"TRADER" SERVICE SHEET

944

INVICTA 72 and 73

Band-Spread A.C./D.C. Superhets

TWO band-spread short-wave ranges are provided in the Invicta 73 receiver in addition to the M.W. and L.W. ranges, band-spreading being achieved by the insertion of a fixed capacitor in series with the normal sections of the tuning gang. The waveband ranges are: 15-20m (Short 2), 24-32m (Short 1), 185-550m and 900-2,000m.

The receiver is a 4-valve (plus rectifier) superhet designed to operate from A.C. or D.C. mains of 100-260 V, 40-60 c/s.

In the export version, model 72, the L.W. band is omitted and the M.W. band takes its place, while the M.W. band position is taken by a third S.W. range of 40-120m (not band-spread). Otherwise the export model 72 is similar in all respects to model 73, on which this *Service Sheet* was prepared. The differences are fully explained overleaf.

Release date and original price: September 1949; £17 10s. plus purchase tax.

CIRCUIT DESCRIPTION

On M.W. and L.W., aerial input via **C1** is inductively coupled via **L1** to single-tuned circuits **L4, C39** (M.W.) and **L5, C39** (L.W.), **S9** being closed. On S.W. bands, input is capacitatively coupled via **C1** and **C3** to band-spread circuits **L2, C5, C39** (Short 2) and **L3, C5, C39** (Short 1). The band-spreading is achieved by opening **S9,** inserting **C5** in series with **C39** and thus reducing the ratio of capacitance change for the swing of **C39.**

In model 72, whose aerial circuit is shown on the extreme left of our circuit diagram below, **L14** is a third S.W. band, not band-spread. L.W. is omitted.

First valve **(V1, Mullard UCH42)** is a triode-hexode operating as frequency changer with internal coupling. Triode oscillator grid coils **L6** (Short 2), **L7** (Short 1), **L8** (M.W.) and **L9** (L.W.) are tuned by **C40, S10** being closed on M.W. and L.W., but opening on the S.W. bands to provide band-spreading again.

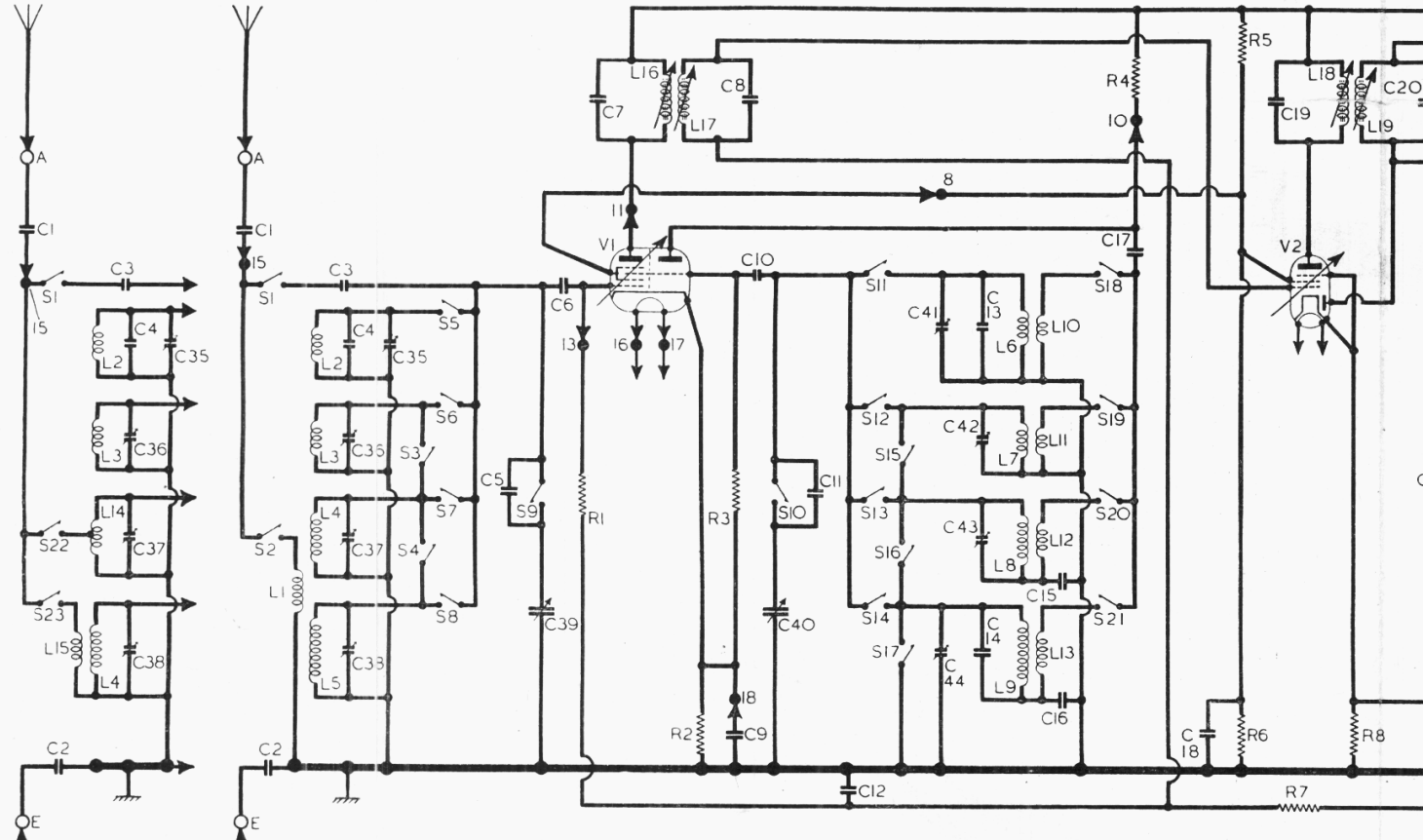
Parallel trimming by **C13, C41** (Short 2), **C42** (Short 1), **C43** (M.W.) and **C14, C44** (L.W.); series tracking by **C15** (M.W.) and **C16** (L.W.). Inductive reaction coupling from anode on all bands by coils **L10, L11, L12** and **L13,** with additional coupling on M.W. and L.W. due to the common impedance of the trackers **C15, C16.**

In model 72 **C14** is omitted, but otherwise the oscillator circuit looks exactly the same as that below. **L8, L12,** however, become the coils of the third S.W. band (not band-spread) while the M.W. coils drop down to the position in which we show **L9, L13.** L.W. is omitted.

Second valve **(V2, Mullard UAF42)** is a variable-mu R.F. single diode pentode operating as intermediate frequency amplifier with tuned transformer couplings **C7, L16, L17, C8** and **C19, L18, L19, C20.**

Intermediate frequency 465 kc/s.

Diode second detector is the diode of **V2.** Audio frequency component in rectified output is developed across the load resistor **R10** and passed via A.F. coupling capacitor **C25** and manual volume control



Circuit diagram of the Invicta 73 superhet, with the modified aerial circuit in the export model 72 on the extreme M.W. coil in both cases; **L14** is the third S.W. band coil in the 72, and **L5** the L.W. coil in the 73. **C5** and **C11** tuning on the Short 2 band (**L2** and **L6**) and Short 1 band (**L3** and **L7**) by reducing the effective capacitance chan **C40.** **C5, C11** are short-circuited on M.W. and L.W. by **S9, S10.** The interconnecting points numbered 7 t quoted in "Dismantling The Set" for the removal of the tuning assembly, and they are repeated in our under-c are also the tags 1 to 6 on the output transformer **T1.**

R11 to pentode control grid of a second diode-R.F. pentode valve **(V3, Mullard UAF42),** which operates as A.F. amplifier. I.F. filtering by **C23, R9** and **C24.**

The single diode of **V3,** fed from **L19** via **C22,** provides a D.C. potential which is developed across **R15** and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving A.G.C.

Resistance - capacitance coupling by **R13, C28** and **R16,** via grid stopper **R17,** between **V3** pentode and pentode output valve **(V4, Mullard UL41).** Variable negative feed-back tone control from a special secondary winding **1-2** on the output transformer **T1** is applied to the cathode circuit of **V3** via **R19, C30** and **C27** being added as required according to the position of the tone control switches **S24, S25** and **S26.**

H.T. current is supplied by I.H.C. half-wave rectifying valve **(V5, Mullard UY41),** which, with D.C. mains, behaves as a low resistance. Smoothing by iron-cored choke **L20** and electrolytic capacitors **C32** and **C33.** Valve heaters, together with scale lamps and ballast resistor **R22** are connected in series across the mains input circuit.

The voltage adjustment strap (shown in our diagram joining **S27** to **R22**) is set for 236-250 V. For 216-235 V mains it joins **S27** to the next tapping on **R22,** and for 200-215 V mains it joins **S27** to the third tapping. For 100 V mains, a second (shown dotted) now joins this third tapping to a fourth tapping at the junction with **V5** heater, and adjustments between 100 V and 130 V can be obtained by suitably connecting the first strap.

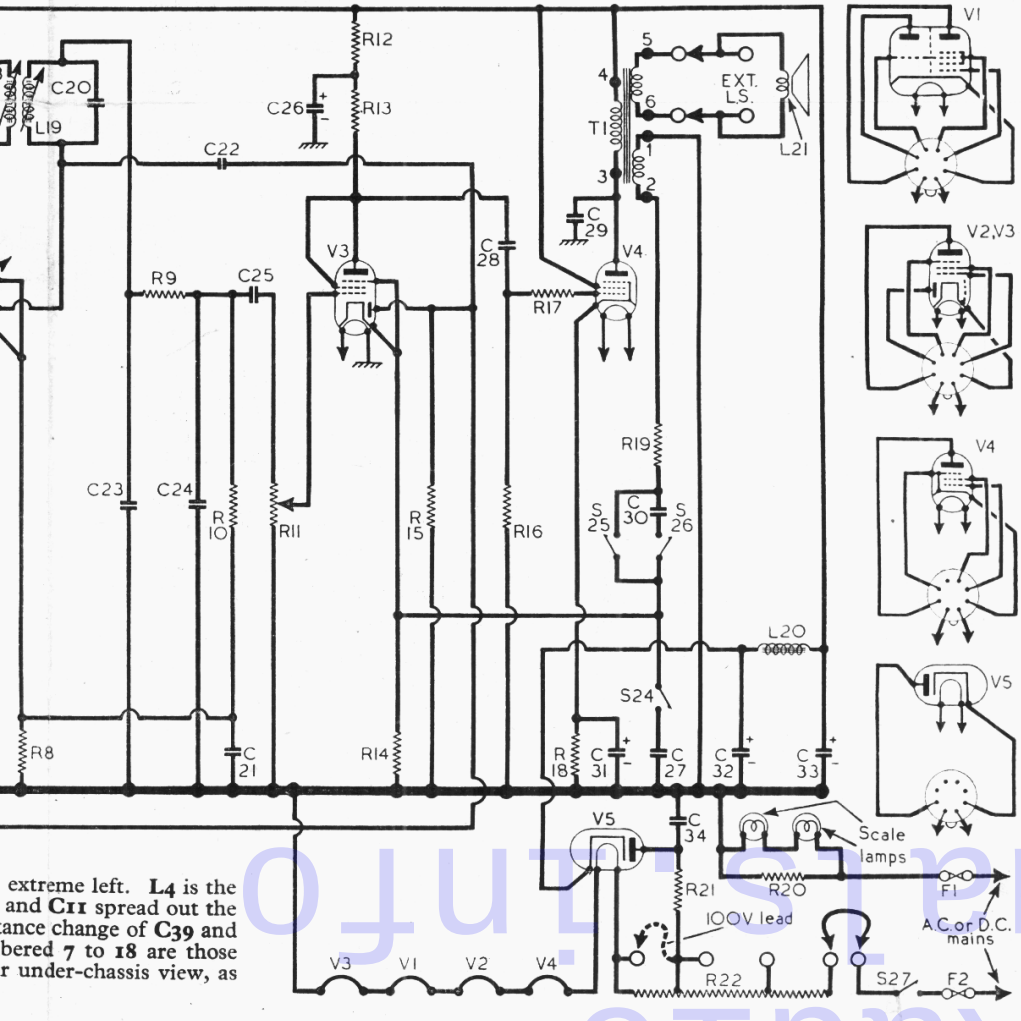
VALVE ANALYSIS

Valve voltages and currents given in the table below are those quoted by the manufacturers, whose receiver was operating from A.C. mains of 200 V, using the 200-215 V mains adjustment tapping.

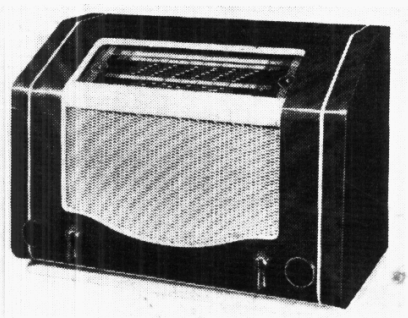
Except for cathode readings, all voltages were measured on the 400 V scale of a model 7 Avometer, chassis being the negative connection.

Valve	Anode		Screen		Cath.
	V	mA	V	mA	V
V1 UCH42	150	1·5	65	2·3	1·7
	Oscillator				
	100	4·8			
V2 UAF42	150	5·0	65	1·6	1·4
V3 UAF42	20	1·0	—	—	0·6
V4 UL41	150	42·0	150	8·0	7·2
V5 UY41	190†	66·2	—	—	185.0

† A.C.



extreme left. **L4** is the and **C11** spread out the tance change of **C39** and bered **7** to **18** are those r under-chassis view, as



COMPONENTS AND VALUES

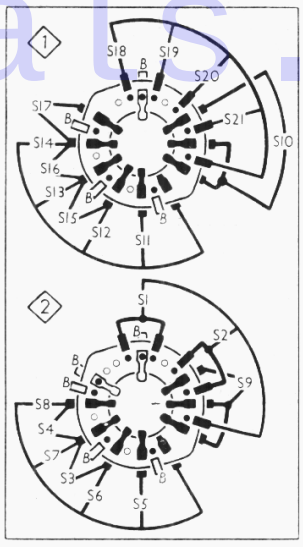
	RESISTORS	Values	Locations
R1	V1 hex. C.G. ...	1MΩ	G3
R2	V1 fixed G.B. ...	220Ω	G2
R3	V1 osc. C.G. ...	22kΩ	G2
R4	Osc. anode load ...	10kΩ	G3
R5	V1, V2 S.G. H.T.	22kΩ	G3
R6	pot. divider ...	22kΩ	G3
R7	A.G.C. decoupling	1MΩ	E3
R8	V2 fixed G.B. ...	220Ω	E3
R9	I.F. stopper ...	47kΩ	F3
R10	Signal diode load ...	470kΩ	F3
R11	Volume control ...	1MΩ	D2
R12	V3 H.T. decoup. ...	47kΩ	E3
R13	V3 pent. anode load	100kΩ	E3
R14	V3 fixed G.B. ...	1kΩ	E3
R15	A.G.C. diode load...	1MΩ	E3
R16	V4 C.G.	560kΩ	E3
R17	V4 grid stopper ...	100kΩ	E3
R18	V4 G.B.	150Ω	D3
R19	F-B resistor ...	47kΩ	D2
R20	Scale lamps shunt...	68Ω	D2
R21	Surge limiter ...	150Ω	D2
R22	Heater ballast ...	1,100Ω†	C1

† Topped at 850Ω + 125Ω + 125Ω from V5 heater.

	CAPACITORS	Values	Locations
C1	Aerial isolator ...	5,000pF	G3
C2	Earth isolator ...	0·05μF	F3
C3	Aerial S.W. coupling	10pF	G2
C4	Aerial S2 trim. ...	60pF	A1
C5	Band spreader ...	140pF	G2
C6	V1 hex. C.G. ...	100pF	G3
C7	1st I.F. trans.	100pF	A1
C8	tuning	100pF	A1
C9	V1 cath. by-pass ...	0·05μF	G3
C10	V1 osc. C.G. ...	60pF	G2
C11	Band spreader ...	140pF	G2
C12	A.G.C. decoupling	0·05μF	G3
C13	Osc. S2 trim. ...	60pF	F2
C14	Osc. L.W. trim. ...	140pF	F2
C15	Osc. M.W. track. ...	570pF	F2
C16	Osc. L.W. track. ...	315pF	F2
C17	Osc. anode coup. ...	5,000pF	G2
C18	V1, V2 S.G. decoup.	0·05μF	F3
C19	2nd I.F. trans.	100pF	B1
C20	tuning	100pF	B1
C21	V2 cath. by-pass ...	0·05μF	F3
C22	A.G.C. coupling ...	22pF	E3
C23	I.F. by-passes ...	100pF	E3
C24		100pF	F3
C25	A.F. coupling ...	0·01μF	E3
C26*	V3 H.T. decoup. ...	2μF	C1
C27	Part tone control ...	0·1μF	D2
C28	A.F. coupling ...	0·05μF	E3
C29	Tone corrector ...	0·01μF	E3
C30	Part tone control...	0·05μF	D2
C31*	V4 cath. by-pass ...	25μF	D3
C32*	H.T. smoothing ...	32μF	C1
C33*		32μF	C1
C34	Mains R.F. by-pass	0·02μF	D3
C35‡	Aerial S2 trim. ...	30pF	A1
C36‡	Aerial S1 trim. ...	30pF	B1
C37‡	Aerial M.W. trim....	30pF	B1
C38‡	Aerial L.W. trim....	30pF	B1
C39†	Aerial tuning ...	532pF	A1
C40†	Oscillator tuning ...	532pF	A1
C41‡	Osc. S2 trim. ...	30pF	F2
C42‡	Osc. S1 trim. ...	30pF	F2
C43‡	Osc. M.W. trim. ...	30pF	F2
C44‡	Osc. L.W. trim. ...	30pF	F2

* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	Aerial coupling coil	75·0	A1
L2	Aerial tuning coils	Very low	B1
L3		Very low	B1
L4		3·5	B1
L5		15·0	B1
L6	Oscillator tuning coils	Very low	F2
L7		Very low	F2
L8		1·7	F2
L9		3·0	F2
L10	Oscillator reaction coils	0·4	F2
L11		0·5	F2
L12		2·4	F2
L13		3·5	F2
L14	S.W.3 tuning coil	—	B1
L15	L.W. aerial coup.	75·0	B1
L16	1st I.F. trans. Pri.	10·0	A1
L17	1st I.F. trans. Sec.	10·0	A1
L18	2nd I.F. trans. Pri.	10·0	B1
L19	2nd I.F. trans. Sec.	10·0	B1
L20	H.T. smoothing	500·0	C1
L21	Speech coil	2·5	—
T1	Output trans. Pri. 4-3&	200·0	
	Output trans. Sec. 5-6	0·4	E2
	Output trans. Sec. 1-2	0·2	
S1-S23	Waveband switches	—	G2
S24-S26	Tone control switches	—	D2
S27	Mains sw., g'd. R11	—	D2



Switch	L.W.	M.W.	Short 1	Short 2
S1	—	—	C	C
S2	C	C	—	—
S3	—	—	—	C
S4	—	—	C	C
S5	—	—	—	C
S6	—	—	C	—
S7	—	C	—	—
S8	C	—	—	—
S9	C	C	—	—
S10	C	C	—	—
S11	—	—	—	C
S12	—	—	C	—
S13	—	C	—	—
S14	C	—	—	—
S15	—	—	—	C
S16	—	—	C	C
S17	—	C	—	—
S18	—	—	—	C
S19	—	—	C	—
S20	—	C	—	—
S21	C	—	—	—

Diagrams of the waveband switch units, viewed from the rear of an inverted chassis. On the right is the associated switch table.

DISMANTLING THE SET

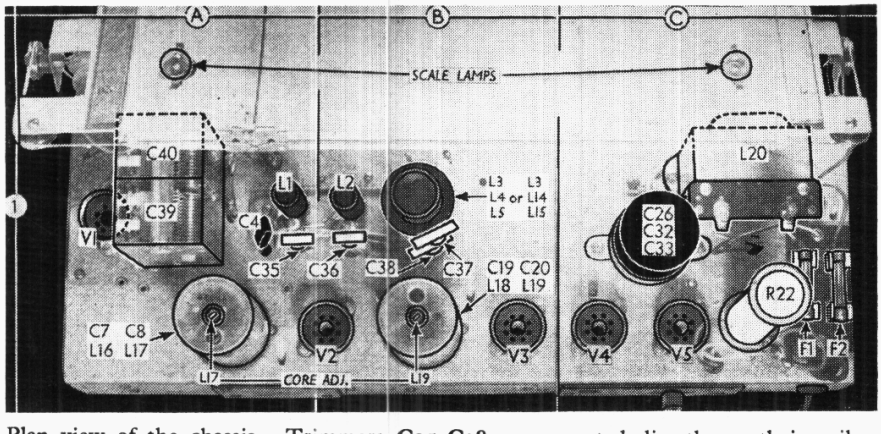
Removing Chassis.—Remove the four control knobs (outer two, recessed grub screws; inner two, pull off);
unplug the speaker leads from the L.S. sockets;
unscrew the two wood screws located on the back of the scale supports;
remove the two 2BA fixing screws from the lower rear corners of the chassis, draw the chassis backwards and lift slightly at the rear, when it may be withdrawn completely from the cabinet.

Removing Speaker.—Loosen the four retaining clamps (four 4BA nuts), swivel the clamps aside, and lift speaker out. *When replacing*, do not omit to replace the four sponge-rubber pads underneath the clamps. The speech coil tags should be uppermost.

Removing Tuning Assembly.—Unsolder from the tag strip on the main chassis all the leads to the tuning unit, including the lead to **C6**; also, the two heater wires and the lead to **C9** from **V1** valve holder, and **C1** connection from the waveband switch; remove the scale lamp lead and the chassis tag lead from the common wire of **C44, C42** and **C41**;
remove four 2BA nuts and bolts from the four corners of the tuning unit, free the waveband switch spindle, and lift out the assembly.

When replacing, connect the leads as follows, using the numbers shown in the circuit diagram and under-chassis illustration (Nos. 7-14 are on a row of tags):
7, no connection to be made;
8, pink lead from pin 5 on **V1** valveholder;
9, no connection to be made;
10, red lead from pin 3 on **V1** valveholder;
11, pink lead from pin 2 on **V1** valveholder;
12, no connection to be made;
13, yellow lead from pin 6 on **V1** valveholder, and **C6**;
14, no connection to be made;
15, connect one side of **C1** to common tag of **S1, S2** (**S1, S22, S23** in model 72);
16, 17, connect white heater leads to pins 1 and 8 on **V1** valveholder;
18, connect one side of **C9** to pin 7 on **V1** valveholder.

Earth connections are not shown in the circuit diagram, but the common connection from the trimmers **C41, C42** and **C44**, and the grey lead from the scale lamps, both go to their respective chassis tags.



Plan view of the chassis. Trimmers **C35-C38** are mounted directly on their coil assemblies. The I.F. transformers secondary core adjustments are indicated.

GENERAL NOTES

Switches.—S1-S21 are the waveband switches, ganged in two rotary units beneath the chassis. The units are indicated in our under-chassis illustration by the numbers **1** and **2** in diamonds, with arrows to show the direction in which they are viewed in the diagrams in col. 2, where they are drawn in detail. **S22** and **S23** are in model 72 only.

The table above gives the switch positions for the four control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open, and **C**, closed.

S24-S26 are the tone control switches, ganged in a single 3-position rotary unit beneath the chassis. This is indicated in our under-chassis view, and shown in detail in the diagram in col. 4, where it is drawn as seen from the rear of an inverted chassis. In the fully anti-clockwise position of the control knob (deep tone) **S26** closes only; in the middle position **S24** and **S26** close; in the fully clockwise position (brilliant tone), **S24** and **S25** close.

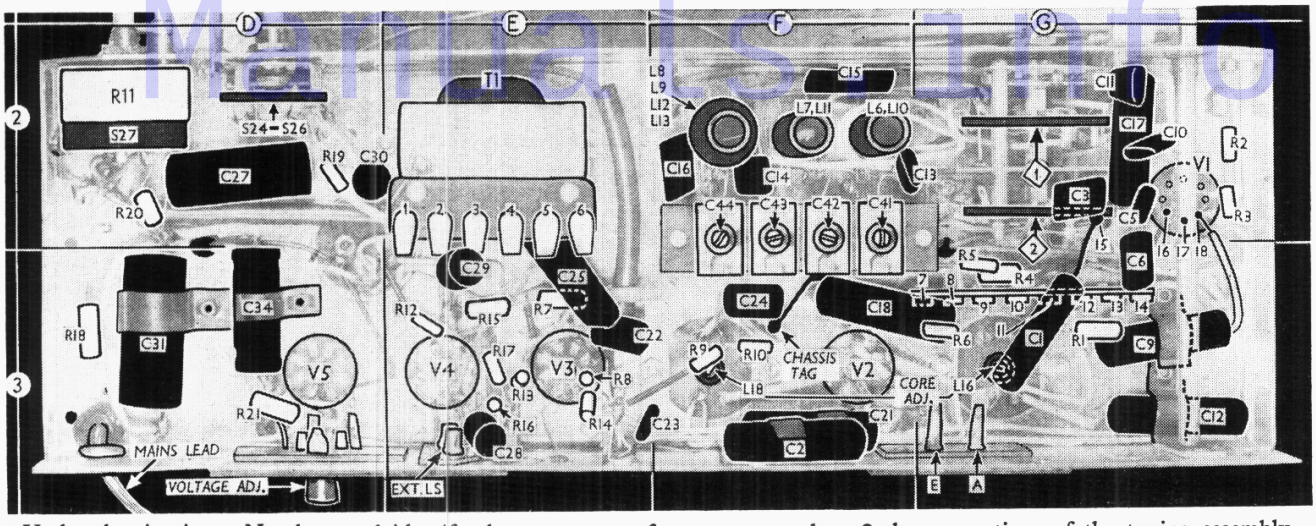
S27 is the Q.M.B. mains switch, ganged with the volume control **R11.**

Scale Lamps.—There are two Osram M.E.S. types, with small clear spherical bulbs, rated at 3.5 V, 0.15 A.

External Speaker.—Two sockets are provided at the rear of the chassis for the connection of the internal speaker or a low impedance (about 3-4 Ω) external speaker. Sockets in the tops of the internal speaker plugs permit both speakers to operate together.

Chassis Modification.—In some very early chassis, **V2** and **V3** were UAF41, and in such cases **R6** was omitted. It should be added when a UAF42 is used to replace the UAF41.

Model 72 Modifications.—Model 72 is an export version of model 73, in which a third S.W. range of 40-120 m is added and the L.W. band is omitted. As the aerial circuit changes considerably, a separate diagram section for it is shown



Under-chassis view. Numbers **1-6** identify the output transformer tags, and **7-18** the connections of the tuning assembly.

on the left of the model 73 diagram overleaf, in which **L14** is the new S.W. tuning coil and **L15, L4** are the M.W. coils.

The wavebands follow suit in the oscillator circuit but, except that **C14** is omitted, the diagram is not altered, although **L8, L12** become S.W. coils, and **L9, L13** M.W. coils.

In addition to the omission of **C14,** two capacitor values are changed : **C15** becomes 2,000pF (0.002 μF), and **C16** becomes 570 pF (0.00057 μF).

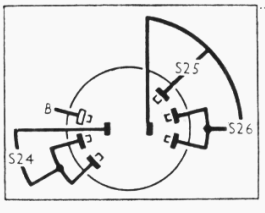


Diagram of the tone control switch unit, viewed from the rear of an inverted chassis.

CIRCUIT ALIGNMENT

For these operations the chassis must be removed from its cabinet as described under "Dismantling the Set." It should be borne in mind that the chassis may be live to the mains.

I.F. Stages.—Switch set to M.W., turn gang and volume control to maximum, connect signal generator (via a 0.1 μF capacitor in the "live" lead) to control grid (pin 6) of **V1** and the **E** socket. Feed in a 465 kc/s (645.16 m) signal and adjust the cores of **L19, L18, L17** and **L16** (location references B1, F3, A1, G3 respectively) for maximum output.

R.F. and Oscillator Stages.—As the chassis is not in the cabinet, the glass scale should also be removed (four wood screws) and placed on top of the scale assembly in such a position as to make the ends of the glass scale coincide with the edges of the scale supporting brackets, care being taken that the cursor moves freely under the glass. The scale should then be bound in position at its ends with adhesive tape.

At maximum capacitance of the gang the cursor should be vertical and coincident with the high-wavelength ends of the tuning scales. It may be adjusted in position by sliding the cursor carriage along the drive cord.

Short 2.—Switch set to Short 2, tune to 15 m on scale, feed in a 15 m (20 Mc/s) signal, and adjust **C41** (F2), then **C35** (A1) for maximum output, at the same time rocking the gang for optimum results. Tune to 20 m on scale, feed in a 20 m (15 Mc/s) signal and check calibration.

Short 1.—Switch set to Short 1, tune to 24 m on scale, feed in a 24 m (12.5 Mc/s) signal, and adjust **C42** (F3), then **C36** (B1) for maximum output, at the same time rocking the gang for optimum results. Tune to 33 m on scale, feed in a 33 m (9.1 Mc/s) signal, and check calibration.

Third S.W. Band (model 72 only).—Switch set to second position clockwise, tune to 40 m on scale, feed in a 40 m (7.5 Mc/s) signal, and adjust **C43** (F3), then **C37** (B1) for maximum output. Tune to 120 m on scale, feed in a 120 m (2.5 Mc/s) signal, and check calibration.

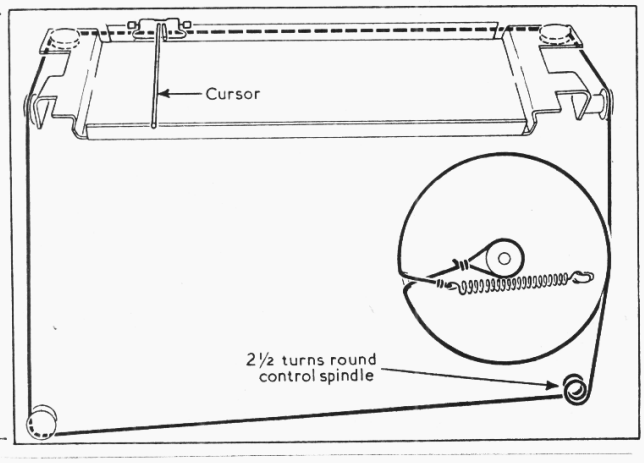
M.W. (model 72 only).—Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust **C44** (F3), then **C38** (B1) for maximum output. Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal and check calibration.

M.W. (model 73 only).—Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust **C43** (F3), then **C37** (B1) for maximum output. Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal and check calibration.

L.W.—Switch set to L.W., tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal, and adjust **C44** (F3), then **C38** (B1) for maximum output. Tune to 2,000 m on scale, feed in a 2,000 m (150 kc/s) signal, and check calibration.

DRIVE CORD REPLACEMENT

Six feet of Nylon braided glass yarn is required for the tuning drive cord, this length leaving ample to spare for tying off. With the gang at minimum, make a loop at one end of the cord large enough to go over the centre boss, then thread the other end through the hole in the drum groove and run the cord as shown in the sketch below, finally tying off at the tension spring, which should be extended to about 1½ times its relaxed length when hooked to its anchor.



Sketch of the tuning drive cord system, drawn as seen from the front of the chassis when the gang is at minimum capacitance. The cursor carriage can be hooked on to the cord easily after the cord has been fitted

Printed in England by The Cornwall Press Ltd., Paris Garden, London, S.E.1.