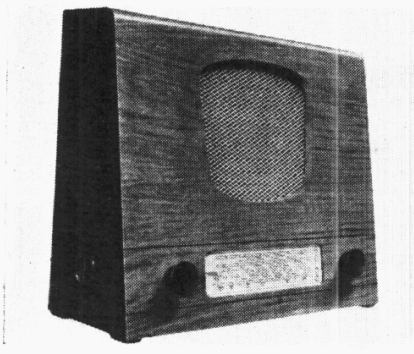
"TRADER" SERVICE SHEET

953

ULTRA T611 & A611

"Minstrel" Receiver and "Symphonic" Autoradiogram



The appearance of the Ultra "Minstrel" table superhet. A webbed control knob is let into each side.

PULL-OFF control knobs and plug-in speaker leads permit rapid removal of the chassis for servicing in the Ultra T611 "Minstrel" receiver, a 3 valve (plus rectifier) 3-band superhet designed to operate from A.C. mains of 200-260 V. Mixed valve types are used, two having B8A bases and 6.3 V heaters, and two having Mazda octal bases and 4 V heaters. They are fed from separate heater windings.

The "Symphonic" radiogram, model A611, employs a modified T611 chassis, the differences being explained under "Radiogram modifications" overleaf. The radiogram uses a Garrard RC70A automatic record changer which handles ten 10in or 12in records unmixed.

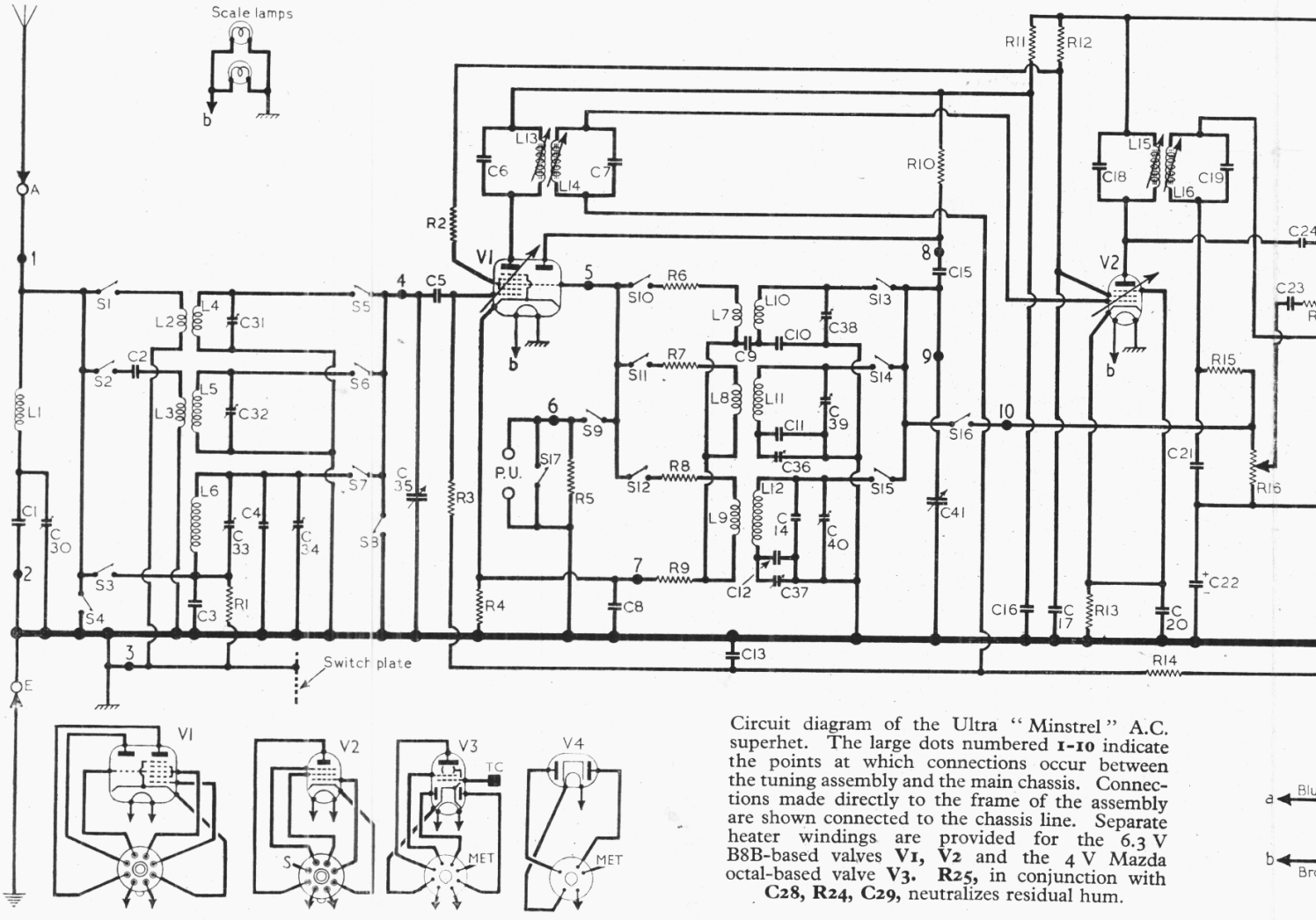
Release date and original prices: T611, August 1949, £17 17*s.*; *A611, December* 1949, £45 0*s. Purchase tax extra.*

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L2** (S.W.) and **L3** (M.W.) to single-tuned circuits **L4, C35** (S.W.) and **L5, C35** (M.W.). On L.W., input is capacitatively "bottom" coupled via **C3, R1** to **L6, C35.** Image suppression by **C33.**

L2 and **L3** are both returned directly to chassis, but in our circuit diagram they go there by different paths in order to show the connection point **3** via which **L2** is connected. The switch plate shown connected via the same point is the metal plate at the end of the waveband switch assembly.

First valve **(V1, Mazda 6C9)** is a triode hexode operating as frequency changer with internal coupling. Triode oscillator anode coils **L10** (S.W.), **L11** (M.W.) and **L12** (L.W.) are tuned by **C41.** Parallel trimming by **C38** (S.W.), **C39** (M.W.) and



Circuit diagram of the Ultra "Minstrel" A.C. superhet. The large dots numbered **1-10** indicate the points at which connections occur between the tuning assembly and the main chassis. Connections made directly to the frame of the assembly are shown connected to the chassis line. Separate heater windings are provided for the 6.3 V B8B-based valves **V1, V2** and the 4 V Mazda octal-based valve **V3. R25,** in conjunction with **C28, R24, C29,** neutralizes residual hum.

C14, C40 (L.W.); series tracking by **C10** (S.W.), **C11, C36** (M.W.) and **C12, C37** (L.W.). Reaction coupling to control grid by **L7** (S.W.), **L8** (M.W.) and **L9** (L.W.), with additional coupling on S.W. via **C9, C10. R9** and **C9** perform the functions of grid leak and capacitor.

Second valve **(V2, Mazda 6F15)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C6, L13, L14, C7** and **C18, L15, L16, C19.** The tuning capacitors are fixed, and alignment is effected by adjustment of the iron-dust cores.

Intermediate frequency 470 kc/s.

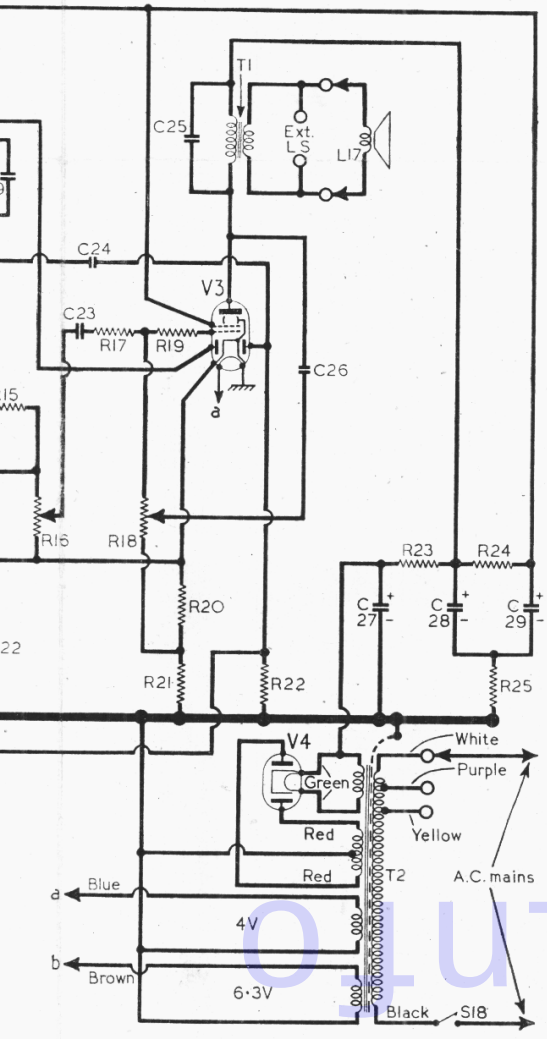
Diode second detector is part of double diode beam tetrode output valve **(V3, Mazda metallized Pen45DD).** Audio frequency component in rectified output is developed across manual volume control **R16,** which operates as load resistor, and passed via **C23, R17** and **R19** to control grid of tetrode section. I.F. filtering by **C21** and **R19.**

Provision is made for the connection of a gramophone pick-up, when the triode section of **V1** operates as an A.F. amplifier. When the waveband control is turned to Gram, **S9** and **S16** close, connecting the pick-up sockets to the triode grid and the output via **C15** to **R16,** and thus to **V3** tetrode. At the same time, **S4** and **S8** close to mute radio. **S17** is a jack-type switch which opens automatically when the pick-up plugs are inserted.

Variable tone control is provided by **R18** and **C26** in a negative feed-back circuit in which the feed-back is predominantly treble, giving increased bass response as the slider of **R18** is advanced towards the control grid. **R17** isolates **R18** from **R16** to avoid undue influence of one upon the other. Provision is made for the connection of a low impedance external speaker across the secondary winding of **T2,** while the plug and socket device permits the internal speaker to be muted.

Second diode of **V3,** fed from **V2** anode via **C24,** provides D.C. potential which is developed across load resistor **R22** and fed back through decoupling circuit to F.C. and I.F. valves, giving automatic gain control. Delay voltage, together with G.B. for triode section, is obtained from the drop along **R20** and **R21** in cathode lead to chassis.

H.T. current is supplied by I.H.C. full-wave rectifying valve **(V4, Mazda metallized UU6).** Smoothing by resistors **R23, R24** and capacitors **C27, C28, C29.** Residual hum across **C29** is neutralized by inverse phase voltage developed across **R25** by ripple current through **C28.** Heater current to **V1** and **V2** is supplied from a 6.3 V secondary winding **b** on the mains transformer **T2. V3** is supplied from a separate 4 V winding **a.**



COMPONENTS AND VALUES

	CAPACITORS	Values	Locations
C1	Part I.F. filter tune	180pF	K6
C2	M.W. coupling ...	470pF	K6
C3	L.W. coupling ...	0·003μF	K6
C4	Aerial L.W. trimmer	25pF	K6
C5	V1 C.G. coupling	470pF	A1
C6	1st I.F. transformer tuning	120pF	B2
C7	1st I.F. transformer tuning	120pF	B2
C8	V1 cath. by-pass	0·05μF	H5
C9	V1 osc. C.G. coupling	270pF	L6
C10	Osc. S.W. tracker	0·005μF‖	L6
C11	Osc. M.W. tracker	500pF	L6
C12	Osc. L.W. tracker	120pF	L6
C13	A.G.C. line decoup.	0·05μF	G4
C14	Osc. L.W. trimmer	68pF	L6
C15	Osc. anode coupling	0·01μF	H4
C16	H.T. feed de-	0·05μF	H4
C17	coupling	0·05μF	H4
C18	2nd I.F. trans-	120pF	B1
C19	former tuning	120pF	B1
C20	V2 cath. by-pass	0·05μF	G5
C21	I.F. by-pass ...	100pF	G4
C22*	V3 cath. by-pass	50μF	G4
C23	A.F. coupling ...	0·01μF	E3
C24	A.G.C. diode coup.	10pF	G4
C25	Tone corrector ...	0·005μF	F4
C26	Part tone control	27pF	E3
C27*	H.T. smoothing	16μF	F3
C28*	H.T. smoothing	24μF	C1
C29*	H.T. smoothing	16μF	C1
C30‡	I.F. filter tuning ...	50pF	J4
C31‡	Aerial S.W. trim	50pF	J4
C32‡	Aerial M.W. trim.	50pF	J4
C33‡	Image rejector ...	—	J3
C34‡	Aerial L.W. trimmer	50pF	J3
C35†	Aerial tuning ...	494pF§	A1
C36‡	Osc. M.W. tracker	50pF	J4
C37‡	Osc. L.W. tracker	50pF	J3
C38‡	Osc. S.W. trimmer	40pF	J5
C39‡	Osc. M.W. trimmer	50pF	J4
C40‡	Osc. L.W. trimmer	50pF	J4
C41†	Oscillator tuning	494pF§	A2

* Electrolytic. † Variable. ‡ Pre-set.
§ "Swing" value, minimum to maximum.
‖ Made up of 0·002μF and 0·003μF connected in parallel.

	RESISTORS	Values	Locations
R1	L.W. coupling ...	12kΩ	K6
R2	V1 S.G. stopper ...	68Ω	H4
R3	V1 hex. C.G. ...	470kΩ	H5
R4	V1 fixed G.B. ...	220Ω	H5
R5	P.U. shunt ...	100kΩ	L6
R6	Oscillator reaction	150Ω	L6
R7	Oscillator reaction	1kΩ	L6
R8	Oscillator reaction	2.7kΩ	L6
R9	V1 osc. C.G. ...	47kΩ	L6
R10	V1 osc. H.T. feed	27kΩ	H4
R11	V1 H.T. feed ...	300Ω	H4
R12	S.G.'s H.T. feed ...	18kΩ	G4
R13	V2 fixed G.B. ...	300Ω	G5
R14	A.G.C. line decoup.	1MΩ	G4
R15	P.U. isolator ...	47kΩ	G4
R16	Volume control ...	1MΩ	E3
R17	F-B isolator ...	100kΩ	E3
R18	Tone control ...	1MΩ	E4
R19	Grid stopper ...	47kΩ	C1
R20	V3 G.B. and	180Ω	G4
R21	A.G.C. delay ...	56Ω	F4
R22	A.G.C. diode load	470kΩ	F4
R23	H.T. smoothing	700Ω	D1
R24	H.T. smoothing	1kΩ	D1
R25	H.T. smoothing	5Ω*	F3

* Made up of two 10Ω resistors in parallel.

	OTHER COMPONENTS	Approx. Values (ohms)	Locations
L1	I.F. filter coil ...	8·0	K6
L2	Aerial coupling	—	K6
L3	Aerial coils	1·8	K6
L4	Aerial S.W. tuning	—	K6
L5	Aerial M.W. tuning	2·4	K6
L6	Aerial L.W. tuning	32·0	K6
L7	Oscillator reaction	—	L6
L8	Oscillator reaction	1·0	L6
L9	Oscillator reaction coils	4·5	L6
L10	Osc. S.W. tuning...	—	L6
L11	Osc. M.W. tuning...	3·5	L6
L12	Osc. L.W. tuning...	8·0	L6
L13	1st I.F. trans. Pri.	7·5	B2
L14	1st I.F. trans. Sec.	7·5	B2
L15	2nd I.F. trans. Pri.	7·5	B1
L16	2nd I.F. trans. Sec.	7·5	B1
L17	Speech coil ...	2·6	—
T1	Output trans. Pri.	500·0	H3
	Output trans. Sec.	0·2	—
T2	Mains trans. Pri., total	30·0	D2
	Mains trans. H.T. sec., total...	350·0	
	Mains trans. 4v. htr. sec.	Very low	
	Mains trans. 5.3 v. htr. sec. ...	Very low	
	Mains trans. Rect. htr. sec. ...	Very low	
S1-S16	Waveband switches	—	K6 L6
S17	P.U. jack-switch ...	—	H5
S18	Mains sw., g'd R16	—	E3

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 233 V, using the 220-240 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the M.W. band, and the volume control was at maximum, but there was no signal input.

Voltages, with the exception of cathode voltages, were measured on the 400 V scale of a Model 7 Avometer, chassis being the negative connection throughout.

Valve	Anode V	Anode mA	Screen V	Screen mA	Cath. V
V1 6C9 ...	220	3·5			
	(oscillator) 90	5·0	94	6·4	2·9
V2 6F15 ...	222	6·0	94	1·7	2·3
V3 Pen 45DD	236	33·0	222	6·2	8·8
V4 UU6 ...	270†	—	—	—	296·0

† Each anode, A.C.

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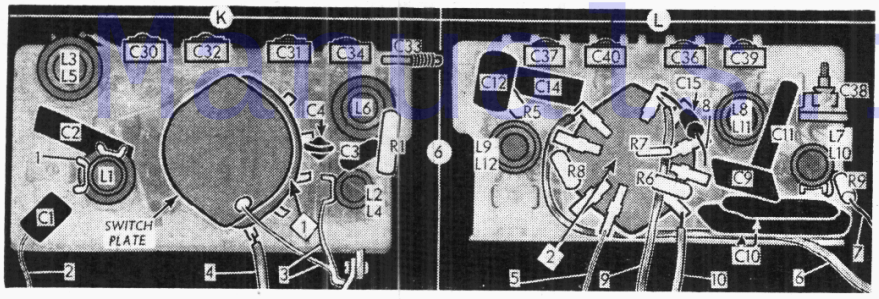


The two sides of the tuning assembly as seen in an inverted chassis. On the left is the outer side, which faces the end of the chassis. Here are indicated connections **1-4** which must be unsoldered to disconnect the assembly for removal. On the right is the inner side of the assembly, in which are indicated connections **5-10.**

Switch Table and Diagrams

Switch	Gram	S.W.	M.W.	L.W.
S1	—	C	—	—
S2	—	—	C	—
S3	—	—	—	C
S4	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	—	—	—

GENERAL NOTES

Switches.—**S1-S16** are the waveband and radio/gram change switches, ganged in two rotary units beneath the chassis. The units are not visible in our under-chassis view, but their positions are indicated by arrows and the numbers **1** and **2** in diamonds, either side of the tuning assembly.

They are indicated again in the illustrations of the tuning assembly, and are shown in detail in the diagrams in col. 3, where they are drawn as seen in an inverted chassis when viewed in the directions of the arrows.

The table (col. 3) gives the switch positions for the four control settings, starting from the fully anti-clockwise (Gram) position of the control. A dash indicates open, and **C,** closed.

S17 is a jack-type switch associated with the pick-up sockets. Normally it is closed to short-circuit the sockets, but it opens automatically when the plugs are inserted.

S18 is the Q.M.B. mains switch, ganged with the volume control **R16.**

Scale Lamps.—These are two Osram M.E.S. type lamps, with small clear spherical bulbs, rated at 6.5 V, 0.3 A. They are connected to the 6.3 V heater secondary on **T2.**

External Speaker.—Three pairs of sockets are provided on a panel at the rear of the chassis for the connection of a gramophone pick-up, an external speaker and the internal speaker respectively, reading them from left to right. The external speaker should be of low impedance (about 3 Ω). The internal speaker may be muted by withdrawing its plug.

Tuning Assembly.—All components, excepting the tuning gang, associated with the R.F. and oscillator circuits are mounted in an assembly located at J8-5 in our under-chassis view. As most of its components are not visible in this view, its two sides are shown in detail in the illustrations above this column, the "outer" side, which faces the end of the chassis, being on the left. Both are shown as seen in an inverted chassis. Instructions for removal and replacement of the unit are given under "Dismantling The Set."

H.T. Smoothing.—This consists of a resistance-capacitance series and a special hum neutralising device. Capacitors **C28** and **C29** are both rated at 350v working, and **C27** is rated at 450 V working. Ripple currents through **C28** are converted into small voltages across **R25** and are applied in inverse phase to **C29** to cancel out residual hum.

It is therefore important to replace **C28** and **C29** only with capacitors of the original values. In the radiogram **R25** is not used, but the values of the capacitors are increased. **R25** consists of two 10Ω resistors connected in parallel.

I.F. Transformers.—The makers explain that although the I.F. transformers appear to be exactly alike, they are not interchangeable. The short length of former tubing projecting from the top of each can bears a small paint mark to distinguish it. White indicates that it is the first I.F. transformer, and blue, the second.

Output Transformer T1.—This is mounted beneath the chassis and connected by means of attached flexible leads. The primary anode lead is marked with a red spot.

Mains Transformer T2.—The "live" leads of this transformer are colour-coded with dabs of paint, and the colours are indicated in our circuit diagram. The leads require careful handling, as the paint flakes off very easily.

Chassis Divergencies.—Early chassis were fitted with a tuning capacitor gang in which the rear (oscillator) section was larger than the other section, owing to wide vane spacing to minimize microphony. When the change was made to a type with equal sections, a change in the "law" of the gang made it necessary to alter the calibration markings on the scale backing plate (see "Circuit Alignment"). At the same time other changes were made to accommodate the Copenhagen Plan. The chassis can easily be identified by inspection of the gang.

Capacitor **C4,** which in our chassis was 25 pF, may be 22 pF.

RADIOGRAM MODIFICATIONS

In the A611 autoradiogram, a T611 chassis is used with the following modifications: **C28** and **C29** both become 30 μF electrolytics, and **R25** is omitted, the common negative lead going directly to chassis.

To match the special lightweight pick-up employed, the pick-up sockets are shunted with a further resistor of 3,300Ω and a capacitor of 0.005 μF, connected in series.

Physical changes in the method of mounting the chassis render our dismantling procedure inapplicable, but the only points that need explaining are that the control knobs are fitted with screws, and the gramophone unit is locked with transit screws while being transported. The makers emphasize the importance of replacing them when transporting the set.

DISMANTLING THE SET

Removing Chassis.—Remove the two control knobs (pull off), with felt washers, from the front of the cabinet, and two more (with webbed finger-grips) from the sides of the cabinet. These latter may be levered off with a screwdriver, using the chassis as a fulcrum;

remove the four ¾in 2BA cheese-head bolts (with metal batten plates) holding the chassis to the base of the cabinet;

slip the scale lamp (spring fitting holders) from their brackets beneath the sub-baffle on the front of the cabinet (these may be conveniently anchored to prevent them from swinging about by fitting the end one in the hole (at location C1) in the chassis deck).

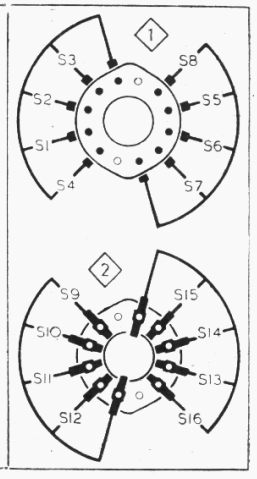
If the speaker leads are now freed from the cleat holding them to the sub-baffle, the chassis may be withdrawn to the extent of the leads; or if the speaker plug is withdrawn from its socket the chassis may be freed entirely.

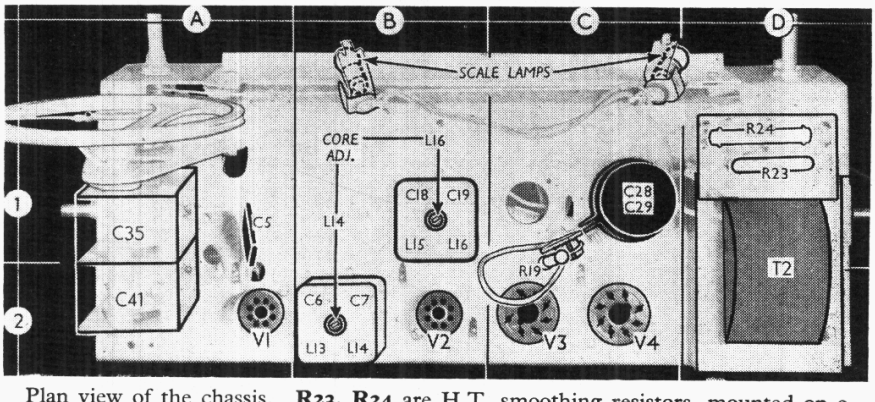
When replacing, if difficulty is experienced in getting the control knobs on to their spindles, this may be done without forcing them if their spring circlips are first drawn forward a little.

Removing speaker.—The speaker is held to the sub-baffle by four wood screws (with flat washers). The connecting tags are on the right, when viewed from the rear.

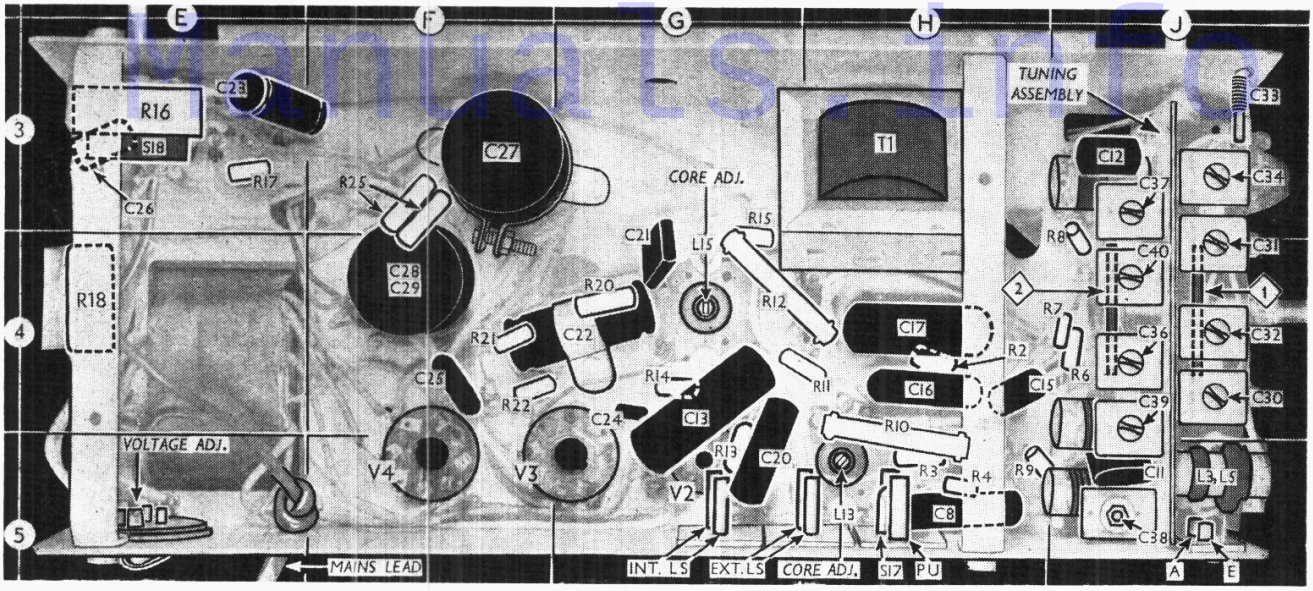
Removing Tuning Assembly.—Unsolder the ten connections between the assembly and the chassis, and remove from the chassis deck the

Diagrams of the two wave band switch units drawn as seen in the directions of the two arrows in our illustrations of the tuning assembly (above) and chassis underside. The associated table is above.





Plan view of the chassis. **R23, R24** are H.T. smoothing resistors, mounted on a panel which also carries the scale lamp connections. **R19** is the grid stopper to **V3,** mounted on the connecting cap. The scale lamps fit on to brackets on the front of the cabinet.



Under-chassis view. On the right is seen the tuning assembly, which is shown in detail in the illustrations at the head of cols. 1 and 2. The waveband switch units, which are indicated by arrows and the numbers **1** and **2** in diamonds, are shown in detail in the diagrams in col. 3. **R25** consists of two 10Ω resistors in parallel. **S17** forms an integral part of the upper pick-up socket.

two ¼in 4BA screws (with lock-washers) holding the unit to the underside.

The connections involved are numbered 1-10 in our circuit diagram and in the two views of the assembly in cols. 1 and 2. The two leads to the gang sections, connections 4 and 9, go through holes in the chassis deck. Connection No. 3 consists of two bare wires to chassis, one from the end-plate of the switch unit and one from a tag on **L2, L4** coil unit. Other chassis connections, with the exception of No. 2, are made to the frame of the assembly and are not indicated by numbers.

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set to M.W., and turn the gang and volume control to maximum. Connect signal generator via a 0.1 μF capacitor to the fixed-vane tag of **C35** (A1) and chassis, feed in a 470 kc/s (638.3 m) signal, and adjust **L16, L15, L14** and **L13** cores (location references B1 and B2) for maximum output, keeping the input signal low enough to avoid A.G.C. action.

I.F. Filter.—Transfer signal generator leads to **A** and **E** sockets, via M.W. dummy aerial (0.0002 μF capacitor). Feed in a strong 470 kc/s signal, and adjust **C30** for minimum output.

R.F. and Oscillator Stages.—With the gang at maximum capacitance, the cursor should cover the short vertical line at the high wavelength end of the scale backing plate, actually on the cursor guide rail.

As the scale panel is mounted in the cabinet and the chassis must be removed for alignment, the scale backing plate carries a number of calibration marks, in the form of dots.

In early chassis (see "Chassis Divergencies"), these marks consisted of six dots numbered 1-6 and three more marked "L," "L" and "H" for the Light Programme on 262 m and 1,500 m and the Home Service on 341 m respectively.

In later models, with the later-type gang, these markings were changed altogether. The calibration points at the ends of the scales were repeated at the same frequencies, but they bore different numbers (4, 7, 1, 6, 9, 3 instead of 1-6) and the station programme positions, which were rendered obsolete by the Copenhagen Plan, were replaced by alignment check points at 30 m (No. 2), 300 m (No. 5) and 1,500 m (No. 8).

In the following instructions, both numbers will be quoted for each frequency where two are involved, the earlier type mark being quoted first. All the adjustments will be found in the tuning assembly, and they are indicated in location references J3, J4 and J5 in our under-chassis view.

M.W.—With the set still switched to M.W., tune to 200 m (mark 1 or 4 on backing plate), feed in a 200 m (1,500 kc/s signal, and adjust **C39,** then **C32,** for maximum output. Tune to 500 m (mark 4 or 6), feed in a 500 m (600 kc/s) signal, and adjust **C36** for maximum output while rocking the gang for optimum results. In later type receivers, check calibration at 300 m (1,000 kc/s (Mark 5).

L.W.—Switch set to L.W., tune to 1,000 m (Mark 2 or 7), feed in a 1,000 m (300 kc/s) signal, and adjust **C40,** then **C34,** for maximum output. Tune to 2,000 m (Mark 5 or 9), feed in a 2,000 m (150 kc/s) signal, and adjust **C37** for maximum output while rocking the gang for optimum results. In later type receivers, check calibration at 1,500 m (200 kc/s) (mark 8).

TV Service Forum

Contributions Invited from Dealers

WHENEVER service engineers meet together within 100 miles of a television transmitter, the conversation comes round to television service work, strange symptoms and remarkable cures, and useful hints and tips change hands in rapid succession, to the benefit and interest of all concerned.

The biggest meeting place of dealers is their trade journal, and we propose to reserve some space for contributions in future issues of *The Trader* under the heading of "TV Service Forum." Like "Service Short-Cuts," which it replaces, it will record service hints by manufacturers and dealers, but it will be of wider scope and include aerials, feeders, jigs, tools and instruments, etc., that dealers have found useful.

Please send contributions to The Technical Editor, "The Wireless and Electrical Trader," Dorset House, Stamford Street, London, S.E.1. Payment will be made at our normal rates for all copy used.

S.W.—Switch set to S.W., and replace dummy aerial with a 400 Ω resistor. Tune to 20 m (mark 3 or 1), feed in a 20 m (15 Mc/s) signal, and adjust **C38,** then **C31,** for maximum output. Tune to 50 m (mark 6 or 3), feed in a 50 m (6 Mc/s) signal, and check calibration. In later type receivers, calibration should also be checked at 30 m (10 Mc/s) (mark 2).

Image Rejector.—When the receiver was designed, the Light Programme on 261 m was liable in areas of high field strength to produce an image on the L.W. band at about 209 kc/s, where it caused a whistle to appear with the L.W. Light Programme. **C33** was then adjusted while a strong 1,149 kc/s (261 m) signal was being fed into the receiver, which was tuned to the image, for minimum output.

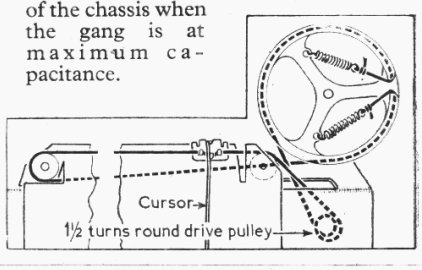
As the Copenhagen has since moved the transmitter to 247 m, the image no longer troubles the L.W. Light Programme, but in some areas it may be troublesome at about 274 kc/s (1,095 m), in which case it would be suppressed by adjusting **C33** while feeding in a strong 1,214 kc/s (247 m) signal and receiving the image on L.W. **C33** should be adjusted for minimum output by sliding the sleeving along the central wire, then sealed with varnish.

DRIVE CORD REPLACEMENT

Four feet of Nylon braided glass yarn is required for a new drive cord, which should be run as shown in the sketch below, where the system is drawn as seen from the front when the gang is at maximum capacitance.

Starting in this position, tie a spring to one end of the cord and hook it on to the lower anchorage. Then run the cord as shown, pulling against the gang stop to hold the cord in position. When tying off, the springs should be extended to about 1½ times their relaxed length. The overall length of our cord, including the knots, was 43½ inches.

Sketch showing the tuning drive system, drawn as seen from the front of the chassis when the gang is at maximum capacitance.



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