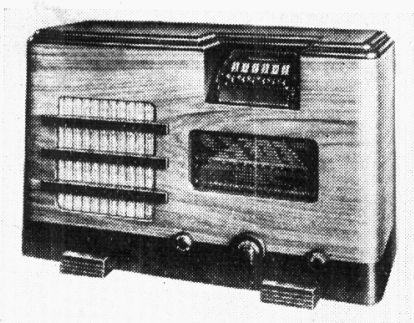
Supplement to The Wireless & Electrical Trader, May 20, 1939

"TRADER" SERVICE SHEET

405

COSSOR 398

PRESS-BUTTON AC SUPERHET



THE Cossor model 398 is a 5-valve (plus rectifier) AC 3-band superhet with press-button permeability tuning for six stations. The set is suitable for 200-250 V, 40-100 C/S mains.

An interesting feature is the incorporation of the de Monge interference suppression circuit, for which a special double aerial feeder is employed, one of the wires being the usual lead-in from the aerial proper, and the other, parallel with it, being free at the aerial end, but connected to the **A2** socket of the receiver at the other end, whence it is fed into the cathode circuit of **V1.** This valve is used solely for suppression, on MW and LW only.

Release date; August, 1938.

CIRCUIT DESCRIPTION

Aerial input from socket **A1** on MW, LW and auto is via **S1, V1, R3, C3,** and switches **S31** and **S6** to **S8** to coupling coils **L3** (MW) and **L4** (LW) or to coupling condensers **C32, C33** (auto) and thus to single tuned circuits **L6, C39** (MW manual), **L7, C39** (LW manual) or the automatic tuning circuit comprising coils **L22** to **L27,** tuned by **C32, C33,** via selector switches **S36** to **S41,** according to which button is depressed.

When the waveband control is in the AT (automatic) position, a 261 m filter is connected directly across the lower of the two LW automatic coils **L26,** while a 342 m filter **L8, C7** is permanently connected across the other LW coil **L27.** In the LW manual position, **L1, C4** is connected across **L4.**

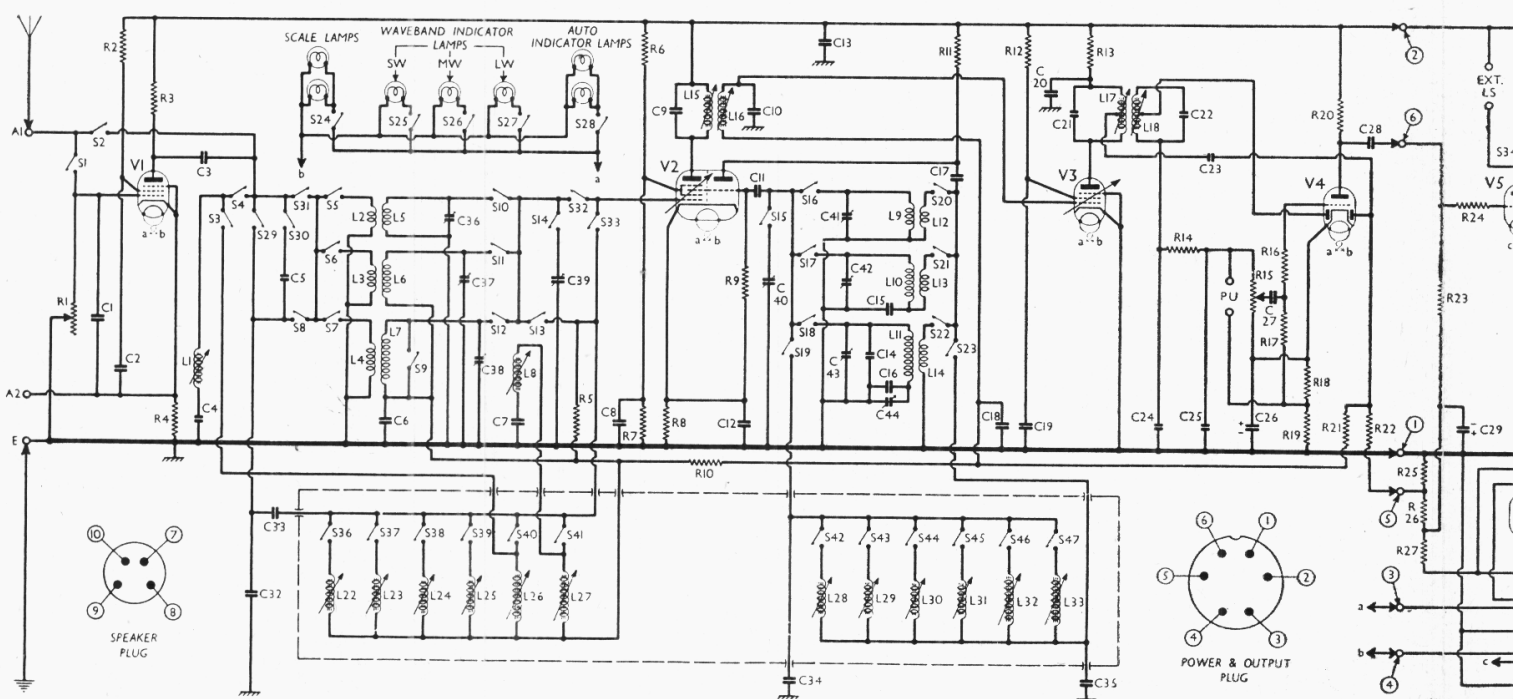
The first valve (**V1, Cossor metallised MSPenB**) is not intended to influence reception unless the special De Monge aerial system employing a twin feeder is used, when it operates as a noise suppressor. The aerial lead proper is connected as before to socket **A1,** and the second (suppressor) lead is connected to **A2.** The earth connection is earthed as usual. The path of the signal from **A1** to the tuning circuits is as described above, but that from **A2,** which is developed across **R4,** is fed to the cathode of **V1** and neutralises any signal (interference) which is common to both leads. **R1** forms an aerial load in the grid circuit of **V1** and is varied by the operator until the best neutralising balance is found.

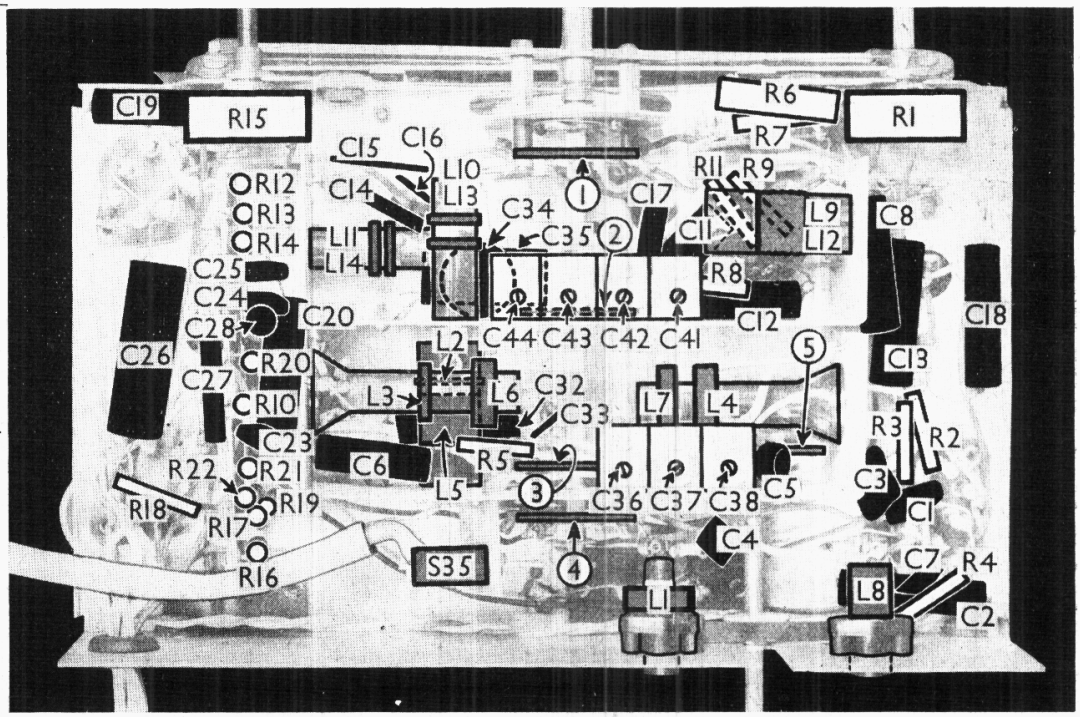
In the diagram, those switches numbered from **S1** to **S28** are those which are controlled by the waveband switch, but the five switches numbered **S29** to **S33** are operated by the setting control, which is used only to adjust the aerial circuit automatic tuning coils. Normally, **S31** and **S32** remain closed, but when the setting control knob is turned one way from its central position, these two switches open and **S29** and **S33** close; if the knob is turned the other way, **S30** closes instead of **S29,** so that **C5** is interposed to increase sharpness of tuning, but **S32** closes as in the central position.

On SW, input from **A1** is via **S2** and coupling coil **L2** to single tuned circuit **L5, C39,** so that **V1** is short-circuited.

Second valve (**V2, Cossor metallised 41 STH**) is a triode hexode operating as frequency changer with internal coupling. For manual tuning, triode oscillator grid coils **L9** (SW), **L10** (MW) and **L11** (LW) are tuned by **C40;** parallel trimming by **C41** (SW), **C42** (MW) and **C14, C43** (LW); tracking by specially-shaped vanes of **C40** (SW), supplemented by condensers **C15** (MW) and **C16, C44** (LW). Reaction by coils **L12** (SW), **L13** (MW) and **L14** (LW).

For automatic tuning, **S19** and **S23** close, so that one of the coils **L28** to **L33** are connected via one of the switches **S42** to **S47,** according to which button is depressed, between the grid and anode circuits. Tuning capacity is provided by **C34** and **C35.**





Under-chassis view. **L1** and **L8** are parts of special filters, and have adjustable cores. Diagrams of the switch units are in col. 6 overleaf. Note the fifth unit, close to **C5** and **L4**.

Third valve (**V3, Cossor metallised MVSPenB**) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C9, L15, L16, C10** and **C21, L17, L18, C22.** Tuning is by adjustment of the iron cores.

Intermediate frequency 465 KC/S.

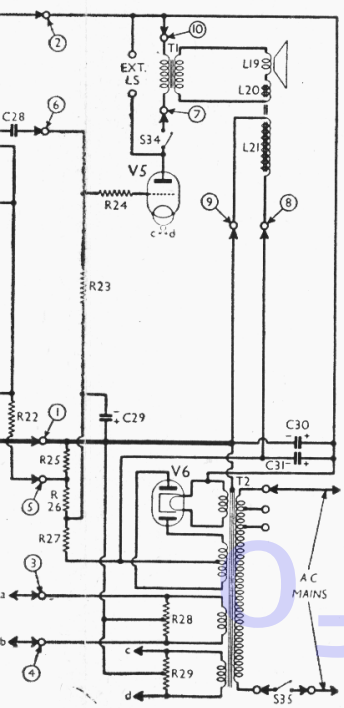
Diode second detector is part of double diode triode valve (**V4, Cossor metallised DDT**). Audio frequency component in rectified output is developed across the manual volume control **R15,** which also operates as load resistance, and passed via AF coupling condenser **C27** and stopper **R16** to CG of triode section, which operates as AF amplifier. IF filtering by **C24, R14, C25.** Provision for connection of gramophone pick-up across **R15, R17.**

Second diode of **V4,** fed from tapping on **L17** via **C23,** provides DC potential which is developed across load resistance **R22** and fed back through decoupling circuits as GB to FC (including auto but excepting SW) and IF valves, giving automatic volume control. Delay voltage is obtained from drop along resistances **R18, R19** in cathode circuit.

Resistance-capacity coupling by **R20, C28** and **R23,** via stopper **R24,** between **V4** triode and triode output valve (**V5, Cossor 2XP**). Provision for connection of high impedance external speaker between anode and HT line. Switch **S34** permits internal speaker to be muted.

HT current is supplied by IHC full-wave rectifying valve (**V6, Cossor 43IU**). Smoothing by speaker field **L21,** which is connected in the HT negative lead to chassis, and dry electrolytic condensers **C30** and **C31.**

Fixed GB for **V2** (in addition to that developed across **R8**) and **V3,** and GB for **V5,** is obtained from potential divider **R25, R26, R27,** which is connected across **L21.**



Circuit diagram of the Cossor 398. **V1** is used for interference suppression, using the special aerial down-lead. Speaker and power and output plug diagrams are inset.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	Interference suppressor control	1,000
R2	V1 SG HT feed	250,000
R3	V1 anode HT feed	50,000
R4	V1 GB resistance	500
R5	V2 hexode CG resistance	2,000,000
R6	V2 SG HT feed potential divider	20,000
R7		30,000
R8	Part V2 fixed GB	130
R9	V2 osc. CG resistance	40,000
R10	V2 hexode CG decoupling	500,000
R11	V2 osc. anode HT feed	30,000
R12	V3 SG HT feed resistance	100,000
R13	V3 anode HT feed	5,000
R14	IF stopper	50,000
R15	Manual volume control; V4 signal diode load	500,000
R16	V4 triode CG stopper	100,000
R17	V4 triode CG resistance	2,000,000
R18	V4 GB and AVC delay resistances	750
R19		1,000
R20	V4 triode anode load	50,000
R21	AVC line decoupling	3,000,000
R22	V4 AVC diode load	1,000,000
R23	V5 CG resistance	500,000
R24	V5 grid stopper	100,000
R25	V3, V5 and part V2 fixed GB; AVC delay	20,000†
R26		300,000†
R27		750,000†
R28	V1-V4 heater circuit pot.	25*
R29	V5 heater circuit pot.	25*

* Centre-tapped. † See Chassis Divergencies.

	CONDENSERS	Values (μF)
C1	V1 CG circuit shunt	0·0002
C2	V1 SG decoupling	0·05
C3	V1 anode coupling	0·0005
C4	261 m filter tuning	0·000065
C5	Auto "setting" coupling	0·000005
C6	V2 hexode CG decoupling	0·05
C7	342 m filter tuning	0·0001
C8	V2 SG decoupling	0·05
C9	1st IF transformer tuning condensers	0·000225
C10		0·000225
C11	V2 osc. CG condenser	0·0001
C12	V2 cathode by-pass	0·1
C13	HT circuit RF by-pass	0·1
C14	Osc. circuit LW fixed trimmer	0·00005
C15	Osc. circuit MW tracker	0·000638
C16	Osc. circuit LW fixed tracker	0·00014
C17	V2 osc. anode coupling	0·0005
C18	V3 CG decoupling	0·05
C19	V3 SG decoupling	0·05
C20	V3 anode decoupling	0·1
C21	2nd IF transformer tuning condensers	0·00006
C22		0·000075
C23	Coupling to V4 AVC diode	0·00005
C24	IF by-pass condensers	0·00005
C25		0·00005
C26*	V4 cathode by-pass	50·0
C27	AF coupling to V4 triode	0·005
C28	V4 triode to V5 AF coupling	0·01
C29*	V5 CG decoupling	10·0
C30*	HT smoothing condensers	16·0
C31*		16·0
C32	Aerial auto tuning input coupling condensers	0·0005
C33		0·00022
C34	Oscillator auto circuit tuning condensers	0·00039
C35		0·00172
C36‡	Aerial circuit SW trimmer	—
C37‡	Aerial circuit MW trimmer	—
C38‡	Aerial circuit LW trimmer	—
C39†	Aerial circ. manual tuning	—
C40†	Osc. circ. manual tuning	—
C41‡	Osc. circuit SW trimmer	—
C42‡	Osc. circuit MW trimmer	—
C43‡	Osc. circuit LW trimmer	—
C44‡	Osc. circuit LW tracker	—

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial 261 m filter coil	3·2
L2	Aerial SW coupling coil	0·6
L3	Aerial MW coupling coil	24·0
L4	Aerial LW coupling coil	135·0
L5	Aerial circuit SW tuning coil	Very low

Continued overleaf

Supplement to The Wireless & Electrical Trader, May 20, 1939

OTHER COMPONENTS (*Continued*)		Approx. Values (ohms)
L6	Aerial MW manual tuning coil	2·25
L7	Aerial LW manual tuning coil	16·0
L8	Aerial 342 m filter coil ..	3·1
L9	Osc. circuit SW tuning coil..	Very low
L10	Osc. manual MW tuning coil	5·8
L11	Osc. manual LW tuning coil	14·0
L12	Oscillator SW reaction ..	0·1
L13	Osc. manual MW reaction ..	2·0
L14	Osc. manual LW reaction ..	6·5
L15	1st IF trans. Pri. ..	3·5
L16	1st IF trans. Sec. ..	4·0
L17	2nd IF trans. Pri., total	17·5
L18	2nd IF trans. Sec., total	17·5
L19	Speaker speech coil	2·0
L20	Hum neutralising coil ..	0·1
L21	Speaker field coil	1,250·0
L22	Aerial circuit automatic tuning coils	1·6
L23		1·8
L24		2·6
L25		3·8
L26		3·25
L27		11·0
L28	Oscillator circuit automatic tuning coils	2·25
L29		2·5
L30		2·25
L31		3·75
L32		6·0
L33		6·2
T1	Speaker input trans. Pri. ..	170·0
	Speaker input trans. Sec. ..	0·15
T2	Mains trans. Pri., total ..	27·0
	Mains trans. V1-V4 heater sec.	0·05
	Mains trans. V5 heater sec. ..	0·05
	Mains trans. Rect. heat. sec. ..	0·05
	Mains trans. HT sec., total ..	250·0
S1-S23	Waveband and auto/manual change switches	—
S24-28	Scale lamps switches ..	—
S29-33	Setting control switches ..	—
S34	Speaker switch	—
S35	Mains switch	—
S36-47	Automatic tuning selector switches	—

DISMANTLING THE SET

Removing Chassis.—The receiver comprises two chassis units: the main chassis and the power and output unit chassis; both independently mounted.

To remove the main chassis, remove the four control knobs from the front of the cabinet and the batten from the rear (two bolts with washers) and withdraw the two connecting plugs from the side of the power and output chassis. Then remove the two press-button indicator lamps from their brackets and the six press-button knobs from their plungers, noting the felt washers on the plungers behind the escutcheon. Remove the two small round-head wood screws holding the scale assembly to the front of the cabinet and the four small round-head wood screws holding the press-button assembly to the top of the cabinet, supporting the chassis with packing.

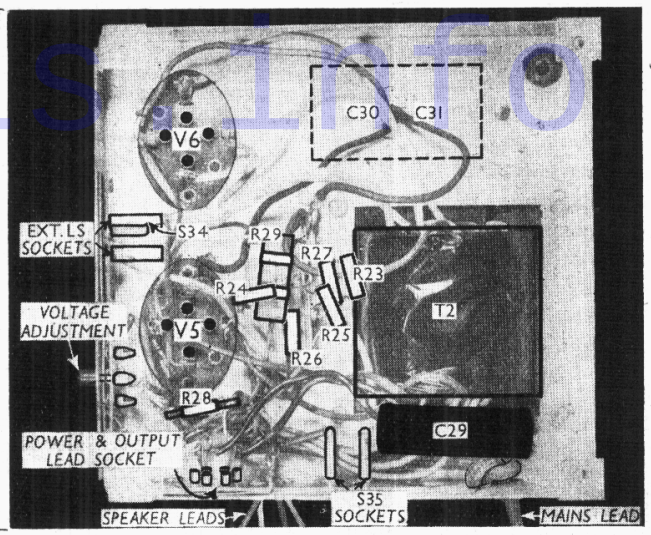
When replacing, see that the two chassis supporting pegs inside the front of the cabinet and those on the batten at the rear are located in the rubber grommets provided for them in the chassis, and that a felt washer, which should be pushed down so that it lies between the escutcheon and the shutter-plate, is fitted to each press-button plunger.

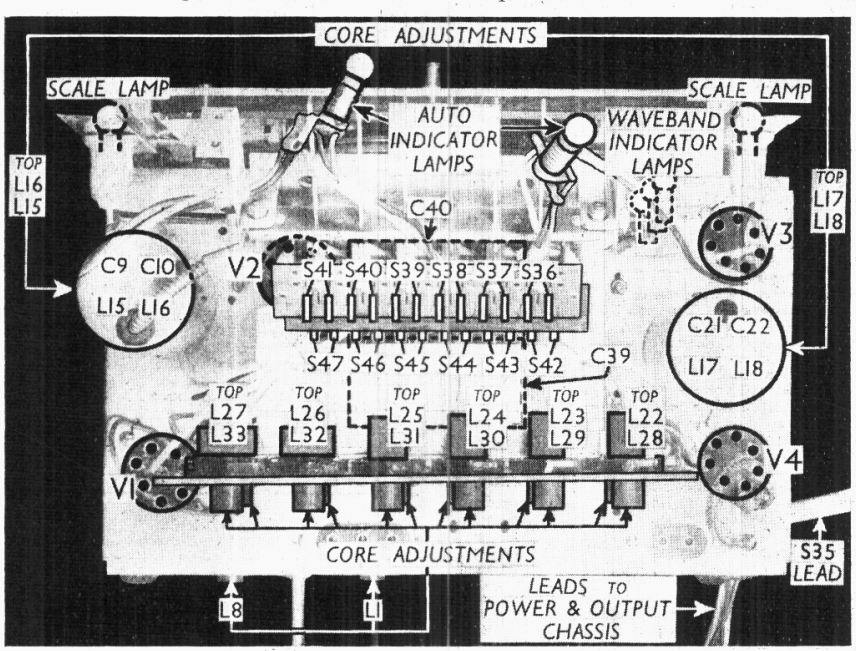
Removing Power and Output Unit.—Remove the batten (mentioned above), and withdraw the two connecting plugs from the side of the unit and the plug from the speaker transformer. Then remove the four bolts (with large metal and rubber washers) holding the unit to the bottom of the cabinet.

When replacing, note that a rubber washer is fitted on each side of the base of the cabinet on each fixing bolt.

Removing Speaker.—Remove the connecting plug from the input transformer, slacken the four square clamp nuts and swivel the clamps. *When replacing*, the transformer should be on the left of the speaker.

Underneath view of the power and output unit. **C30, C31** are in one unit on the deck of this chassis. All the other components are seen in this view. **S34** is associated with one of the Ext. LS sockets.





Plan view of the main chassis, showing the press-button unit and auto-tuning coils.

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 220 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 Voltage (mA)
V1 MSPenB	147	2·6	62	0·9
V2 41STH	290	2·4	100	5·8
	Oscillator			
	112	6·0		
V3 MVSPenB	260	5·2	110	1·6
V4 DDT	132	2·8	—	—
V5 2XP	282	42·0	—	—
V6 43IU	338†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—**S1-S28** are the waveband and scale lamp switches, in four ganged rotary units beneath the chassis. These are indicated in our under-chassis view, and shown in detail in the diagrams (1 to 4) in col. 6, where they are drawn as seen looking from the underside of the chassis in the directions of the arrows. The table (col. 5) gives the switch positions for the five control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed.

The QMB mains switch **S35** is ganged with these switches, and operated by an arm on the main shaft, which opens **S35** in the "off" position, and closes it for all other positions.

S29-S33 are the switches associated with the spring-loaded station setting control, which projects from the rear of the chassis. They are ganged in a single rotary unit, indicated in our under-chassis view, and shown in detail in the fifth diagram in col. 6. In the normal (central) position of the control, **S31** and **S32** are closed; in the clockwise (1) position, **S29** and **S33** are closed; while in the anti-clockwise (2) position, **S30** and **S32** are closed.

S34 is the internal speaker muting switch, associated with one of the Ext. LS sockets, in the power and output unit. On fully inserting the external speaker plug, **S34** opens and breaks the primary circuit of **T1,** thus muting the internal speaker. **S35** is the mains switch.

S36-S47 are the auto-tuning selector switches, ganged in a press-button unit, on the auto-tuning assembly above the chassis deck. The contacts of all these switches are indicated in our plan chassis view. Each button controls two switches (one aerial circuit and one oscillator) which are closed when the button is pressed.

Coils.—**L1** and **L8** are two adjustable iron-cored coils beneath the chassis, with screw adjustments at the rear of the chassis. **L2, L5; L3, L6; L4, L7; L9, L12; L10, L13** and **L11, L14** are in six unscreened units beneath the chassis. The IF transformers **L15, L16** and **L17, L18** are in two screened units on the chassis deck, with core adjustments at the sides of the cans. **L22-L33** are the permeability-tuned auto-tuning coils, in the assembly above the chassis. The aerial coils are the upper ones in each case.

Scale Lamps.—Under this heading come two actual scale lamps, controlled by **S24,** three waveband indicator lamps switched by **S25-S27** and two auto-indicator lamps, controlled by **S28.** They are all Osram MES types, rated at 6·5 V, 0·3 A, with small bulbs.

External Speaker.—Two sockets are provided on the power and output unit for a high impedance (3,000 O) external speaker. **S34** is associated with one of the sockets for muting the internal speaker.

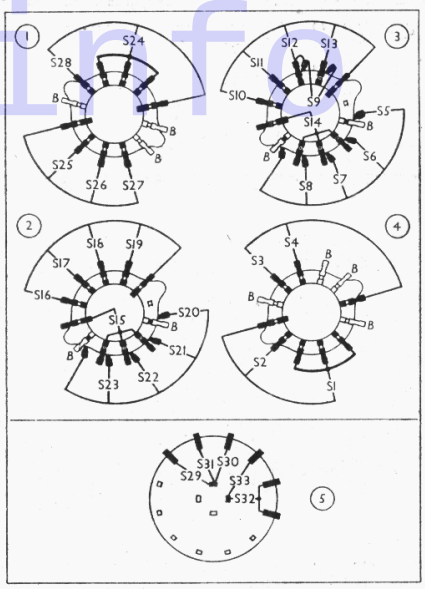
Condensers C30, C31.—These are two 16 μF (450 V working) dry electrolytic condensers, mounted on the power and output unit, and having a common positive (red) lead. The black lead is the negative of **C30,** and the blue lead the negative of **C31.**

Inter-Chassis Connections. — **S35** is linked to the power and output chassis by a 2-pin plug, fitting two sockets mounted at the side of this chassis. The remaining connections between the two chassis are by a 6-way cable, with a 6-pin plug and socket. The connections are numbered and indicated by arrows in the circuit diagram, and inset beneath it is a diagram of the plug, looking at the free ends of the pins. The colour-coding of the connections to the plug is: 1, black; 2, yellow; 3 and 4, yellow systoflex; 5, blue; 6, red.

A small 4-pin plug and socket at the end of a 4-way lead provide the connections between the power and output unit and the speaker. These connections are numbered 7 to 10 in the circuit diagram, and a diagram of the plug is inset below. The coding of the plug connections is: 7, red; 8, blue; 9, black; 10, yellow.

TABLE AND DIAGRAMS OF THE SWITCH UNITS

Switch	Off	SW	MW	LW	AT
S1	—	—	C	C	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	C	C	—
S15	—	C	C	C	—
S16	—	C	—	—	—
S17	—	—	C	—	—
S18	—	—	—	C	—
S19	—	—	—	—	C
S20	—	C	—	—	—
S21	—	—	C	—	—
S22	—	—	—	C	—
S23	—	—	—	—	C
S24	—	C	C	C	—
S25	—	C	—	—	—
S26	—	—	C	—	—
S27	—	—	—	C	—
S28	—	—	—	—	C



Diagrams of the five switch units, four for wave-changing and the fifth for station setting. They are viewed as shown by the arrows in the under-chassis picture.

Valve V5.—This is a 2 V directly-heated type, and its heater is run from a separate secondary (c, d) of **T2.**

Chassis Divergencies.—In later models, **R25, R26** and **R27** may have values different from those shown in our table of resistances. Their values may be respectively 7,000 O, 90,000 O and 150,000 O. **C10** is shown directly across **L16** by the makers; in our receiver it is returned to chassis. The speaker field may be 1,000 O.

PRESS-BUTTON SETTING

First tune in the desired station manually, and choose the correct button for the particular wavelength. Numbering the buttons from left to right, looking at the front of the set, the wavelength coverages are given in the table below.

Button	Wavelength Range (m)
1	186 - 283
2	215 - 315
3	310 - 455
4	380 - 545
5	1,100 - 1,475
6	1,450 - 1,930

Depress the chosen button, but do not touch any other controls. Turn the setting switch at the rear of the chassis to position 1 (clockwise) and turn the upper screw adjustment associated with the button chosen until the station is heard. Allow setting switch to return to normal.

Now move the wavechange switch to the AT position, and turn the lower adjusting screw until the station is accurately tuned. Make certain that it *is* the correct station, as several may be tunable under these conditions.

Finally, re-adjust the upper screw for maximum volume. If this adjustment is unduly flat, hold the setting switch in position 2 (anti-clockwise) while adjusting.

CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator via a 0·1 μF condenser to control grid (top cap) of **V3** and chassis, feed in a 465 KC/S signal, and adjust the cores of **L17** and **L18,** having first softened the wax by the application of a warm screwdriver. Transfer signal generator to top cap of **V2,** and similarly adjust cores of **L15, L16.** The existing lead to each top cap should be left in position, and the response curve of the IF stages should be symmetrical, with a perceptible flat top when viewed on an oscilloscope.

RF and Oscillator Stages.—With gang at maximum, pointer should cover the vertical lines at the extreme right-hand ends of the scales. Connect signal generator to **A1** and **E** sockets, via a suitable dummy aerial. Turn noise suppressor knob fully anti-clockwise.

LW.—Switch set to LW, and tune to 1,200 m on scale. Feed in a 1,200 m (250 KC/S) signal, and adjust **C43,** then **C38,** for maximum output. Feed in a 1,875 m (160 KC/S) signal, tune it in, and adjust **C44** for maximum output, while rocking the gang for optimum results. Repeat the LW adjustments.

MW.—Switch set to MW, and tune to 214 m on scale. Feed in a 214 m (1,400 KC/S) signal, and adjust **C42,** then **C37,** for maximum output. Tracking is fixed on this band.

SW. — Switch set to SW, tune to 18 MC/S on scale, and feed in an 18 MC/S (16·67 m) signal. Adjust **C41,** then **C36** for maximum output. **C41** must be adjusted to the peak involving the smaller trimmer capacity.

L1, C4 Filter.—This has to be set to 261 m to reject the National stations when operating on LW (manual or AT). Feed a 261 m signal into the **A1** and **E** sockets, and tune it in manually at about 1,370 m on LW. Adjust core of **L1** (rear of chassis) for *minimum* output.

L8, C7 Filter.—This is for the rejection of London Regional on AT button 6. Feed in a 342·1 m signal, switch set to AT, and depress button 6. Adjust the lower adjusting screw for this button until the signal is tuned in, then adjust the core of **L8** (rear of chassis) for *minimum* output.