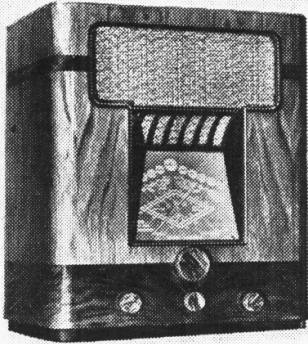


'TRADER' SERVICE SHEET

# 330

# INVICTA 500

## FIVE STATIONS PRE-TUNED



**A** FEATURE of the Invicta 500, Monomatic, receiver is that tuning for five stations (two LW and three MW) is pre-set by means of trimmers for the aerial and oscillator circuits, the required station being selected by a rotary switch, which also performs the functions of a wave-change and gramophone switch.

The receiver is a 4-valve (plus rectifier) AC 4-band superhet covering short-wave ranges of 13-53 m (referred to below as SW1) and 50-200 m (SW2) and suitable for mains of 200-250 V, 40-100 C/S in its standard form, although a special model is also made for 100-120 V, 40-100 C/S.

In addition, there are seven different models, varying only in the station groupings arranged. Models with the suffix A, B, C, D, E and F all cater for Droitwich and Luxembourg, but have different medium-wave stations, while models with the suffix S are special sets with the stations set up according to individual customers' requirements.

This Service Sheet was prepared on a 500A model suitable for mains of 200-250 V, 40-100 C/S.

### CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1** (SW1), **L2** (SW2) and **L3** (MW and LW), plus **C1** on MW, to single-tuned circuits comprising coils **L4** (SW1), **L5** (SW2), **L6** (MW), **L7** (LW), tuned by **C34** (manual) or by appropriate trimmers **C38-C47** (automatic), selection being effected by switches **S20-S26**.

First valve (**V1**, Mullard metallised **TH4A**) is a triode hexode operating as frequency changer with internal coupling. Triode anode coils **L12** (SW1), **L13** (SW2), **L14** (MW) and **L15** (LW) are tuned by **C37** (manual) or by appropriate trimmers **C48-C57** (automatic), selection being effected by switches **S27-S33**. Parallel trimming by **C8**, **C35** (MW) and **C9**, **C36** (LW); series tracking by **C10** (SW1), **C11** (SW2) and **C12** (MW and LW). Reaction by grid coils **L8** (SW1), **L9** (SW2), **L10** (MW) and **L11** (LW). All the waveband switches are ganged with the automatic selector switches and open and close appropriately to select the band occupied by the required automatic position.

Second valve (**V2**, Mullard metallised **VP4B**) is a variable- $\mu$  RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C4**, **L16**, **L17**, **C5** and **C14**, **L18**, **L19**, **C15**.

Intermediate frequency 465 KC/S. Diode second detector is part of double-diode triode valve (**V3**, Mullard metallised **TDD4**). Audio frequency component in rectified output is developed across load resistances **R8**, **R12** and passed via AF coupling condenser **C19**, switch **S34** and manual volume control **R10** to CG of triode section which operates as AF amplifier. Fixed tone compensation by **R9**, **C21** from centre-tap on **R10**. Three-position tone control by **C22**, **S48**; **C20**, **R7**, **S46**; **C20**, **S47**. IF filtering by **C17**, **R6**, **C18**.

Potential developed across **R12** is used to operate cathode-ray tuning indicator (**T.I.**, Mullard **TV4**).

Second diode of **V3**, fed from **L19** via **C24**, provides DC potential which is developed across load resistance **R17** and fed back through decoupling circuit as GB to

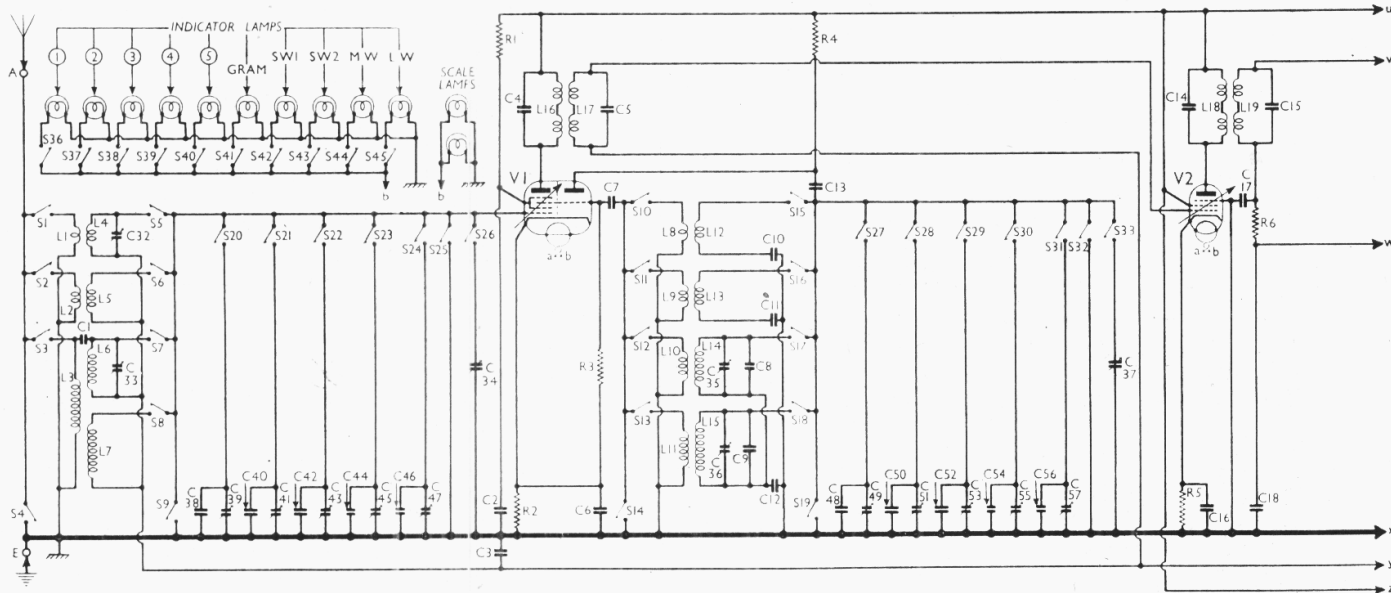
FC and IF valves, giving automatic volume control. Delay voltage is obtained from drop along **R13** in cathode circuit.

Resistance-capacity coupling by **R15**, **C27** and **R18** via grid stopper **R19**, between **V3** triode and pentode output valve (**V4**, Mullard **PenA4**). Provision for connection of low impedance external speaker across secondary of output transformer **T1**, while **S49** permits speech coil circuit of internal speaker to be broken, thus muting the latter.

HT current is supplied by IHC full-wave rectifying valve (**V5**, Mullard **1W4/350**). Smoothing by speaker field **L22** and dry electrolytic condensers **C29**, **C30**.

### COMPONENTS AND VALUES

RESISTANCES		Values (ohms)
R1	V1 SG HT feed	20,000
R2	V1 fixed GB resistance	300
R3	V1 osc. CG resistance	20,000
R4	V1 osc. anode HT feed	20,000
R5	V2 fixed GB resistance	450
R6	IF stopper	100,000
R7	Part of tone control circuit	250,000
R8	Part of V3 signal diode load	250,000
R9	Part of fixed tone compensator	60,000
R10	Manual volume control	1,000,000
R11	T1 CG decoupling	250,000
R12	Part of V3 signal diode load	250,000
R13	V3 GB and AVC delay resistance	1,000
R14	V3 triode anode decoupling	40,000
R15	V3 triode anode load	60,000
R16	AVC line decoupling	1,000,000
R17	V3 AVC diode load	1,000,000
R18	V4 CG resistance	500,000
R19	V4 grid stopper	100,000
R20	V4 GB resistance	150
R21	T.I. anode HT feed	2,000,000

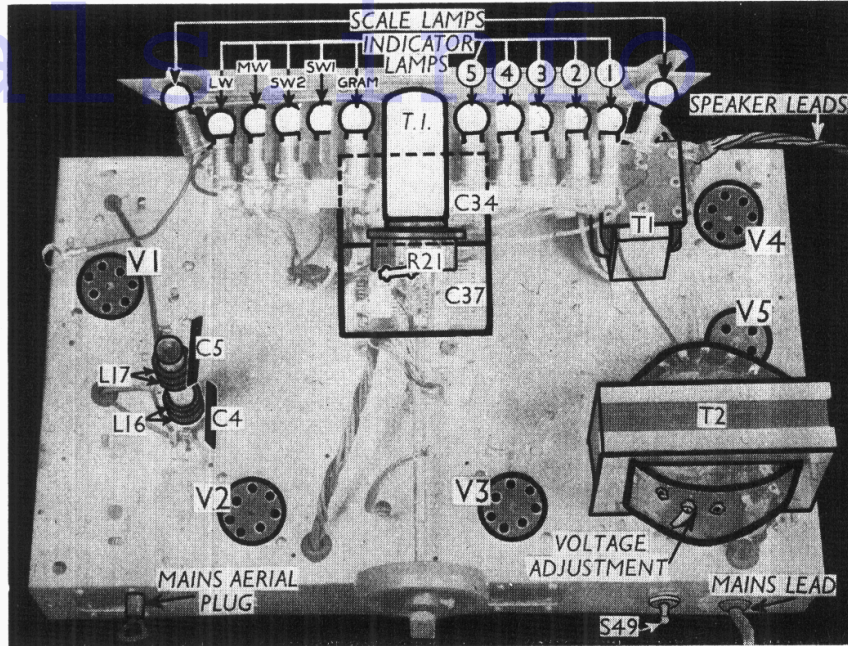


Tuning for five stations (two LW and three MW) can be pre-set in the Invicta 500, Monomatic, 4-valve (plus rectifier) AC 4-band superhet, pairs of fixed and variable trimmers being switched into the aerial and oscillator circuits. This circuit diagram is divided between V2 and V3 and is continued on the opposite page.

For more information remember  
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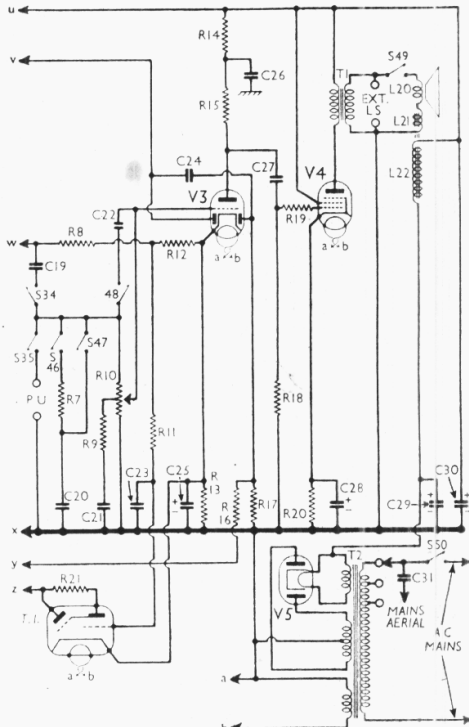
CONDENSERS	Values (μF)
C1	Aerial MW coupling . . . . . 0·000006
C2	V1 SG decoupling . . . . . 0·1
C3	AVC line decoupling . . . . . 0·1
C4	1st IF trans. pri. tuning . . . . . 0·00015
C5	1st IF trans. sec. tuning . . . . . 0·00015
C6	V1 cathode by-pass . . . . . 0·1
C7	V1 osc. CG condenser . . . . . 0·00015
C8	Osc. circuit LW fixed trimmer . . . . . 0·00032
C9	Osc. circuit SW1 fixed trimmer . . . . . 0·0003
C10	Osc. circuit SW2 tracker . . . . . 0·005
C11	Osc. circuit SW2 tracker . . . . . 0·0013
C12	Osc. MW and LW tracker . . . . . 0·00057
C13	V1 osc. anode coupling . . . . . 0·00015
C14	2nd IF trans. pri. tuning . . . . . 0·00015
C15	2nd IF trans. sec. tuning . . . . . 0·00015
C16	V2 cathode by-pass . . . . . 0·1
C17	IF by-pass condensers . . . . . 0·00015
C18	IF by-pass condensers . . . . . 0·00015
C19	AF coupling to V3 triode . . . . . 0·05
C20	Part of tone control circuit . . . . . 0·001
C21	Part of tone compensator . . . . . 0·005
C22	Part of tone control circuit . . . . . 0·00002
C23	T.I. CG decoupling . . . . . 0·1
C24	Coupling to V3 AVC diode . . . . . 0·00015
C25*	V3 cathode by-pass . . . . . 20·0
C26	V3 triode anode decoupling . . . . . 1·0
C27	V3 triode to V4 AF coupling . . . . . 0·05
C28*	V4 cathode by-pass . . . . . 20·0
C29*	HT smoothing . . . . . 8·0
C30*	HT smoothing . . . . . 8·0
C31	Mains aerial coupling . . . . . 0·001
C32†	Aerial circuit SW1 trimmer . . . . . 0·00003
C33†	Aerial circuit MW trimmer . . . . . 0·00003
C34†	Aerial circuit manual tuning . . . . . 0·00054
C35†	Osc. circuit MW trimmer . . . . . 0·00003
C36†	Osc. circuit LW trimmer . . . . . 0·00003
C37†	Oscillator circuit manual tuning . . . . . 0·00054
C38	0·00026§
C39†	0·00003
C40	0·000175§
C41†	0·00003
C42	0·00015§
C43†	Aerial circuit automatic tuning trimmers . . . . . 0·00003
C44	0·000095§
C45†	0·00003
C46	0·00001§
C47†	0·00003
C48	0·00026§
C49†	0·00003
C50	0·000175§
C51†	0·00003
C52	Oscillator circuit automatic tuning trimmers . . . . . 0·00015§
C53†	0·00003
C54	0·000095§
C55†	0·00003
C56	0·00001§
C57†	0·00003

\* Electrolytic. † Variable. ‡ Pre-set. § Values for model 500A only.



The second IF transformer is unscreened and is mounted, together with its fixed trimmers, on the chassis deck, as shown in this plan view.

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial SW1 coupling coil . . . . .	0·4
L2	Aerial SW2 coupling coil . . . . .	0·7
L3	Aerial MW and LW coupling . . . . .	70·0
L4	Aerial SW1 tuning coil . . . . .	Very low
L5	Aerial SW2 tuning coil . . . . .	0·4
L6	Aerial MW tuning coil . . . . .	2·7
L7	Aerial LW tuning coil . . . . .	13·0
L8	Osc. circuit SW1 reaction . . . . .	47·0
L9	Osc. circuit SW2 reaction . . . . .	85·0
L10	Osc. circuit MW reaction . . . . .	11·0
L11	Osc. circuit LW reaction . . . . .	17·0
L12	Osc. circuit SW1 tuning coil . . . . .	Very low
L13	Osc. circuit SW2 tuning coil . . . . .	0·4
L14	Osc. circuit MW tuning coil . . . . .	1·5
L15	Osc. circuit LW tuning coil . . . . .	2·0
L16	1st IF trans. Pri. . . . .	6·5
L17	1st IF trans. Sec. . . . .	6·5
L18	2nd IF trans. Pri. . . . .	6·5
L19	2nd IF trans. Sec. . . . .	6·5
L20	Speaker speech coil . . . . .	1·75
L21	Hum neutralising coil . . . . .	0·2
L22	Speaker field coil . . . . .	2,000·0
T1	Output trans. Pri. . . . .	345·0
	Sec. . . . .	0·15
	Heater sec. . . . .	49·0
T2	Mains trans. Rect. heat. sec. . . . .	Very low
	HT sec., total . . . . .	0·15
S1-S19	Waveband switches . . . . .	375·0
S20-S26	Aerial auto/manual selector switches . . . . .	—
S27-S33	Oscillator auto/manual selector switches . . . . .	—
S34-S35	Radio/gram change switches . . . . .	—
S36-S45	Indicator lamp switches . . . . .	—
S46-S48	Tone control switches . . . . .	—
S49	Speaker switch . . . . .	—
S50	Mains switch, ganged R10 . . . . .	—



the cabinet, when the chassis can be withdrawn to the extent of the speaker leads, which is sufficient for manual purposes.

When replacing, see that there is a rubber washer for each of the fixing bolts, between the chassis and cabinet bottom.

To free the chassis entirely, unsolder the speaker leads and when replacing, connect them as follows, numbering the tags from bottom to top:—1, red; 2, green; 3, no external connection; 4, yellow; 5, black.

**Removing Speaker.**—To remove the speaker from the cabinet, unsolder the leads and remove the nuts from the four screws holding it to the sub-baffle. When replacing, see that the transformer 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 228 V, using the 216-235 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 TH4A	257 Oscil. 4·2	—	134	6·5
V2 VP4B	112 6·1	—	—	—
V3 TDD4	257 9·3	—	257	3·4
V4 PenA4	85 1·6	—	—	—
V5 IW4/350	245 33·0	—	257	5·2
T.I. TV4	355† 19 0·1	—	—	—
	257 0·3	—	—	—

† Each anode, AC.

**GENERAL NOTES**

**Switches.**—The switches S1-S45, which are in eight rotary units beneath the chassis, can be divided logically into the following groups: S1-S19, waveband switches; S20-S28, aerial auto/manual switches; S27-S33, oscillator auto/manual switches; S34, S35, radio/gram switches; S36-S45, indicator lamp switches. The units are indicated in our under-chassis view, and are shown in detail in the diagrams overlaid.

Once the functions of the various sets of switches are

Continued overlaid

**DISMANTLING THE SET**

A detachable bottom is fitted to the cabinet and upon removal (four countersunk-head wood screws) gives access to most of the components beneath the chassis, including the trimmers for the pre-set stations.

**Removing Chassis.**—If it is necessary to remove the chassis from the cabinet, remove the knobs (pull off) and felt washers from the control spindles, taking care not to lose the springs from the knobs. Next remove the four bolts (with washers, rubber washers and distance pieces) holding the chassis to the bottom of

**INVICTA 500—Continued**

understood, it will be fairly obvious which ones should close in each of the ten positions of the selector control. It was thought that a complete switch table in our usual style would be cumbersome and unnecessary, but below the switches which are closed in each position (starting from fully anti-clockwise) are given. The pre-set stations indicated are those in Model 500A.

**Position 1 (Droitwich):** S3, S8, S13, S18, S20, S27, S34, S36.

**Position 2 (Luxembourg):** S3, S8, S13, S18, S21, S23, S34, S37.

**Position 3 (London Reg.):** S3, S7, S12, S17, S22, S29, S34, S38.

**Position 4 (Midland Reg.):** S3, S7, S12, S17, S23, S30, S34, S39.

**Position 5 (R. Normandie):** S3, S7, S12, S17, S24, S31, S34, S40.

**Position 6 (Gram.):** S4, S9, S14, S19, S25, S32, S35, S41.

**Position 7 (Short, SW1):** S1, S5, S10, S15, S26, S33, S34, S42.

**Position 8 (Med.-Short, SW2):** S2, S6, S11, S16, S28, S33, S34, S43.

**Position 9 (MW):** S3, S7, S12, S17, S26, S33, S34, S44.

**Position 10 (LW):** S3, S8, S13, S18, S26, S33, S34, S45.

S46-S48 are the tone control switches in a 3-position rotary switch at the front of the chassis. The switches are indicated in our under-chassis view. In the fully anti-clockwise position, S47 is closed; in the central position S46 is closed; and in the fully clockwise position S48 is closed.

S49 is the QMB internal speaker switch, at the rear of the chassis, while S50 is the QMB mains switch ganged with the volume control R10.

**Coils.—**L1, L2, L4, L5; L3, L6, L7; L8, L10, L12, L14 and L9, L11, L13, L15 are in four unscreened units beneath the chassis. The IF transformers (fixed tuned) are also unscreened. L16, L17 is on the chassis deck, and L18, L19 beneath the chassis.

**Scale and Indicator Lamps.—**There are two scale lamps, and ten indicator lamps. All are MES types, rated at 6.2 V, 0.3 A.

**Trimmers.—**These are all beneath the chassis, with the exception of the fixed trimmers C4, C5 on the first IF unit on the chassis deck.

Each of the five pre-selected stations has two fixed and two variable trimmers. The latter are of low capacity, and slight changes in their capacity will have a negligible effect on the tuning.

The fixed trimmers for the selected stations are silvered mica type, with values specially chosen for the indicated station. The values given in our condenser table are those for the fixed trimmers used in Model

500A. Models with other suffix letters may have condensers of different values in these positions.

Both aerial and oscillator circuits use condensers of the same value for the selected stations.

The variable trimmers only cover a small band of wavelengths, and if stations of appreciably different wavelengths are required, pairs of fixed trimmers of the correct capacity (obtainable from the makers) will have to be substituted for the original ones. Station nameplates are also available from the makers.

**Condensers C29, C30.—**These are two 8 μF dry electrolytics in a single carton beneath the chassis, having a common negative (black) lead. The red lead to V5 valve-holder is the positive of C29, and the red lead to R14 is the positive of C30.

**Condenser C1.—**This is a small fixed condenser formed of one insulated wire spiralled over a thicker straight wire. It is associated with the L3, L6, L7 coil unit.

**Chassis Divergencies.—**C8, C9 and R19 were not shown in the maker's diagram, but are included in our own chassis.

**CIRCUIT ALIGNMENT**

**IF Stages.—**The makers state that the IF transformers are permanently adjusted at the factory and do not anticipate that their adjustment will alter at all in use. They state that no endeavour should be made to adjust the transformers.

Should a transformer be damaged in such a way as to alter its adjustment a new replacement should be obtained from the makers.

**RF and Oscillator Stages.—**Make sure that the tuning scale is properly adjusted. The cross in the centre of the scale should be exactly over the centre of the pointer spindle and the bottom edge of the scale should be horizontal. If not, slacken the two screws on either side of the scale, adjust it and tighten the screws.

Then turn the gang to maximum capacity and slip the pointer on the spindle so that it covers the 200 m mark on the SW2 scale.

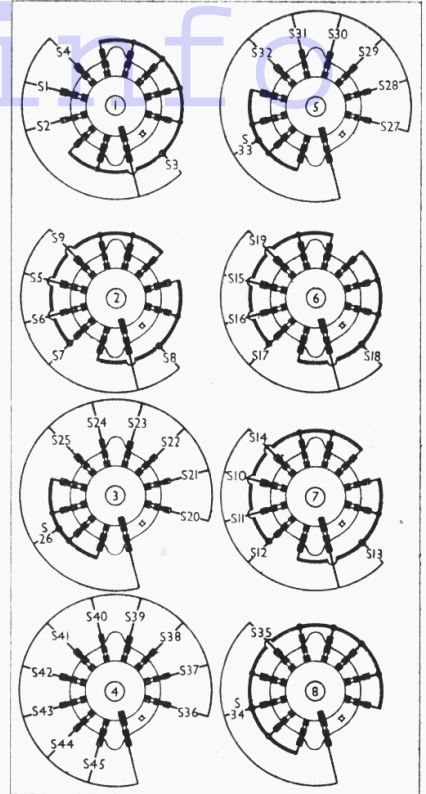
It should be noted that any re-alignment of the MW and LW circuits will necessitate readjustment of the trimmers for the pre-selected stations.

**MW.—**Connect signal generator to A and E sockets, switch set to MW, tune to 250 m on scale and inject a 250 m (1,200 KC/S) signal. Adjust C35 and C33 in that order for maximum output, keeping input as low as possible, consistent with a reasonable deflection on the output meter.

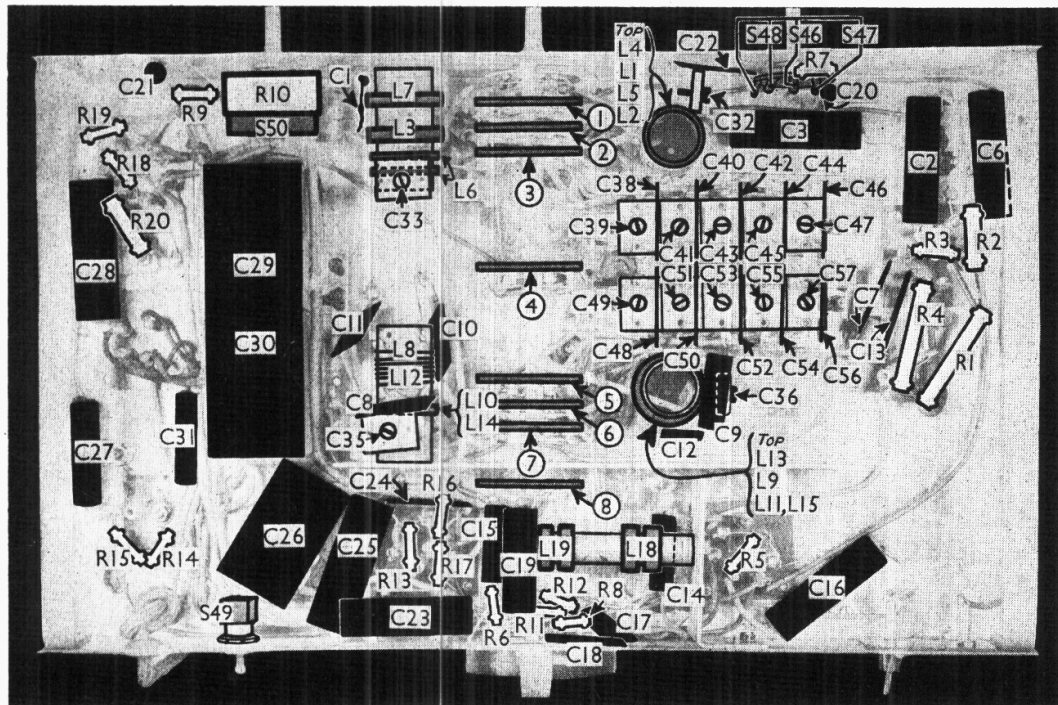
**LW.—**Switch set to LW, tune to 1,200 m on scale, feed in a 1,200 m (250 KC/S) signal, and adjust C36 for maximum output, keeping input low. There is no aerial trimmer.

**SW1.—**Switch set to SW1 (13.52 m), tune to 14 m on scale, feed in a 14 m (21.43 MC/S) signal and adjust C32 for maximum output, keeping input low. There is no oscillator trimmer. Check calibration at 50 m.

**SW2.—**There are no trimmers on this band so no adjustment can be made.



Diagrams of the wave-change switch units, drawn as seen from the directions of the arrows in the under-chassis view below.



The variable trimmers for the pre-set stations are seen on the right of this view of the under-neath of the chassis, the aerial trimmers being at the top, with the oscillator trimmers at the bottom. Diagrams of the wave-change switches are given above, but the tone control switches (S46 - S48) are indicated here.