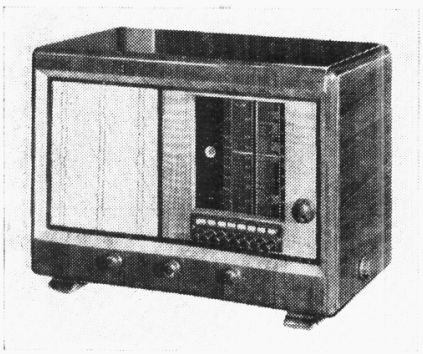
Supplement to The Wireless & Electrical Trader, June 3, 1939

"TRADER" SERVICE SHEET

408

ULTRA 500

3-BAND AC SUPERHET



Release date : September, 1938.

THE Ultra model 500 is a 7-valve (plus rectifier) 3-band AC superhet, for 200-260 V, 40-100 C/S mains. The SW range is from 16·5 to 51 metres.

A mechanical system of press-button tuning for eight stations is fitted, and there is a 3-position selectivity control.

The circuit includes an RF stage, a triode-hexode frequency changer, a pentode IF amplifier, a double-diode for second detection and AVC (using two separate cathodes), a triode first AF amplifier, and two beam tetrodes in push-pull in the output stage. A tuning indicator is fitted, and there is provision for a pick-up and an extension speaker.

CIRCUIT DESCRIPTION

Aerial input is via coupling coils **L1** (SW), **L2** (MW) and **L3** (LW) to single-tuned circuits **L4, C46** (SW), **L5, C46** (MW) and **L6, C46** (LW) which precede variable-mu RF pentode valve (V1, **Mazda metallised VP41**) operating as signal frequency amplifier.

Tuned-secondary RF transformer coupling by **L7, L10, C48** (SW), **L8, L11, C48** (MW) and **L9, L12, C48** (LW) between **V1** and triode-pentode valve (**V2, Mazda metallised AC/TH1**) which operates as frequency changer with internal coupling. Triode oscillator anode coils **L16** (SW), **L17** (MW) and **L18** (LW) are tuned by **C52** ; parallel trimming by **C49** (SW), **C50** (MW) and **C19, C51** (LW) ; series tracking by **C16** (SW), **C17** (MW) and **C18** (LW). Reaction by coils **L13** (SW), **L14** (MW) and **L15** (LW).

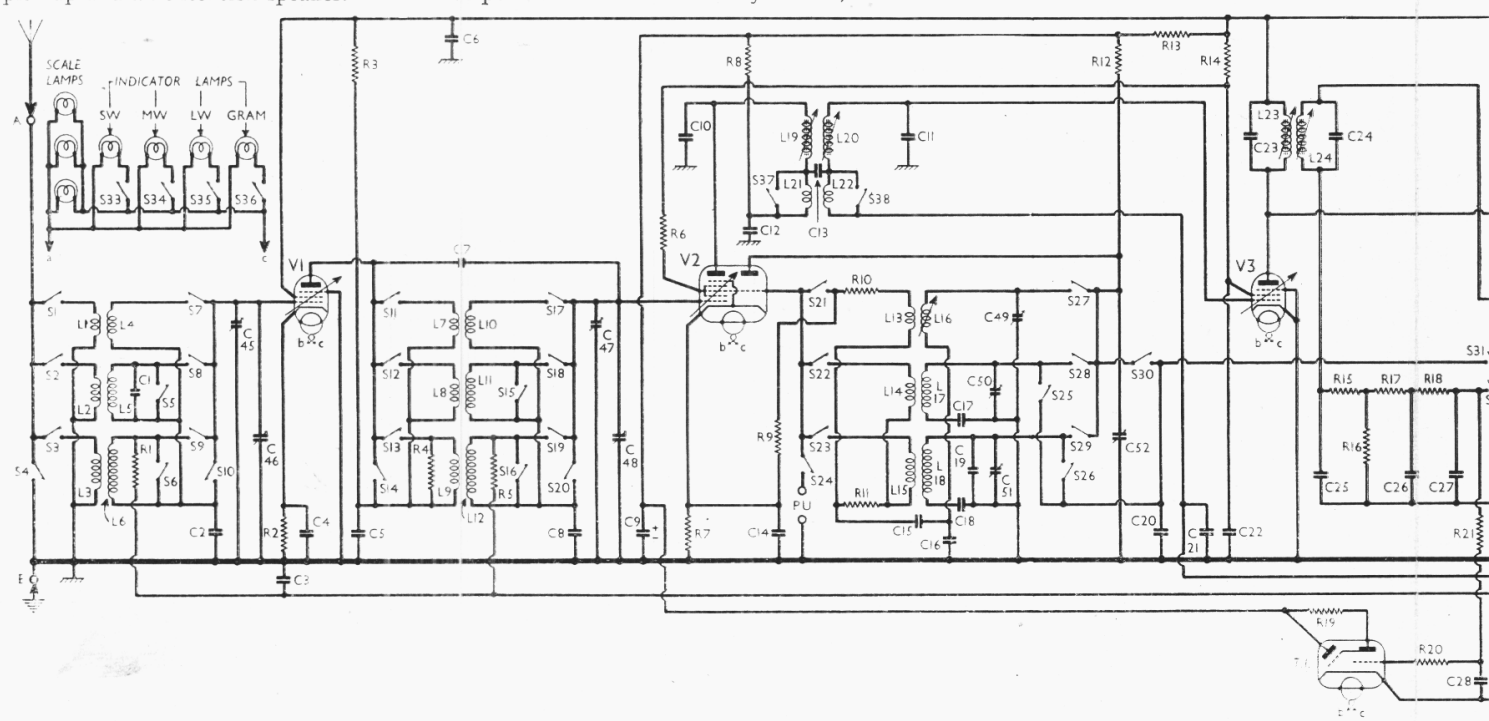
Third valve (**V3, Mazda metallised VP41**) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C10, L19, L20, C11** (with **L21, C13** and **L22**) and **C23, L23, L24, C24.** The coils **L21** and **L22** are short-circuited by **S37, S38** in position 1 of the selectivity control, so that the coupling between **L19** and **L20** is normal ; but when the control is in position 2 or 3 the switches are open and the coupling is modified to provide variable selectivity. Tuning of bothIF transformers is effected by adjustment of the iron cores.

Intermediate frequency : 470 KC/S.

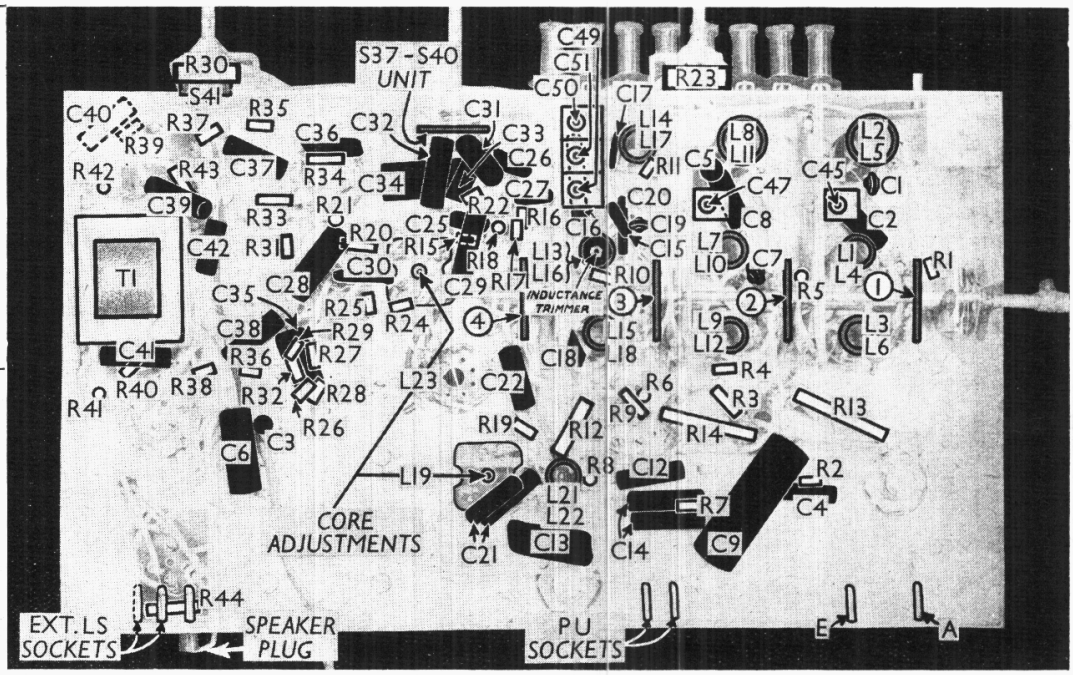
Diode second detector is part of separate double diode valve (**V4, Mazda metallised DD41**) which has independent cathodes. Audio frequency component in rectified output is developed across load resistance **R16** and passed via IF filter, **S32**, AF coupling condenser **C29,** variable tone control filter **R22, C31, C32** and **R23,** and manual volume control **R30** to CG of phase-splitting valve (**V5, Mazda metallised HL41**). IF filtering by **C25, R15, R17, C26, R18** and **C27** in diode circuit, and **C35, C36** in **V5** anode and cathode circuits. Operating potential for cathode ray tuning indicator (**T.I. Mazda ME41**) is obtained from junction of **R18** and **S32** and fed via **R21, R22, C28. T.I.** cathode is connected to **V4, V5** cathode line.

When the selectivity control is turned to position 2, **S39** closes so that **C33** is connected between the top of **R30** and the low potential end of the first IF transformer secondary winding, to produce an improved high note response.

When the waveband switch control is



Circuit diagram of the Ultra 500 receiver. The switches **S37-S40** form a three-position selectivity control. The screen which separates the



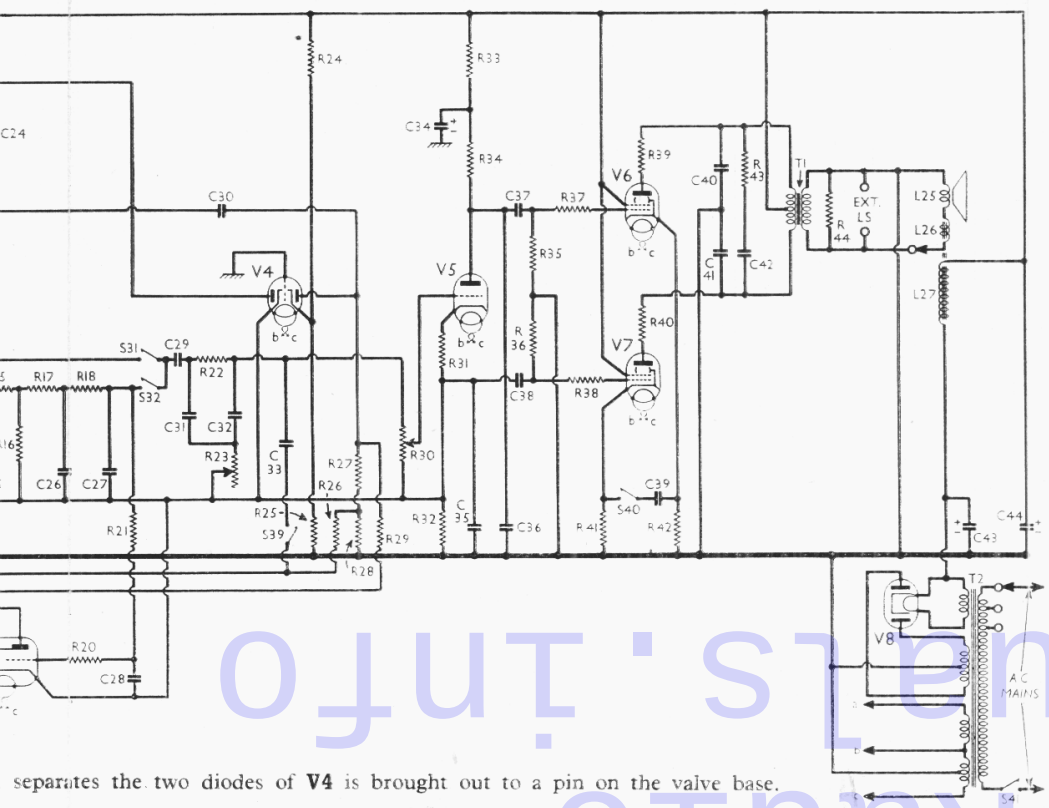
Under-chassis view. The four switch units controlled by the waveband knob, and the **S37-S40** unit, are indicated here and shown in detail in the diagrams in col. 6 overleaf.

turned to the gram. position, **S32** opens to mute radio, and **S24, S30** and **S31** close, so that the pick-up is connected in the grid circuit of **V2** triode section, which then operates as an AF amplifier. Its output, which is developed across **R12,** is passed via **S30** and **S31** to **C29** and thus to **V5** control grid.

Second diode of **V4,** fed from **V3** anode via **C30,** provides DC potentials which are developed across load resistances **R27** and **R28** and fed back through decoupling circuits as GB to RF, FC and IF valves, giving automatic volume control. Delay voltage is obtained from potential divider **R24, R25,** which is connected across the HT supply.

Resistance-capacity coupling by **R34, C37** and **R35,** via grid stopper **R37** (from anode) and **R32, C38** and **R36,** via grid stopper **R38** (from cathode) between **V5** and push-pull output stage comprising two beam tetrode valves (**V6, V7 Mazda AC5/Pen's**). Fixed tone correction in anodes circuit by **R43, C42.** **S40** closes in position 3 of selectivity control to connect **C39** between the two cathodes and so modify the negative feedback, which is introduced by the omission of the usual by-pass condenser. Provision for connection of low impedance external speaker across secondary of output transformer **T1,** while a plug and socket device permits the internal speaker to be muted. **R44** provides a permanent load across **T1** secondary and will prevent damage which may otherwise occur should both speakers be disconnected.

HT current is supplied by IHC full-wave rectifying valve (**V8, Mazda UU4**). Smoothing by speaker field **L27** and wet electrolytic condensers **C43** and **C44.**



separates the two diodes of **V4** is brought out to a pin on the valve base.

DISMANTLING THE SET

The cabinet is fitted with a detachable bottom, upon removal of which access may be gained to most of the components beneath the chassis. If it is required to remove the chassis from the cabinet, remove the three small control knobs (pull off) and the tuning knob (recessed grub screw) from the front of the cabinet and, by slackening the fixing screw inside the cabinet, the remaining knob with its extension spindle from the side of the cabinet. Then remove the two round-head wood screws holding the top of the scale assembly to the front of the cabinet, slip the bottom right-hand scale lamp from its bracket on the front of the cabinet and remove the four cheese-head bolts (with claw washers and lock washers) holding the chassis to the bottom of the cabinet, when the chassis may be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free the chassis entirely, unsolder the four leads from the connecting panel on the speaker. *When replacing,* note that a felt washer is fitted on the spindle between each of the front control knobs and the cabinet, and connect the speaker leads as follows, numbering from left to right: 1, red; 2, yellow; 3, green; 4 no connection; 5, black. All four leads are covered with yellow braiding, but three of them are coded with paint near their ends as detailed above.

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Removing Speaker.—Unsolder the four connecting leads and slacken the three hexagon nuts holding the fixing clamps to the rim of the speaker; remove one nut and clamp, when the speaker may be lifted out. *When replacing*, the connecting panel should be at the top, and the leads connected as already indicated.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 CG decoupling	1,000,000
R2	V1 fixed GB resistance	200
R3	V1 anode HT feed	4,000
R4	V1 anode LW damping	150
R5	V2 pentode CG decoupling	1,000,000
R6	V2 SG RF stopper	60
R7	V2 fixed GB resistance	200
R8	V2 pentode anode HT feed	4,000
R9	V2 osc. CG resistance	25,000
R10, R11	Oscillator reaction stabilising resistances	60
R12	V2 osc. anode HT feed	20,000
R13	V2 anodes decoupling	2,000
R14	V2, V3 SG's HT feed resistance	10,000
R15	IF stopper	50,000
R16	V4 signal diode load	250,000
R17, R18	IF stopper resistances	10,000
R19	T.I. anode HT feed	1,000,000
R20, R21	T.I. CG feed decoupling resistances	2,000,000
R22	Part of variable tone control	50,000
R23	Variable tone control	2,000,000
R24, R25	AVC delay potential divider resistances	1,000,000
R26	V3 CG decoupling	3,000,000
R27, R28	V4 AVC diode load resistances	250,000
R29	AVC line decoupling	1,000,000
R30	Manual volume control	1,000,000
R31	V5 GB resistance	2,300
R32	V5 cathode load resistance	30,000
R33	V5 anode decoupling	10,000
R34	V5 anode load resistance	30,000
R35	V6 CG resistance	250,000
R36	V7 CG resistance	250,000
R37	V6 CG stopper	3,000
R38	V7 CG stopper	3,000
R39	V6 anode stopper	60
R40	V7 anode stopper	60
R41	V7 GB resistance	170
R42	V6 GB resistance	170
R43	Part of fixed tone corrector	30,000
R44	T1 sec. artificial loading	60

	CONDENSERS	Values (μF)
C1	Aerial circ. MW fixed trimmer	0·000005
C2	V1 CG decoupling	0·05
C3	AVC line decoupling	0·01
C4	V1 cathode by-pass	0·01
C5	V1 anode decoupling	0·1
C6	HT circuit RF by-pass	0·2
C7	Part V1 to V2 pent. coupling	0·00001
C8	V2 pentode CG decoupling	0·05
C9*	V2 anodes decoupling	4·0
C10, C11	1st IF transformer fixed tuning condensers	0·0001
C12	V2 pent. anode decoupling	0·05
C13	Part 1st IF trans. coupling	0·003
C14	V2 cathode by-pass	0·035§
C15	V1 osc. CG condenser	0·0002
C16	Osc. circuit SW tracker	0·0035
C17	Osc. circuit MW tracker	0·000536
C18	Osc. circuit LW tracker	0·000138
C19	Osc. circuit LW fixed trimmer	0·00003
C20	RF by-pass condenser	0·0006
C21	V3 CG decoupling	0·035§
C22	V2, V3 SG's decoupling	0·05
C23, C24	2nd IF transformer fixed tuning condensers	0·0001
C25, C26, C27	IF by-pass condensers	0·0001, 0·0001, 0·0002
C28	T.I. CG decoupling	0·1
C29	AF coupling to V5	0·01
C30	Coupling to V4 AVC diode	0·0002
C31, C32	Parts of variable tone control	0·001, 0·003
C33	Part of variable selectivity circuit	0·0001
C34*	V5 anode decoupling	2·0
C35, C36	IF by-pass condensers	0·0002, 0·0002
C37	V5 to V6 AF coupling	0·05
C38	V5 to V7 AF coupling	0·05
C39	Part selectivity control	0·1
C40, C41	V6, V7 anodes stabilising condensers	0·0002, 0·0002
C42	Part of fixed tone corrector	0·001
C43*, C44*	HT smoothing condensers	16·0, 32·0
C45‡	Aerial circuit SW trimmer	—
C46†	Aerial circuit tuning	—
C47‡	RF trans. sec. SW trimmer	—
C48†	RF trans. sec. tuning	—
C49‡	Osc. circuit SW trimmer	—
C50‡	Osc. circuit MW trimmer	—
C51‡	Osc. circuit LW trimmer	—
C52†	Oscillator circuit tuning	—

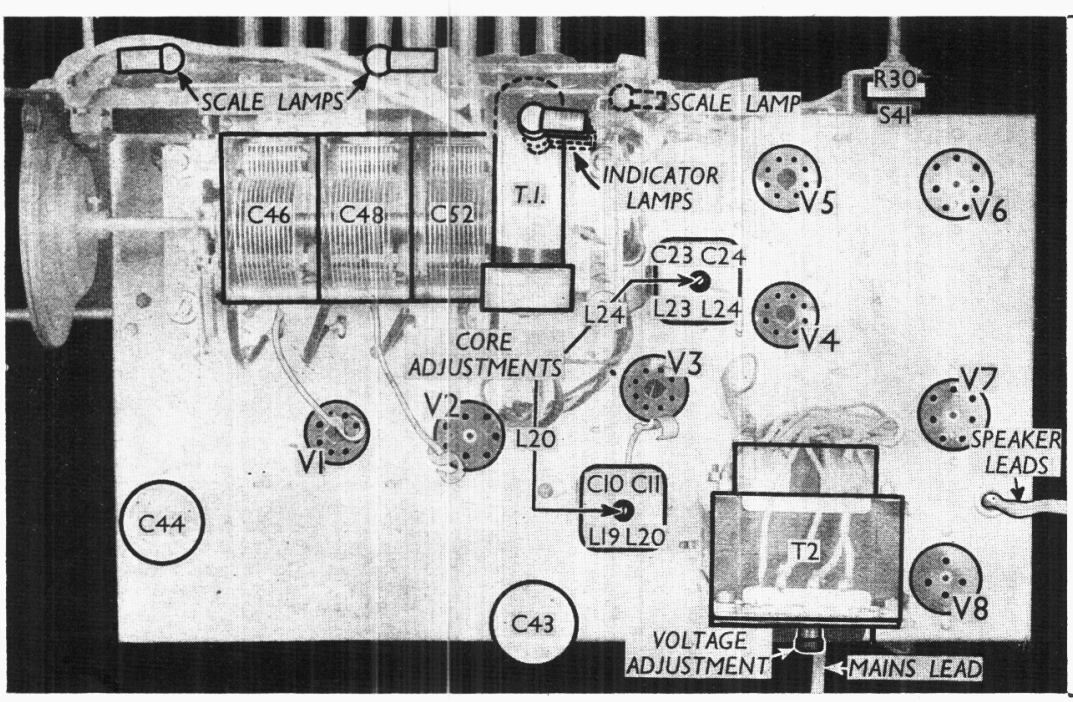
* Electrolytic. † Variable. ‡ Pre-set.
§ 0·01 and 0·025 in parallel.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial SW coupling coil	2·4
L2	Aerial MW coupling coil	12·0
L3	Aerial LW coupling coil	100·0
L4	Aerial SW tuning coil	Very low
L5	Aerial MW tuning coil	4·0
L6	Aerial LW tuning coil	31·0
L7	RF trans. SW pri. coil	4·3
L8	RF trans. MW pri. coil	0·3
L9	RF trans. LW pri. coil	6·3
L10	RF trans. SW sec. coil	Very low
L11	RF trans. MW sec. coil	4·0
L12	RF trans. LW sec. coil	31·0
L13	Oscillator SW reaction	0·2
L14	Oscillator MW reaction	0·8
L15	Oscillator LW reaction	1·4
L16	Osc. circuit SW tuning coil	Very low
L17	Osc. circuit MW tuning coil	4·6
L18	Osc. circuit LW tuning coil	13·0
L19, L20	1st IF trans. Pri. / Sec.	9·0 / 9·0
L21, L22	Variable selectivity coupling coils	4·0 / 4·0
L23, L24	2nd IF trans. Pri. / Sec.	9·0 / 9·0
L25	Speaker speech coil	2·0
L26	Hum neutralising coil	0·1
L27	Speaker field coil	400·0
T1	Output trans. Pri., total / Sec.	440·0 / 0·3
T2	Mains trans. Pri., total	10·0
	Heater sec., b, c	Very low
	Scale lamps, sec., a, c	0·05
	Rect. heat. sec.	0·1
	HT sec., total	300·0
S1-29	Waveband switches	—
S30-32	Radio/gram change switches	—
S33-36	Indicator lamps switches	—
S37-40	Variable selectivity and tone control switches	—
S41	Mains switch, ganged R30	—

VALVE ANALYSIS

Valve voltages and currents given in the table (col. 4) are those measured in our receiver when it was operating on mains of 222 V, using the 220-240 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.



Plan view of the chassis. Note that the IF transformer adjustments shown here are for the cores of the secondaries only. The primary core adjustments are indicated in the underchassis view overleaf.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 VP41 ..	190	12	233	3·0
V2 AC/TH1	190	4·0	118	8·6
	Oscillator			
	90	4·7		
V3 VP41 ..	233	8·3	118	2·1
V4 DD41 ..	—	—	—	—
V5 HL41 ..	155	1·4	—	—
V6 AC5Pen	220	40·0	233	6·0
V7 AC5Pen	220	40·0	233	6·0
V8 UU4 ..	295†	—	—	—
T.I. ME41	50	0·5	—	—
	Target			
	215	0·3		

† Each anode, AC.

GENERAL NOTES

Switches.—**S1-S32** are the waveband and radio/gram switches, and **S33-S36** the scale lamps switches, in four rotary units beneath the chassis, indicated in the under-chassis view, and shown in the diagrams in col. 6 where they are viewed as seen looking from one end of the chassis, in the direction shown by the arrows in the under-chassis view. The table (col. 5) gives the switch positions for the four control settings, starting from fully anti-clockwise. A dash indicates *open*, and **C**, *closed*.

S37-S40 are the variable-selectivity control switches, in a separate rotary unit at the front of the chassis, also indicated in our under-chassis view. A diagram of this unit as seen from the rear of the underside of the chassis is shown in col. 6. In position 1 of the control, **S37** and **S38** are closed; in position 2, **S39** is closed; in position 3, **S40** is closed.

S41 is the QMB mains switch, ganged with the volume contol **R30.**

Coils.—All the coils, with the exception of the IF transformers, are in three screened compartments beneath the chassis with their associated trimmers, trackers and switches. The IF transformers **L19, L20** and **L23, L24** with their fixed trimmer condensers are in two screened units on the chassis deck; the primary core adjusting screws are reached from beneath the chassis, under their respective units, while the secondaries are adjusted through holes in the detachable caps on the tops of the screening cans. The supplementary coils **L21, L22,** which are associated with the first IF transformer, are wound on a tubular unscreened former beneath the chassis, situated near the IF transformer.

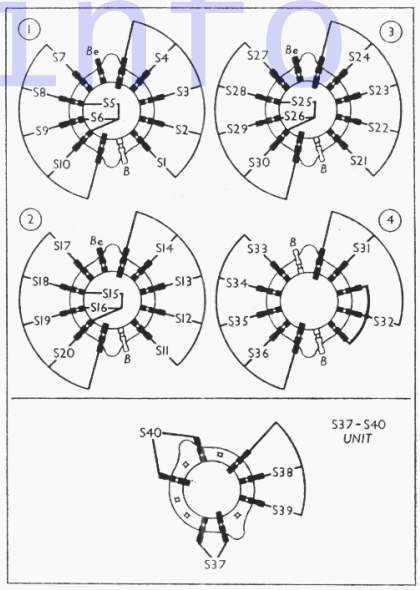
Mains Transformer T2.—This is provided with three low-voltage secondary windings, besides that for the rectifier heater: two of these are connected in parallel and supply heater current to valves **V1-V7** and the tuning indicator; the third winding is connected in series with the heater windings to provide a higher voltage for the scale lamps. In the diagram, the heater windings terminate at **b** and **c**; the additional scale lamp windings at **a** and **b.**

Scale and Indicator Lamps.—These are seven Osram MES types, rated at 0·5 V, 0·3 A. Note that they are connected across the points **a** and **c** of the mains transformer.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2-4 Ω) external speaker. A plug and socket device permits the internal speaker to be muted if desired.

TABLE AND DIAGRAMS OF SWITCH UNITS

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



Diagrams of the switch units, viewed as indicated by the arrows in the under-chassis view.

Chassis Divergencies.—In some chassis, the values of some components may be different from those given in our tables: condensers **C14** and **C21,** which were made up of a 0·01 μF and a 0·025 μF connected in parallel, may each be a single condenser; **C14** may be 0·01 μF, and **C21** 0·05 μF. **C22** may be 0·01 μF; **R12** may be 10,000 Ω. **R44** may not be fitted in some chassis, and **R9** may be connected to the opposite end of **R10.**

CIRCUIT ALIGNMENT

IF Stages.—Set the selectivity control to position 1, the waveband control to MW and the gang to maximum. Connect signal generator to **A** and **E** sockets, feed in a 470 KC/S signal, and adjust the iron cores of **L19, L20, L23** and **L24** for maximum output.

RF and Oscillator Stages.—With the gang at maximum, the pointer should cover the horizontal line at the bottom (high wavelength) end of the MW scale. Signal generator should remain connected as above.

SW.—Switch receiver to SW, tune to 19 m on scale, feed in a 19 m (15·8 MC/S) signal and adjust **C49** to the first peak reached from the fully unscrewed position. Adjust **C45** for maximum, while rocking the gang for optimum results, then adjust **C47** for maximum output. Tune to 50 m, feed in a 50 m (6 MC/S) signal, and adjust the nut on the threaded rod, inside **L16** former, for maximum while rocking the gang.

MW.—Switch receiver to MW, tune to 200 m, feed in a 200 m (1,500 KC/S) signal, and adjust **C50** for maximum output while rocking the gang for optimum results.

LW.—Switch receiver to LW, tune to 1,000 m on scale, feed in a 1,000 m (300 KC/S) signal and adjust **C51** for maximum output, while rocking the gang for optimum results.

All tracking condensers are fixed and so do not require adjustment. Once the trimmers **C45** and **C47** have been adjusted on SW, their settings should not be altered.

MECHANICAL UNIT

This is a De Jur Amsco unit of simple construction, with nothing in it which is likely to get out of order. There are eight press-buttons, and each one is adjustable to any station.

The principle is very similar to that of the Mechomatic Model 11 described on page 1 of *Radio Maintenance* dated June 4, 1938, and readers are referred to this for full details.

The gang condenser spindle is connected by means of a bell-crank and a system of connecting links to a metal pressing of curved formation which is pivoted on two end plates so as to be rotatable. Rotation of the metal pressing also rotates the gang.

Each of the eight plungers carries an adjustable metal contact plate whose leading edge, when a button is depressed, makes contact with, and rotates, the metal pressing to an extent depending on the angle of the leading edge of the contact plate relative to the axis of the plunger.

By adjusting the contact plate, it is possible to rotate the metal pressing, and hence the gang, to any pre-determined point.

The press buttons, on being slightly unscrewed, free their associated contact plates, which can then be adjusted, and subsequently clamped up by tightening the press buttons again.

Station selection is simple. The particular button which is to receive a given station is first unscrewed slightly. The required station is then tuned in manually, and, holding the manual knob firmly to prevent movement of the gang, the button is pushed in to its fullest extent. The button is then allowed to return to its "out" position, and is finally screwed up to clamp the contact plate.