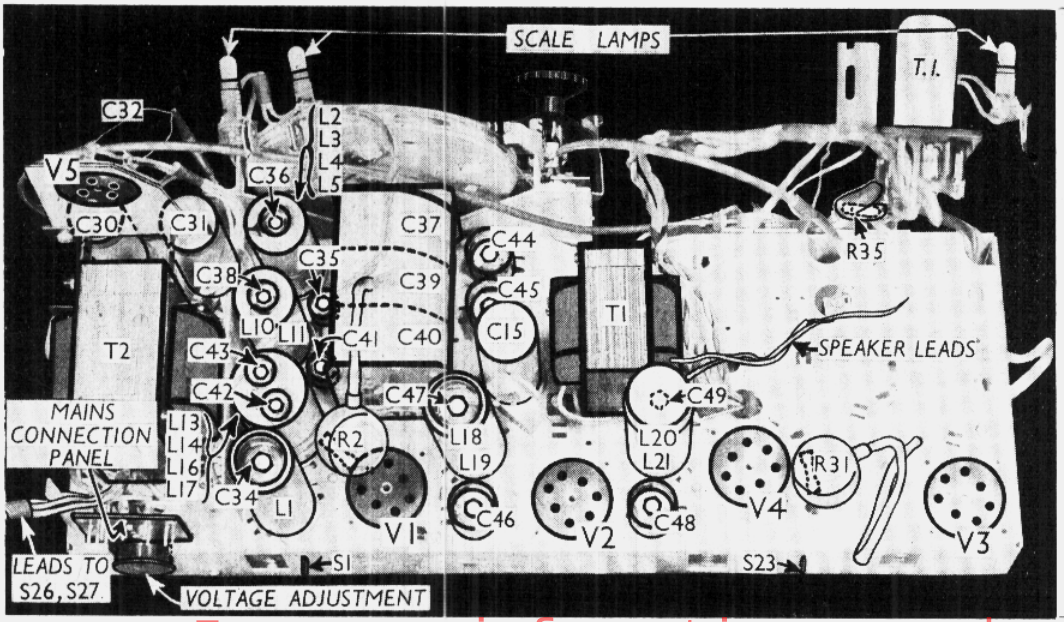
L.W.—Switch set to L.W., and feed in a 395 KC/S (760 m.) signal. Connect a 0·1 μF condenser from oscillator grid of **V1** to chassis. Connect up auxiliary receiver as on M.W., and tune set under alignment for maximum output. Disconnect aux. receiver, remove 0·1 μF condenser from oscillator grid of **V1** and re-connect output meter to set being aligned. Adjust **C43** for maximum output.

Feed in a 160 KC/S (1,875 m.) signal, connect 0·1 μF condenser from osc. grid of **V1** to chassis, and connect aux. receiver again. Adjust set being aligned for maximum output. Disconnect aux. receiver, remove 0·1 μF condenser and re-connect output meter to set being aligned. Adjust **C44** for maximum output.

S.W.—Switch set to S.W., and turn condenser to bear on jig. Feed in a 17 MC/S (17·6 m.) signal to aerial socket via a S.W. artificial aerial, and adjust **C41** for maximum output. If two tuning positions are found, use that requiring the higher trimmer capacity.

Image Suppressor.—Switch set to M.W. Feed in a 744 KC/S (403 m.) signal, and tune it in. Without altering tuning of receiver, feed in a strong signal of 1,000 KC/S (300 m.), and adjust **C35** for *minimum* output.

I.F. Filter.—Switch set to L.W., feed in a strong 128 KC/S signal, turn tuning condenser to maximum, and adjust **C34** for *minimum* output.



Plan view of the chassis. Note the various trimmers on the coil cans and on the chassis. **R2** and **R31** are inside the **V1** and **V4** top cap connectors. **R35** is inside insulated sleeving close to the T.I. holder.

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