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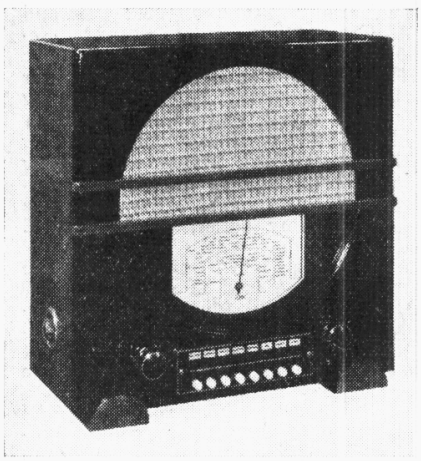
Supplement to The Wireless & Electrical Trader, July 6, 1940

"TRADER" SERVICE SHEET

474

ULTRA 309, 310

TABLE AND CONSOLE MODELS



The Ultra 309 Table Model.

THE Ultra 309 table receiver is a 3-valve (plus valve rectifier) 3-band AC superhet, with eight press-buttons, of which three are for wave-band switching and five for pre-set station selection (three MW and two LW). The SW range is 16.5 to 50 m, and the set is suitable for 200-260 V, 40-100 C/S AC mains.

Model 310 is the corresponding console receiver, having an identical chassis.

Release date, both models: August, 1939.

CIRCUIT DESCRIPTION

Aerial input from socket **A1** is via IF rejector circuit **L1, C27, C28** and coupling components **L2, C2** and **R1** to single tuned circuits **L3, C32** (SW), **L4, C32** (MW manual) and **L5, C32** (LW manual), which are linked by switches **S1a, S1b** (SW), **S2a, S2b** (MW) and **S3a, S3b** (LW).

These switches, together with all the subsequent tuning switches, are comprised in the press-button unit, and they are numbered and lettered to indicate their action.

The switch number indicates the group with which it is associated, and is the same as the number given in the illustration of the tuning unit to the plunger which controls that group. All switches bearing the same number close when the group button is pressed, and open when it is released.

The lettered suffix permits identification of a switch in the group.

For automatic operation, one of the coils **L6** to **L10** is connected between the coupling circuit **C2, R1** and the control grid line via switches **S4a** to **S8a**, and tuned by the fixed condenser **C3** via switches **S4b** to **S8b**, according to which button is depressed.

A second aerial socket **A2** feeds the signal to **A1** via the small series condenser **C1.**

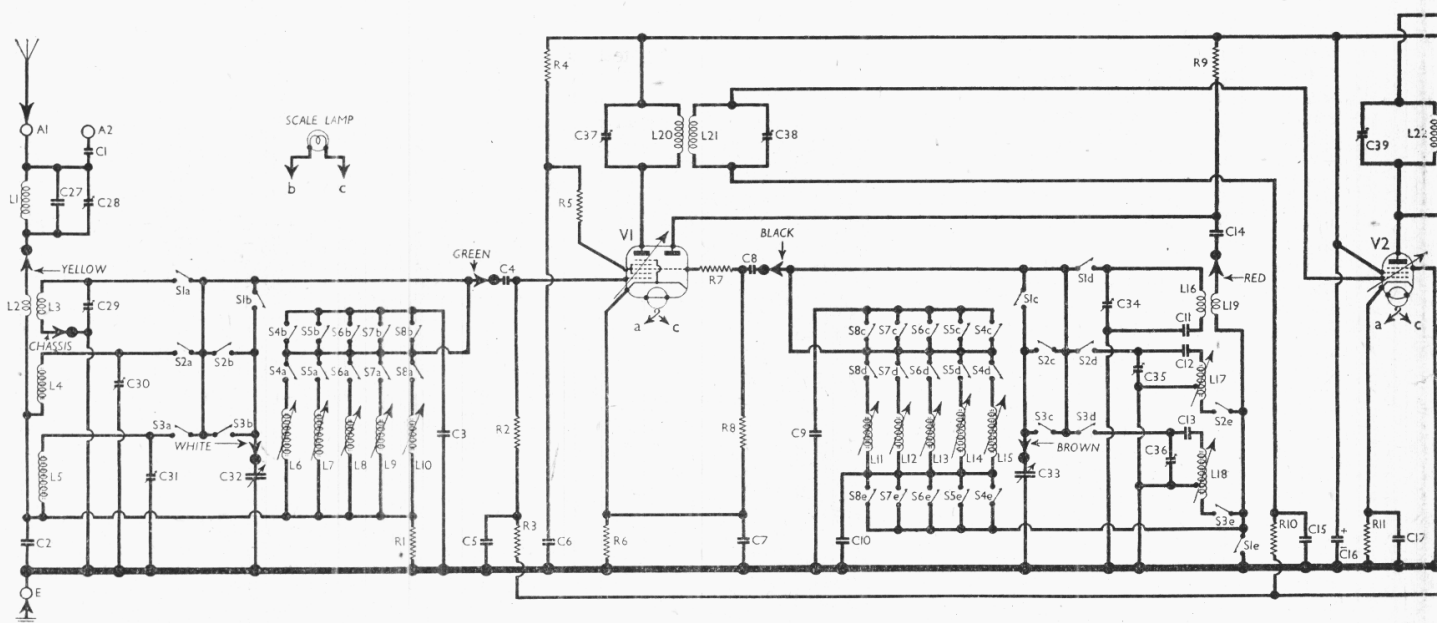
First valve **(V1, Mazda metallised TH41** or **AC/TH1A)** is a triode heptode operating as frequency changer with internal coupling. For manual operation, triode grid coils **L16** (SW), **L17** (MW) and **L18** (LW) are tuned by **C33;** parallel trimming by **C34** (SW), **C35** (MW) and **C36** (LW); series tracking by **C11** (SW), **C12** (MW) and **C13** (LW). Reaction by **L19** (SW), the end turns of **L17** (MW) and the end turns of **L18** (LW).

For automatic operation, one of the coils **L11** to **L15** is connected between **V1** oscillator grid circuit and the reaction coupling condenser **C10** which is common to grid and anode circuits. Tuning capacity is provided by **C9.**

Second valve **(V2, Mazda metallised VP41)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C37, L20, L21, C38** and **C39, L22, L23, C40.**

Intermediate frequency 470 KC/S

Diode second detector is part of double diode beam tetrode output valve **(V3, Mazda Pen 45 DD).** Audio frequency component in rectified output is developed across load resistance **R17** and passed via AF coupling condenser **C19,** manual volume control **R13** and grid



Circuit diagram of the Ultra 309 receiver. The console model 310 has an identical circuit. Five permeability pre-tune available, the aerial and oscillator coil cores being ganged, so that only one adjustment for each station is needed. The circu connections between the tuning unit and the rest of the chassis by means of arrows and black dots, with colour coding

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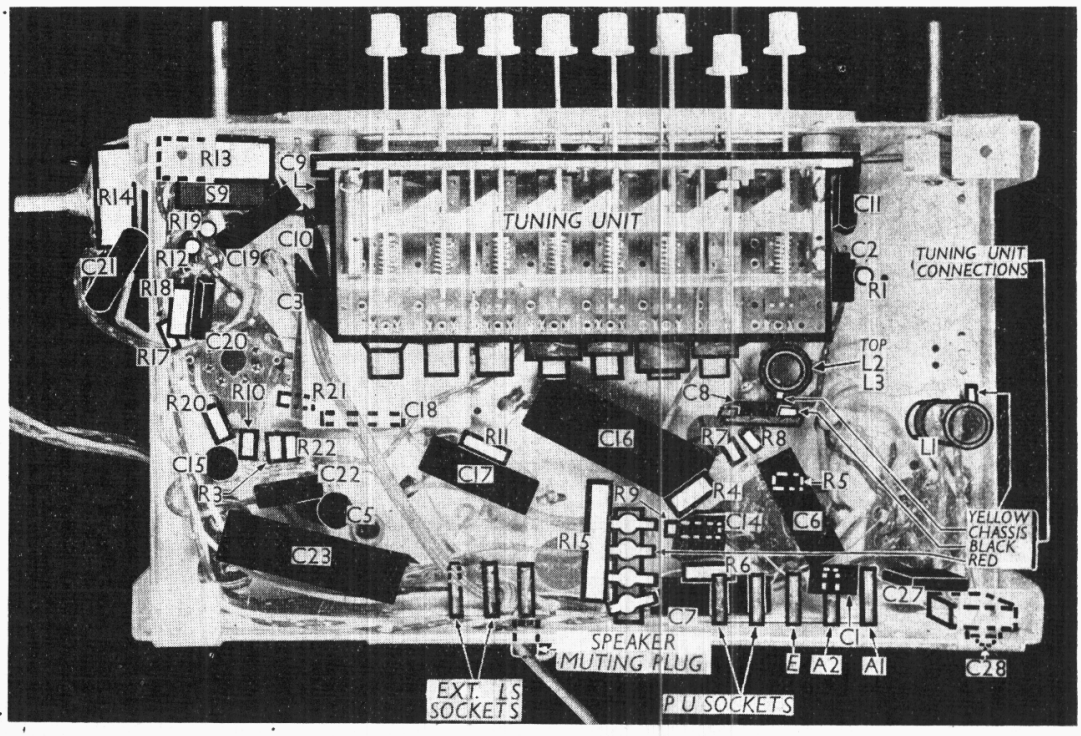


Under-chassis view. A detailed illustration of the tuning unit is overleaf. Some of the connecting points of the wires from the tuning unit are indicated. **C28** is the IF rejector tuning condenser, adjustable from the back of the chassis.

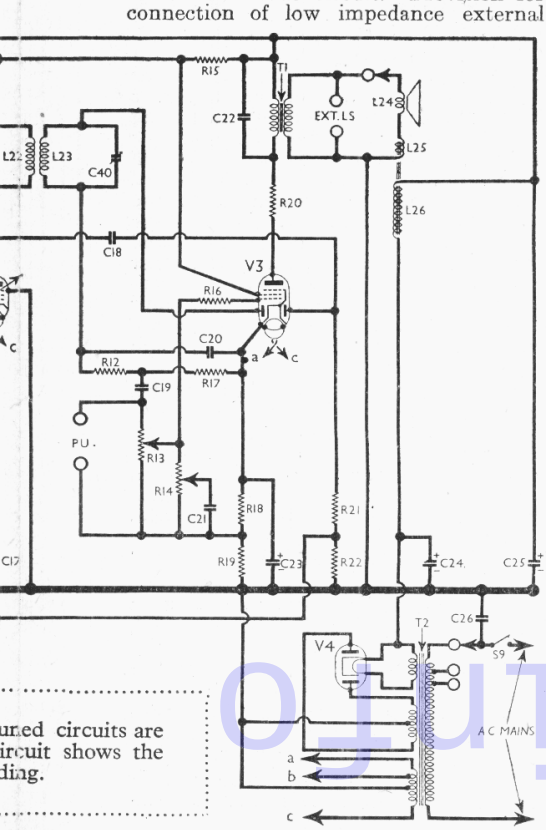
stopper **R16** to CG of tetrode section, which provides the total AF amplification. IF filtering by **C20, R12.**

Provision for connection of gramophone pick-up across **R13.** Variable tone control by **R14, C21** in tetrode grid circuit. Fixed tone correction by **C22** in tetrode anode circuit. Provision for connection of low impedance external speaker across secondary of internal speaker input transformer **T1,** while a plug and socket device permits the internal speaker to be muted if desired.

Second diode of **V3,** fed from **V2** anode via **C18,** provides DC potential which is developed across load resistances **R21, R22.** That at their junction is fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control. Delay voltage, together with GB for tetrode section, is obtained from drop along resistances **R18, R19** in cathode lead to chassis.

HT current is supplied by IHC full-wave rectifying valve **(V4, Mazda metallised UU6).** Smoothing by speaker field **L26** and electrolytic condensers **C24, C25.** Mains circuit RF filtering by **C26.**

Valve heaters (with the exception of **V4** heater) are connected across the total heater secondary winding of the mains transformer **T2,** but the scale lamp is connected between one end and a tapping on the winding. The centre of the winding is tapped and connected to chassis.



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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.

Removing Chassis.—Remove the two control knobs from the front of the cabinet (recessed grub screws);

remove the escutcheon (2 small countersunk-head wood screws) and the tone control knob (pull-off) from the side of the cabinet;

remove the fixing nut (with lock-washer) holding the tone control to the bracket on the side of the cabinet;

remove the four cheese-head screws (with lock-washers and claw washers) holding the chassis to the bottom of the cabinet, when the chassis can be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free the chassis entirely, unsolder from the connecting strip on the speaker the six leads connecting it to chassis.

When replacing, connect the speaker leads as follows, numbering the tags from left to right as seen from the rear of the cabinet:

1, no external connection;
2, red;
3, green;
4, brown;
5, blue
6, black;
7, yellow.

Fit a felt washer on each of the front control spindles, between the control knob and the cabinet.

Removing Speaker.—Unsolder the six connecting leads;

remove the two round-head wood screws holding the ends of the eliptical speaker frame to the sub-baffle;

slacken the four clamp nuts (with lock-washers holding the rim of the speaker), swivel two of the clamps round, and lift out the speaker.

When replacing, the transformer should be at the bottom, and the leads should be connected as indicated above.

Removing the Tuning Unit.—To examine the upper side, which is normally hidden from view by the chassis deck, and upon which are mounted the switch contacts and tuning coils, remove the two round-head brass screws (with lock-washers) holding the unit to the front member of the chassis.

The unit may now be lifted at one end and turned over, while the other end remains hinged on the connections.

To free the unit from the chassis, un-

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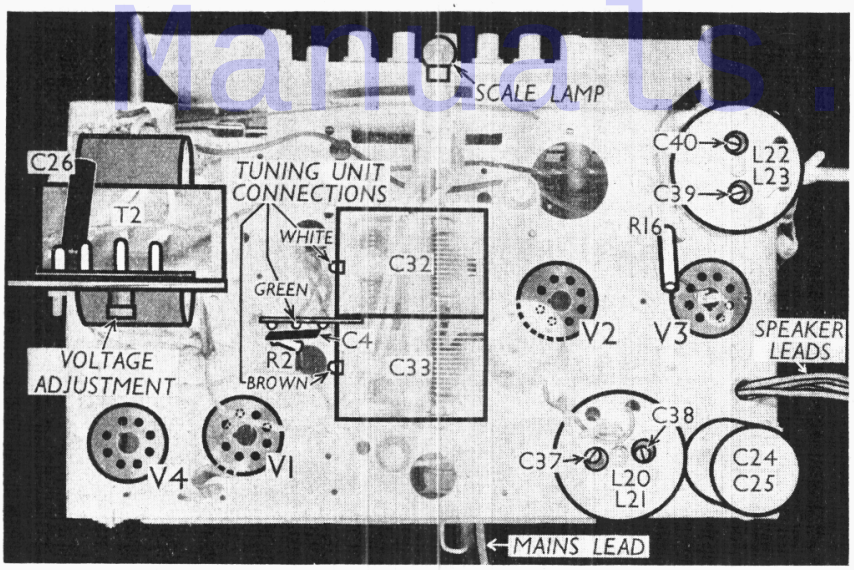

Plan view of the chassis. Three of the tuning unit connections are indicated, for use if this unit has to be removed. The leads from them pass through a hole in the chassis.

solder the outer ends of the six connecting leads and the braided chassis wire to the tag on **L3** at the points indicated in the two chassis illustrations, when the unit can be lifted out.

When replacing, the seven connecting points for the wires, which are still attached to the unit, and **L3** tag, can be clearly seen in our chassis illustrations.

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	A2 series condenser	0·00005
C2	Part aerial coupling	0·0024
C3	Aerial auto tuning condenser	0·00046
C4	V1 heptode CG condenser ...	0·000025
C5	V1 heptode CG decoupling	0·05
C6	V1 SG decoupling	0·1
C7	V1 cathode by-pass	0·1
C8	V1 osc. CG condenser ...	0·00005
C9	Osc. auto tuning condenser	0·00035
C10	Osc. auto reaction coupling	0·00035
C11	Osc. circuit SW tracker ...	0·005
C12	Osc. circuit MW tracker ...	0·00035
C13	Osc. circuit LW tracker ...	0·00015
C14	V1 osc. anode coupling ...	0·0005
C15	V2 CG decoupling	0·05
C16*	HT circuit decoupling ...	4·0
C17	V2 cathode by-pass	0·1
C18	Coupling to V3 AVC diode	0·00001
C19	AF coupling to V3 tetrode	0·01
C20	IF by-pass	0·0002
C21	Part of variable tone control	0·002
C22	Fixed tone corrector ...	0·004
C23*	V3 cathode by-pass	50·0
C24*	HT smoothing condensers	8·0
C25*		16·0
C26	Mains RF by-pass	0·004
C27	Aerial IF rejector fixed trimmer...	0·002
C28‡	Aerial IF rejector tuning ...	—
C29‡	Aerial circuit SW trimmer	—
C30‡	Aerial circuit MW trimmer	—
C31‡	Aerial circuit LW trimmer	—
C32†	Aerial circ. manual tuning	—
C33†	Osc. circ. manual tuning ...	—
C34‡	Osc circuit SW trimmer ...	—
C35‡	Osc. circuit MW trimmer ...	—
C36‡	Osc. circuit LW trimmer ...	—
C37‡	1st IF trans. pri. tuning ...	—
C38‡	1st IF trans. sec. tuning ...	—
C39‡	2nd IF trans. pri. tuning ...	—
C40‡	2nd IF trans. sec. tuning ...	—

* Electrolytic. †Variable. ‡Pre-set.

	RESISTANCES	Values (ohms)
R1	Part aerial coupling	12,000
R2	V1 heptode CG resistance ...	1,000,000
R3	V1 heptode CG decoupling...	1,000,000
R4	V1 SG HT feed	10,000
R5	V1 SG stabiliser	60
R6	V1 fixed GB resistance ...	200
R7	V1 osc. CG stabiliser... ...	60
R8	V1 osc. CG resistance ...	100,000
R9	V1 osc. anode HT feed ...	40,000
R10	V2 CG decoupling	1,000,000
R11	V2 fixed GB resistance ...	130
R12	IF stopper	100,000
R13	Manual volume control ...	1,000,000
R14	Variable tone control ...	2,000,000
R15	HT feed resistance	2,000
R16	V3 tetrode grid stopper ...	1,000
R17	V3 signal diode load	500,000
R18	V3 tetrode GB and AVC delay resistances	140
R19		115
R20	V3 tetrode anode stopper ...	60
R21	V3 AVC diode load resistances	250,000
R22		750,000

	OTHER COMPONENTS	Approx. Values (ohms.)
L1	Aerial IF rejector coil ...	4·0
L2	Aerial SW coupling coil ...	9·0
L3	Aerial SW tuning coil ...	0·05
L4	Aerial manual MW tuning..	3·5
L5	Aerial manual LW tuning..	12·0
L6	Aerial circuit LW auto tuning coils	10·5
L7		10.0
L8	Aerial circuit MW auto tuning coils	1·75
L9		1·25
L10		1·0
L11	Oscillator circuit MW auto tuning coils	2·1
L12		2·8
L13		3·25
L14	Oscillator circuit LW auto tuning coils	6·3
L15		6·5
L16	Osc. circuit SW tuning coil	0·05
L17	Osc. circ.MW manual tuning	3·5
L18	Osc. circ.LW manual tuning	6·5
L19	Osc. SW reaction coil ...	7·5
L20	1st IF trans. Pri.	13·0
L21	Sec.	13·0
L22	2nd IF trans. Pri. ...	13·0
L23	Sec. ...	13·0
L24	Speaker speech coil	2·0
L25	Hum neutralising coil ...	0·1
L26	Speaker field coil	1,000·0
T1	Speaker input trans. Pri...	430·0
	Sec..	0·5
T2	Mains trans. Pri., total... ...	38·0
	Heater sec., total	0·05
	Rect. heat. sec....	0·1
	HT sec., total ...	450·0

(*Continued in next column*)

	OTHER COMPONENTS *continued*	Approx* Values (ohms.)
S1-S3 a & b	Aerial circuit manual waveband switches	—
S1-S3 c, d & e	Oscillator circuit manual waveband switches ...	—
S4-S8 a & b	Aerial circuit auto selector switches	—
S4-S8 c, d & e	Oscillator circuit auto selector switches	—
S9	Mains switch, ganged R13...	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 235V, using the 220-240V 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 400V scale of a model 7 Universal Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TH41	210	5·0	142	7·0
	Oscillator			
	76	3·0		
V2 VP41	262	10·0	210	2·5
V3 Pen45DD	245	34·0	210	6·9
V4 UU6	320†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—**S1a, b, c, d, e** to **S8a, b, c, d, e** are the waveband and auto selector switches, in a press-button unit beneath the chassis. This is indicated in our under-chassis view, and, on a larger scale, in a separate view of the tuning unit. A diagram of the switch unit is in the next two columns, and shows all the switches in detail. It should be noted that this view is of the side facing the chassis deck. To examine the unit, the two fixing screws may be removed, and one end of the unit lifted up. The other end can remain "hinged" on the connecting wires. The points to which four of these coloured wires are attached are indicated at the left of our switch diagram.

In numbering the switches in this set, it has been found convenient to give each of the five switches operated by each button the same number, followed by the suffix **a, b, c, d** or **e**. Thus button 1 (on the extreme right hand looking at the front of the cabinet) controls **S1a, b, c, d** and **e**. The buttons are numbered 1 to 8 in our illustration of the coil and switch unit.

All the switches associated with a button close when the button is pressed, and open when it is released. See also the early part of the Circuit Description.

S9 is the QMB mains switch, ganged with the volume control **R13**, and indicated in our under-chassis view.

Coils.—All the RF and oscillator coils are beneath the chassis and are un-

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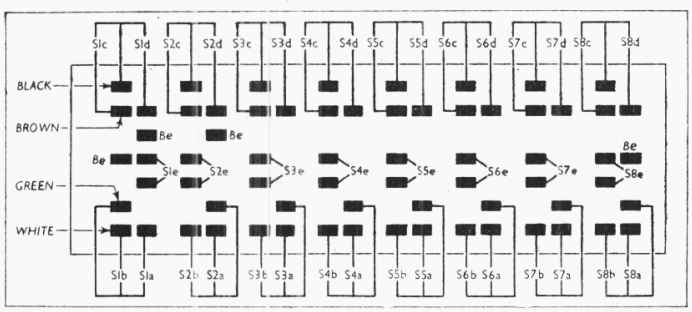
screened. **L1** is on a tubular former to the right of our under-chassis view. The remaining coils are associated with the tuning unit, and are indicated in our view of this unit, which shows the side facing the chassis deck. The SW units **L2, L3** and **L16, L19** are on small tubular formers on the left; **L3** and **L16** are the thick wire windings. The remaining coils are in pairs on seven tubular formers mounted in a row over the press-button unit. Each of these units has a single core adjustment projecting through the front plate of the unit, the cores of each of the five auto-tuning pairs being ganged.

The IF transformers **L20, L21** and **L22, L23** are in two screened units on the chassis deck, with their associated trimmers.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (about 2 O) external speaker. To the left of these sockets is a plug on a flying lead, fitting into another socket. When this plug is withdrawn, the internal speaker is muted.



The press-button switch unit, as seen when the tuning unit is removed and turned over. Normally this side faces the chassis. Note the tags to which some of the tuning unit connections are made.

Scale Lamp.—This is an Osram MES type, rated at 4.5V, 0.3A. It is run from a suitable tapping on the heater secondary of **T2**.

Condensers C24, C25.—These are two surge limiting dry electrolytics, in a single tubular metal can on the chassis deck, the can being the common negative connection. The red spotted tag beneath the chassis is the positive of **C24** (8μF, 500 V working), and the plain tag is the positive of **C25** (16μF, 500 V working).

Tuning Unit Connections.—As this unit may possibly have to be removed for repairs to components on its side facing the chassis, the seven connections to it are indicated by arrows and black dots in the circuit diagram, with their colour-coding. In addition, the connecting wires are shown in our separate view of the tuning unit, and the points of connection are indicated in the plan and under-chassis views.

Trimmers.—Apart from the IF trimmers in the IF units, and the seven core adjustments for certain of the coil units, there are six trimmers in a row on the tuning unit, shown in our view of this unit, and reached through a slot in the front chassis member. In addition, there is the IF rejector trimmer which is attached to the rear chassis member, and adjusted from the rear of the set.

Tone Control R14.—This is mounted on a bracket, and its spindle projects through one side of the cabinet. It is shown on the left of our under-chassis view.

AUTO-TUNING ADJUSTMENT

Of the eight press-buttons, the three on the right control the manual wave-band switching. Adopting the numbering used in our view of the tuning unit, button 1 is on the extreme right, looking at the front of the cabinet, while button 8 is on the left. Buttons 8, 7, 6, 5 and 4 control pre-set stations, the wavelength ranges being: 8, 200-290 m; 7, 280-400 m; 6, 390-550 m; 5, 1,250-1,500 m; 4, 1,400-1,700 m.

To select a station, tune it in manually, then remove the press-button escutcheon. Press the appropriate button, and slowly turn the core adjusting screw situated above it with the tool provided until the required station is heard. Check by switching to manual and back again to make sure that the station is correctly tuned.

Do not touch the two right-hand adjusting screws (which are for manual tuning alignment only) or any of the six pre-set condensers.

A number of additional station name tabs are supplied with the set. To fit fresh ones corresponding with the station adjustments, undo the two knurled nuts at the back of the escutcheon plate and lift out the retaining piece. Place the new names in position and fix them by refitting the retaining piece and knurled nuts. Finally replace the escutcheon plate and its fixing screws.

CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator to control grid (top cap) of **V1** and chassis, turn gang to maximum, and press MW button. Feed in a 470 KC/S signal, and adjust **C40, C39, C38** and **C37** in turn for maximum output. Repeat these adjustments.

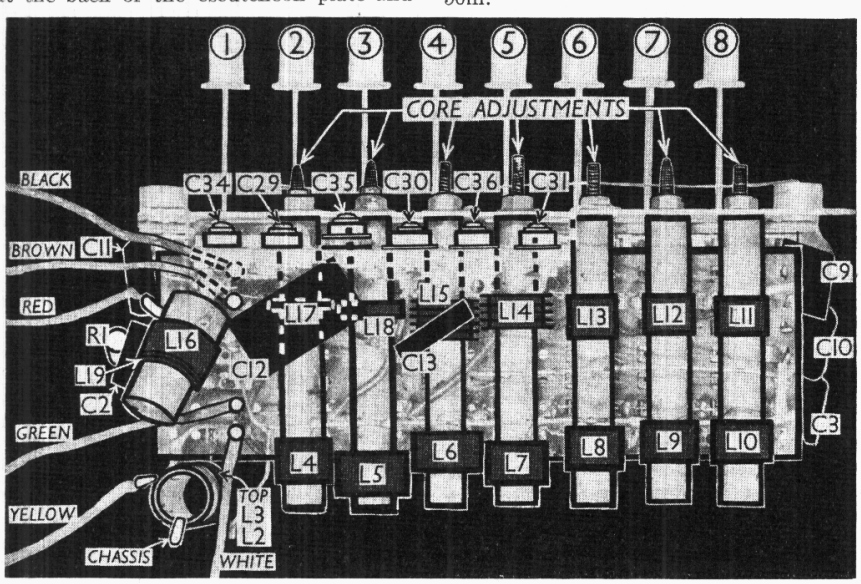
IF Rejector.—Connect signal generator to **A1** and **E** sockets, feed in a strong 470 KC/S signal, and adjust **C28** (rear of chassis) for *minimum* output.

RF and Oscillator Stages.—With gang at maximum, pointer should be horizontal. Connect signal generator, via a suitable dummy aerial, to **A1** and **E** sockets.

MW.—Press MW button, tune to 200 m on scale, feed in a 200 m (1,500 KC/S) signal, and adjust **C35** for maximum output. Feed in a 250 m (1,200 KC/S) signal, tune it in, and adjust **C30** for maximum output, rocking the gang slightly if necessary. Feed in a 500m (600 KC/S) signal, tune it in, and adjust core of **L17** for maximum output, while rocking the gang for optimum results.

LW.—Press LW button, tune to 1,000m on scale, feed in a 1,000m (300 KC/S) signal, and adjust **C36** for maximum output. Feed in a 1,300m (232 KC/S) signal, tune it in, and adjust **C31** for maximum output, while rocking the gang slightly, if necessary. Feed in a 1,700m (176.3 KC/S) signal, tune it in, and adjust core of **L18** for maximum output, while rocking the gang for optimum results.

SW.—Press SW button, tune to 19m on scale, feed in a 19m (15.8 MC/S) signal, and adjust **C34**, then **C29**, for maximum output. Check at 30m and 50m.



View of the side of the tuning unit facing the chassis. The leads and connection points to the rest of the chassis are shown. Note the various condenser and core adjustments.

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