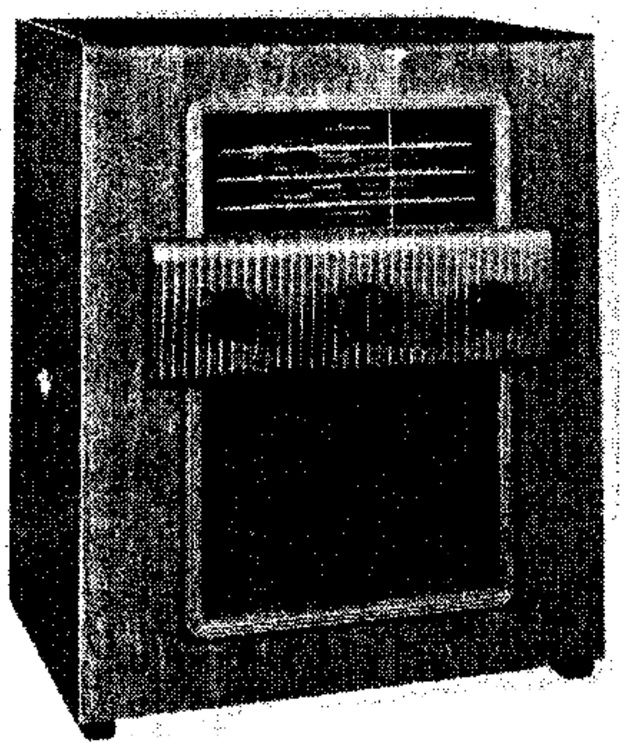
COSSOR 456AC

3-BAND SUPERHET



The Cossor 456AC Superhet.

A CHASSIS divided into two units is employed in the Cossor 456AC receiver, a 4-valve (plus rectifier) 3-band A.C. superhet. Interconnecting points between the two units are shown in the circuit diagram.

There is provision for the connection of a gramophone pick-up and a high impedance external speaker, a rejector circuit in series with the aerial lead is tuned to the intermediate frequency, and variable tone control is provided.

The short-wave range is 16.35-51.3 metres, and the receiver is suitable for mains of 200-250 V, 40-100 c/s. The output valve is a directly heated triode, its filament being returned to chassis via the transformer winding. The speaker field is in the H.T. negative lead, and a potential divider across it provides grid bias voltages.

Release date and original price: April, 1946; £19 6s 10d, plus £4 3s 2d purchase tax.

CIRCUIT DESCRIPTION

Aerial input is via intermediate frequency rejector circuit **L1, C1,** aerial series capacitor **C2** and coupling coils **L2** (S.W.), **L3** (M.W.) and **L4** (L.W.) to single-tuned circuits **L5, C33** (S.W.), **L6, C33** (M.W.) and **L7, C33** (L.W.). I.F. rejector tuning is effected by adjusting the variable iron core of **L1.**

First valve **(V1, Cossor metallised 41STH)** is a triode-hexode operating as frequency changer with internal coupling. Triode oscillator grid coils **L8** (S.W.), **L9** (M.W.) and **L10** (L.W.) are tuned by **C34;** parallel trimming by **C35** (S.W.), **C36** (M.W.) and **C10, C37** (L.W.); series tracking by **C11** (M.W.) and **C12, C38** (L.W.). There is no tracking capacitor on the S.W. band. Part of **L12** is included in the tuned circuit with **L9.**

Reaction is applied from anode via coupling capacitor **C13** and coils **L11** (S.W.), **L12** (M.W.) and **L13** (L.W.).

Second valve **(V2, Cossor metallised**

Circuit diagram of the Cossor 456AC 3-band superhet. Connecting points between the main receiver chassis and the power and outpu the diagram. Four more connections (numbered **7** to **10**) show the positions of the connections between the speaker and the power and outpu the lower part of it is included in the tuned circuit with **L9.** The filament (cathode) of the 2V output valve is returned to chassis via the second

MVS PenB) is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary iron-dust cored transformer couplings **C5, L14, L15, C6** and **C17, L16, L17, C18.** The tuning capacitors are fixed, and alignment adjustments are effected by varying the positions of the cores.

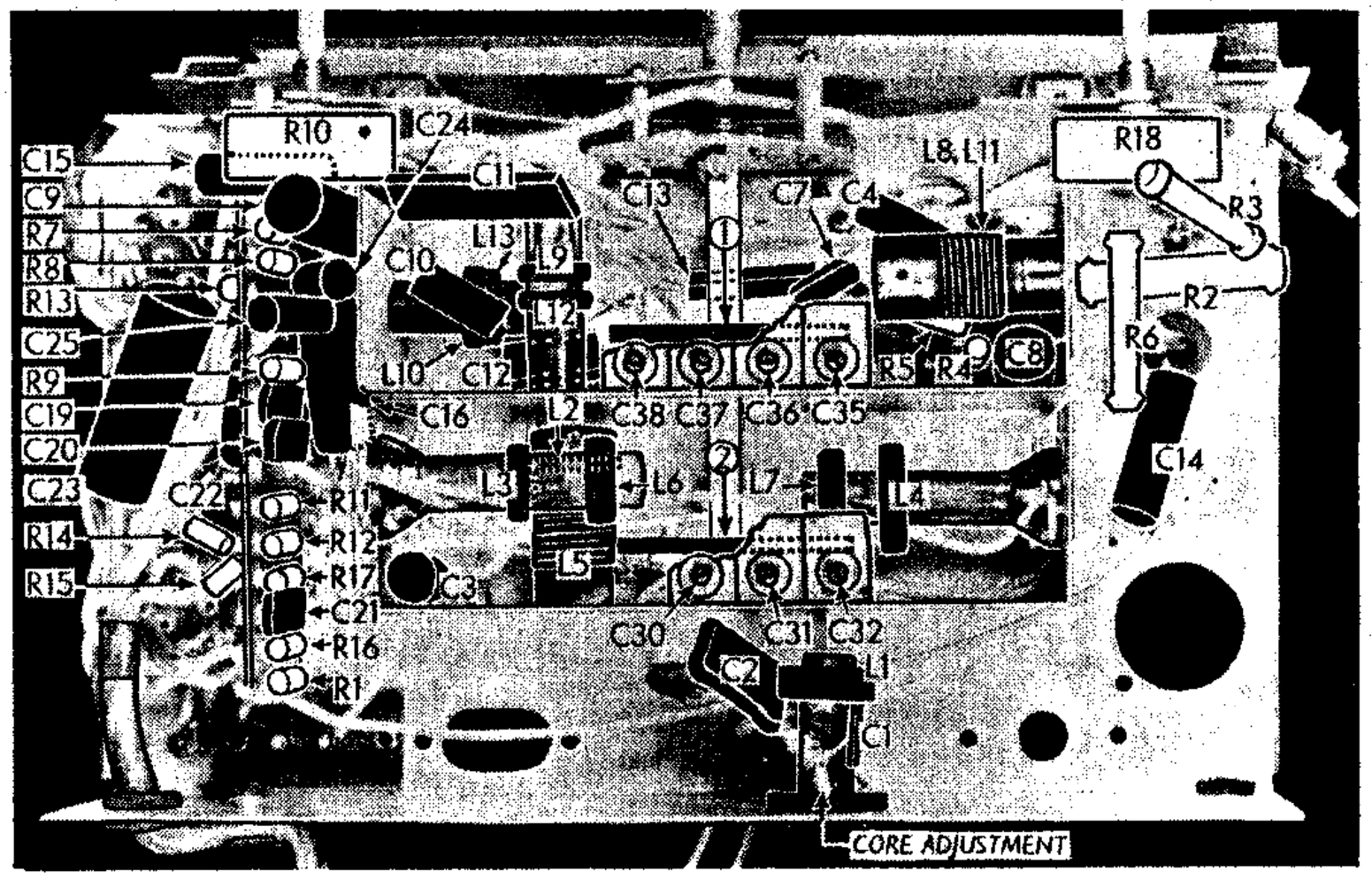
Intermediate frequency 465 kc/s.

Diode second detector is part of double diode triode valve **(V3, Cossor metallised DDT).** Audio frequency component in rectified output is developed across manual volume control **R10,** which also operates as load resistor, and passed via A.F. coupling capacitor **C22,** C.G. resistor **R12** and grid stopper **R11** to C.G. of triode section, which operates as an A.F. amplifier.

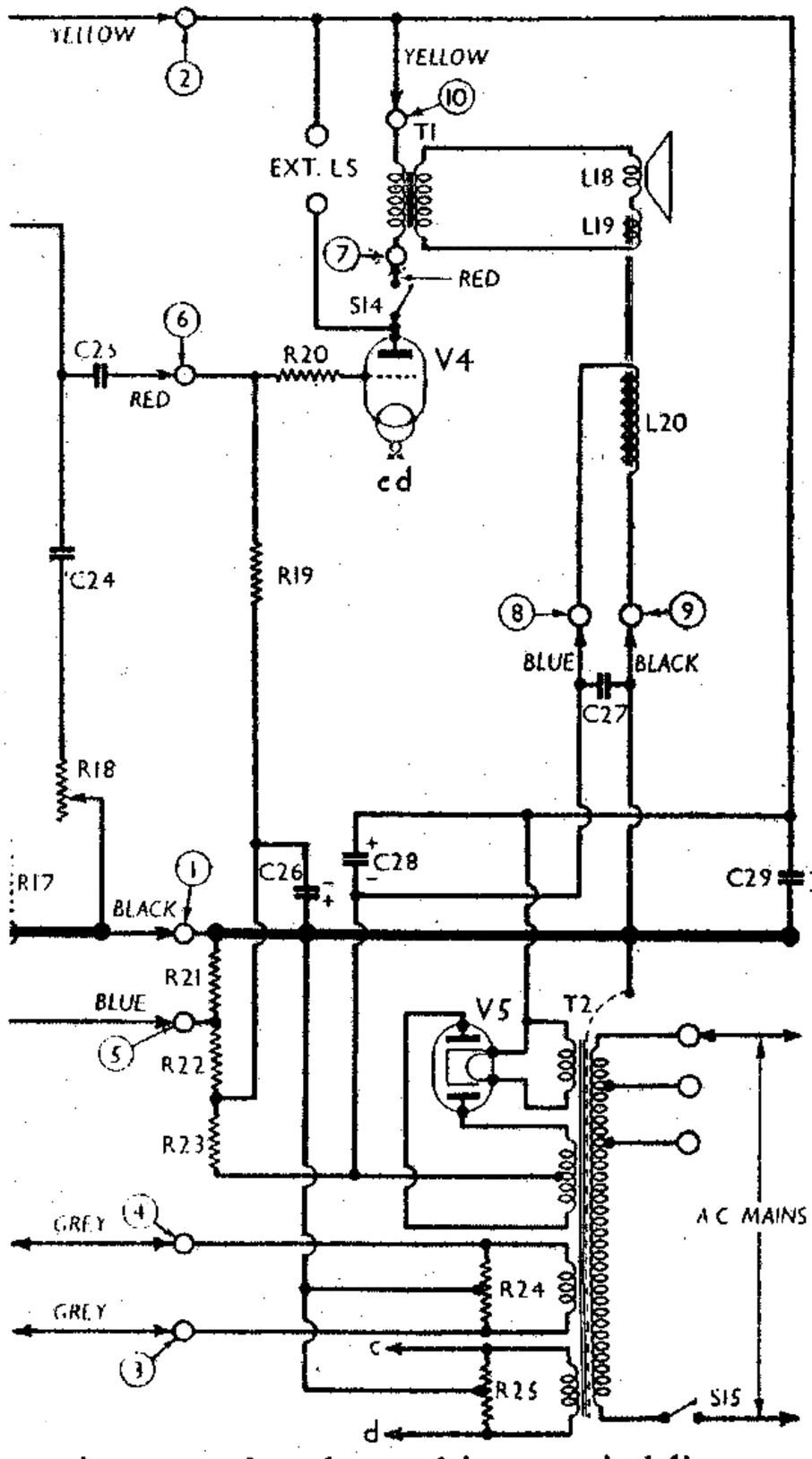
I.F. filtering by **C19, R9** and **C20** in diode circuit, and by **R11** and the valve input capacitance in triode C.G. circuit.

Provision for connection of gramophone pick-up by sockets across **R10, C23.** Variable tone control by **C24** and **R18,** which are connected in series between **V3** triode anode and chassis.

Second diode of **V3,** fed from tapping on **L16** via **C21,** provides D.C. potential which is developed across load resistor **R17** and fed back through decoupling circuits as G.B. to F.C. (except on S.W. band)



Underside view of the main chassis. The aerial and oscillator tuning components are in two screened compartments. Their associated switch units (1 and 2) are shown in detail in diagrams in col. 2 overleaf, where they are viewed from the front.



t unit are numbered 1 to 6 in a vertical line across : unit. **L12** in the oscillator circuit is tapped, and lary winding **c, d,** on **T2** and the potential divider **R25.**

and I.F. valves, giving automatic volume control. Delay voltage, together with G.B. for triode section, is obtained from drop along resistors **R14** and **R15** which form a potential divider in cathode lead to chassis.

Resistance-capacitance coupling by **R13, C25** and **R19,** via grid stopper **R20,** between **V3** triode and directly-heated filament triode output valve **(V4, Cossor 2P).** This valve has a two-volt filament, which is energised from a special two-volt heater secondary on the mains transformer **T2.** Across this heater circuit is connected a centre-tapped wire-wound resistor **R25** for purposes of earthing the filament and applying grid bias.

Sockets are provided on the power and output chassis for the connection of a high-impedance external speaker. They are connected to **V4** anode and H.T. positive respectively, and on one of them switch **S14** is so fitted that, if the connecting plug is partly inserted, both speakers are in circuit, while if the plug is pushed fully home, **S14** opens automatically. The primary of the internal speaker transformer **T1** is thus disconnected from **V4** anode, muting the internal speaker, and the H.T. current in the anode circuit must then flow via the external speaker circuit.

H.T. current is supplied by I.H.C. full-wave rectifying valve **(V5, Cossor 431U).** Smoothing is effected by speaker field **L20,** which is connected in the H.T. negative lead to chassis, and dry electrolytic capacitors **C28** and **C29.** H.T. circuit R.F. filtering by **C9.**

Fixed G.B. potential for **V1** (in addition to that developed across **R4)** and **V2,** and G.B. for **V4,** are obtained from the junctions of **R21, R22** and **R23** which form a potential divider across **L20** in the negative H.T. lead. The voltage developed across **R21** will, of course, form part of the A.V.C. delay potential in addition to that which is developed across **R14** and **R15.**

COMPONENTS AND VALUES

	CAPACITORS	Values (μF)
C1	Aerial I.F. filter tuning ...	0·00025
C2	Aerial series capacitor ...	0·0005
C3	V1 hex. C.G. decoupling	0·05
C4	V1 S.G. decoupling ...	0·05
C5, C6	1st I.F. transformer tuning capacitors	0·000225, 0·000225
C7	V1 osc. C.G. capacitor ...	0·0001
C8	V1 cathode by-pass ...	0·1
C9	H.T. circuit R.F. by-pass	0·1
C10	Osc. L.W. fixed trimmer...	0·00005
C11	Osc. M.W. fixed tracker ...	0·000638
C12	Osc. L.W. fixed tracker ...	0·00014
C13	V1 osc. anode coupling ...	0·0005
C14	V2 C.G. decoupling ...	0·05
C15	V2 S.G. decoupling ...	0·05
C16	V2 anode decoupling ...	0·1
C17, C18	2nd I.F. transformer tuning capacitors	0·00006, 0·000075
C19, C20	I.F. by-pass capacitors ...	0·00005, 0·00005
C21	V3 A.V.C. diode coupling	0·00005
C22	V3 C.G. coupling... ...	0·005
C23*	V3 cathode by-pass ...	50·0
C24	Part variable tone control	0·01
C25	V3 triode to V4 A.F. coupling	0·01
C26*	V4 C.G. decoupling ...	12·0
C27	Speaker field shunt ...	0·05
C28*, C29*	H.T. smoothing capacitors	8·0, 8·0
C30‡	Aerial circ. S.W. trimmer	—
C31‡	Aerial circ. M.W. trimmer	—
C32‡	Aerial circ. L.W. trimmer	—
C33†	Aerial circuit tuning ...	—
C34†	Oscillator circuit tuning...	—
C35‡	Osc. circ. S.W. trimmer...	—
C36‡	Osc. circ. M.W. trimmer...	—
C37‡	Osc. circ. L.W. trimmer...	—
C38‡	Osc. circ. L.W. tracker ...	—

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTORS	Values (ohms)
R1	V1 hex. C.G. decoupling ...	470,000
R2	V1 S.G. H.T. potential divider	22,000
R3		33,000
R4	V1 fixed G.B. resistor ...	150
R5	V1 osc. C.G. resistor ...	22,000
R6	V1 osc. anode H.T. feed ...	33,000
R7	V2 S.G. H.T. feed ...	100,000
R8	V2 anode H.T. feed ...	4,700
R9	I.F. stopper	47,000
R10	Manual volume control; V3 signal diode load ...	500,000
R11	V3 grid stopper	100,000
R12	V3 C.G. resistor	2,200,000
R13	V3 triode anode load ...	47,000
R14	V3 triode G.B. and A.V.C. delay resistors	1,000
R15		1,000
R16	A.V.C. line decoupling ...	3,300,000
R17	V3 A.V.C. diode load ...	1,000,000
R18	Variable tone control ...	250,000
R19	V4 C.G. resistor	470,000
R20	V4 grid stopper	100,000
R21	G.B. and A.V.C. delay potential divider resistors	6,800
R22		68,000
R23		150,000
R24	Heater circuit potential dividers...	25*
R25		25*

* Centre tapped.

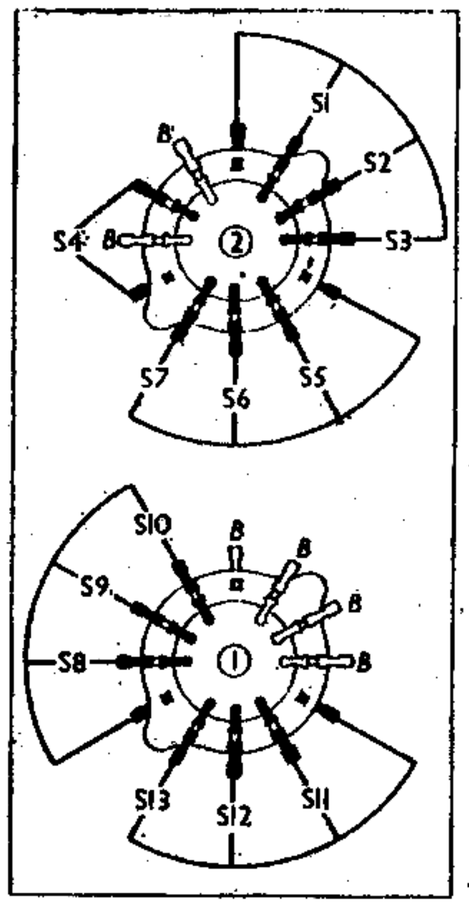
	OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial I.F. filter coil ...		4·0
L2	Aerial S.W. coupling coil...		0·4
L3	Aerial M.W. coupling coil		24·0
L4	Aerial L.W. coupling coil...		150·0
L5	Aerial S.W. tuning coil ...		Very low
L6	Aerial M.W. tuning coil ...		2·0
L7	Aerial L.W. tuning coil ...		15·0
L8	Osc. S.W. tuning coil ...		Very low
L9	Osc. M.W. tuning coil ...		4·5
L10	Osc. L.W. tuning coil ...		15·0
L11	Osc. S.W. reaction coil ...		0·15
L12	Osc. M.W. reaction coil ...		4·5
L13	Osc. L.W. reaction coil ...		7·0
L14	1st I.F. trans.	Pri. ...	4·5
L15		Sec. ...	4·5
L16	2nd I.F. trans.	Pri., total	18·0
L17		Sec., total	18·0
L18	Speaker speech coil ...		2·0
L19	Hum neutralising coil ...		0·15
L20	Speaker field coil		1,000·0
T1	Speaker input trans.	Pri.	100·0
		Sec.	0·15
T2	Mains trans.	Pri., total ...	28·0
		V1–V3 heat, sec.	0·1
		V4 heater sec. ...	0·1
		Rect. heat. sec.	0·2
		H.T. sec., total	240·0
S1-S13	Waveband switches ...		—
S14	Speaker switch		—
S15	Mains switch		—

DISMANTLING THE SET

Removing Chassis.—To remove the receiver chassis, take off the four control knobs (recessed grub screws);

slacken the two round-head wood screws retaining the scale positioning clamps at the top corners of the cabinet;

Switch Diagrams



Diagrams of the two waveband switch units, drawn as seen when viewed from the front of an inverted chassis. The associated table appears below.

Switch Table

Switch	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

unplug the interconnecting cable from the power and output unit;

remove the metal supporting batten at the rear of the chassis (one cheese-head screw and washer at each end), taking the weight of the chassis with one hand while removing screws with the other.

When replacing, note that two large grommets (two front and two rear) are correctly positioned to accept the supporting lugs.

Removing Power and Output Unit.—Unplug the four-way cable from the speaker output transformer;

slacken the inside locking nut on the mains switch at the side of the cabinet, then remove the fixing nut from the outside of the cupped escutcheon, and push the switch into the cabinet;

remove the four cheese-head fixing screws (with large metal and rubber washers) holding the unit to the cabinet bottom.

When replacing, ensure that two rubber washers are fitted to each fixing bolt, one either side of the bottom of the cabinet.

Removing Speaker.—Withdraw the connecting plug from the speaker transformer, and remove the four cheese-head screws (with lock washers) holding the speaker to the sub-baffle.

When replacing, the transformer should be at the bottom.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those quoted in the manufacturers' manual. Their receiver was operating on mains of 200 V, using the 200 V tapping on the mains transformer. The aerial was disconnected, and the receiver was tuned to 320 m.

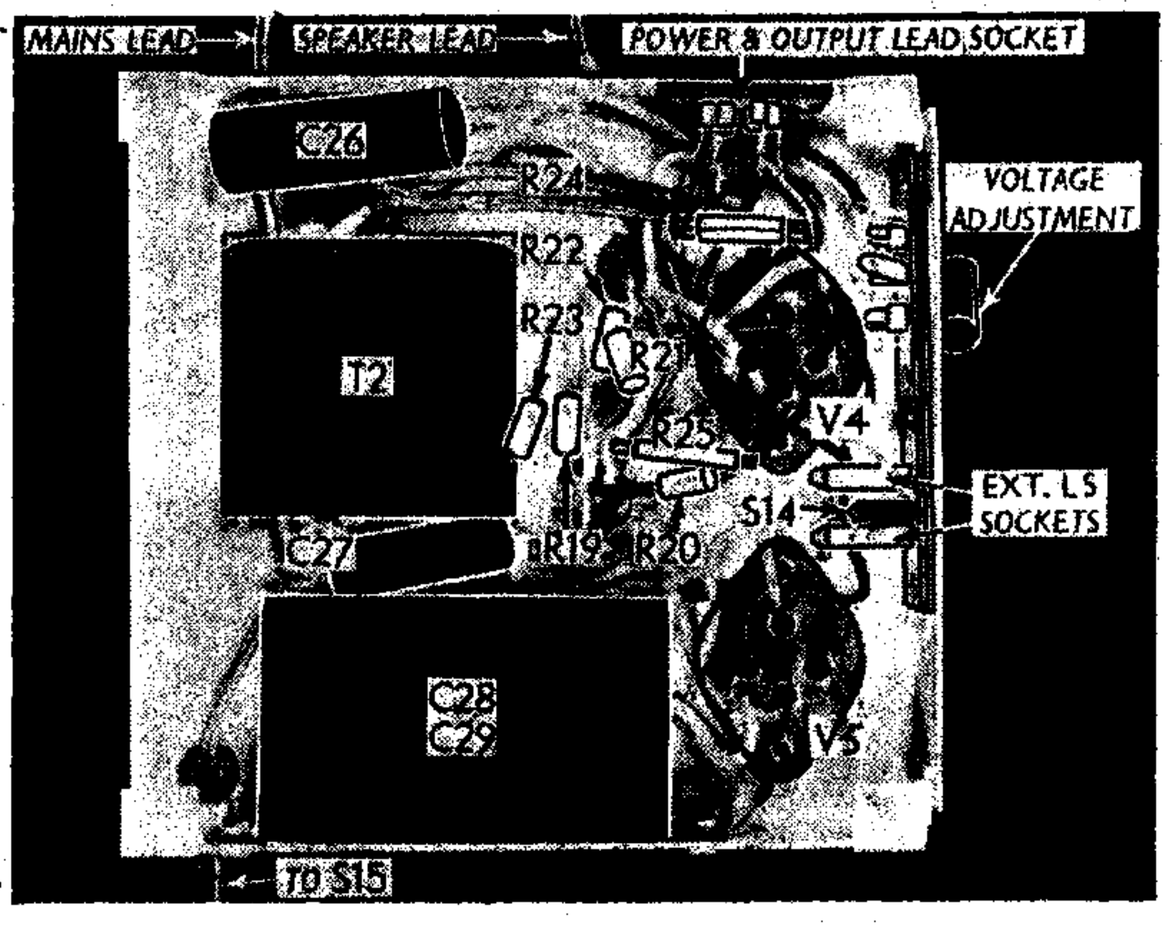
Voltages were measured with a popular type of test meter whose negative lead was connected to chassis. The unsmoothed H.T. voltage is quoted as 345 V.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 41STH	276	1·5	110	5·0
	Oscillator			
	80	6·0		
V2 MVSPenB	246	5·0	116	1·5
V3 DDT	149	2·3	—	—
V4 2P	270	43.0	—	—
V5 43IU	295†	—	—	—

† Each anode to H.T. negative, A.C.

GENERAL NOTES

Switches.—S1-S13 are the waveband switches, in two ganged rotary units beneath the chassis. These are indicated in our under-chassis view, and are shown in detail in the diagrams in col. 2, where they are drawn as seen when viewed from



Underside view of the power and output unit. The socket for the lead from the main receiver chassis (connections 1 to 6) is seen. The speaker plug (connections 7 to 10) is on the far end of the speaker lead. The mains switch S15 fits on the side of the cabinet.

the underside of the chassis in the direction indicated by the arrows.

The table (col. 2) gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed.

S14 is the internal speaker muting switch, associated with one of the Ext. L.S. sockets, in the power and output unit. When the external speaker connecting plug is fully inserted in the sockets, **S14** opens and breaks the connection between **T1** primary winding and the anode of the output valve, thus muting the internal speaker.

S15 is the Q.M.B. mains switch, mounted in a cupped escutcheon on the side of the cabinet and wired to the power and output chassis.

Coils.—L1 is the intermediate frequency rejector coil, mounted on the rear member of the chassis, and shown in our underchassis view with its fixed tuning capacitor. It has an adjustable iron-dust core, reached through a hole in the chassis, through which the moulded former protrudes.

The aerial and oscillator coils **L2, L5; L3, L6; L4, L7** and **L8, L11; L9, L12; L10, L13** are in six unscreened tubular units, mounted in two screened compartments beneath the chassis.

The I.F. transformers **L14, L15** and **L16, L17** are in two screened units on the chassis deck with their associated fixed tuning capacitor. The screw core adjustments of the variable iron-dust cores are reached through holes in the sides of the cans; their positions are indicated approximately in our plan chassis view.

Pre-set Capacitors.—All the aerial trimmers and the oscillator trimmers and trackers are mounted in the screened compartments with their coils beneath the chassis, and they are shown in our underchassis view.

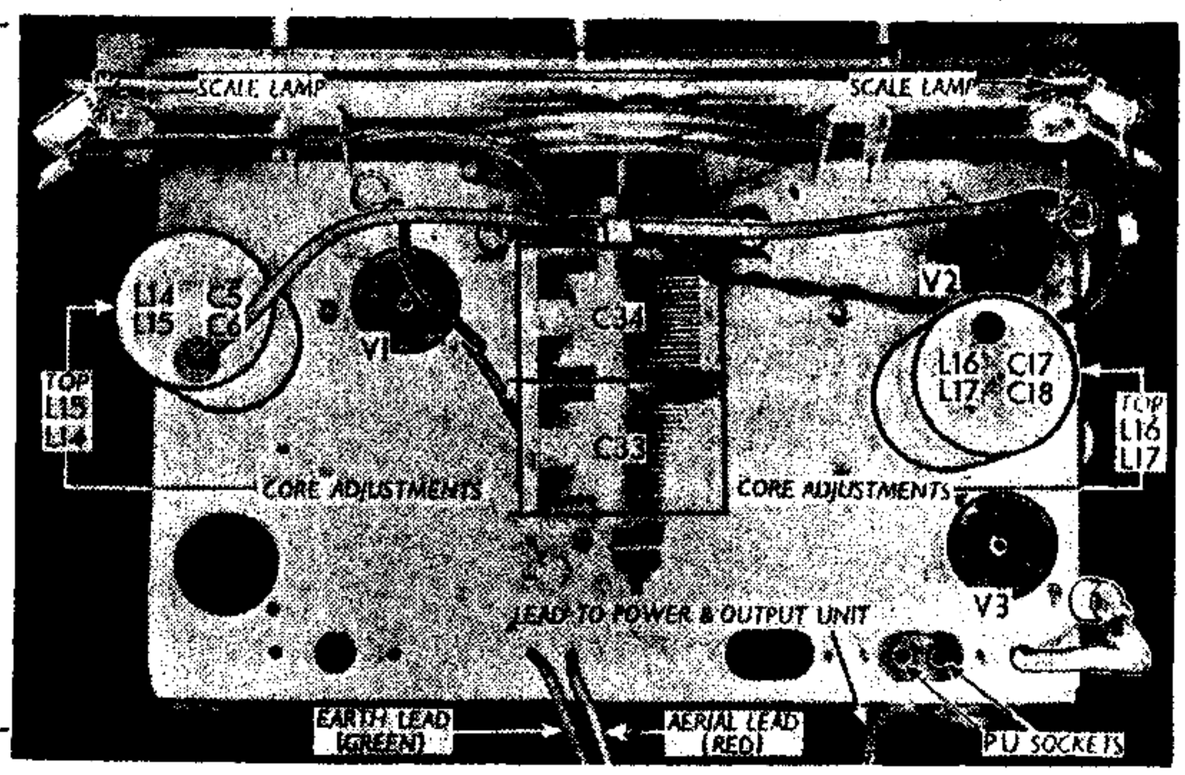
Scale Lamps.—These are two Osram M.E.S. type lamps, rated at 6.5 V, 0.3 A. They have small bulbs.

External Speaker.—Two sockets are provided on the power and output chassis for connection of a high impedance (3,000 Ω) external speaker. **S14** is associated with one of these sockets for muting the internal speaker.

Capacitors C28, C29.—These are two 8 μF (450 V working) dry electrolytic capacitors in a cardboard container, mounted beneath the power and output chassis. The red lead is the positive of **C29,** whose negative (black) lead is connected to chassis. The yellow lead is the positive of **C28,** its negative lead being blue.

Inter-Chassis Connections.—The connections between the two chassis are by a 6-way cable, with a 6-pin plug and socket. The connections are numbered 1 to 6, and indicated by arrows in the circuit diagram, while inset beneath it is a diagram of the plug, drawn as seen when viewed from the free ends of the pins. The colour-coding of the connections to the plug is: 1, black; 2, yellow; 3 and 4, grey; 5, blue; 6, red.

A small 4-pin plug and socket at the end of a 4-way lead provides 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, drawn as seen when viewed from the free ends of the pins, is inset below it. The colour-coding of the plug connections is: 7, red; 8, blue; 9, black; 10, yellow.



Plan view of the main chassis, which contains only three of the valves. Arrows indicate approximately the positions of the I.F. coil core adjustments.

Resistors R24, R25.—These are two wire-wound 25 Ω centre-tapped fixed potential dividers, situated beneath the power and output unit.

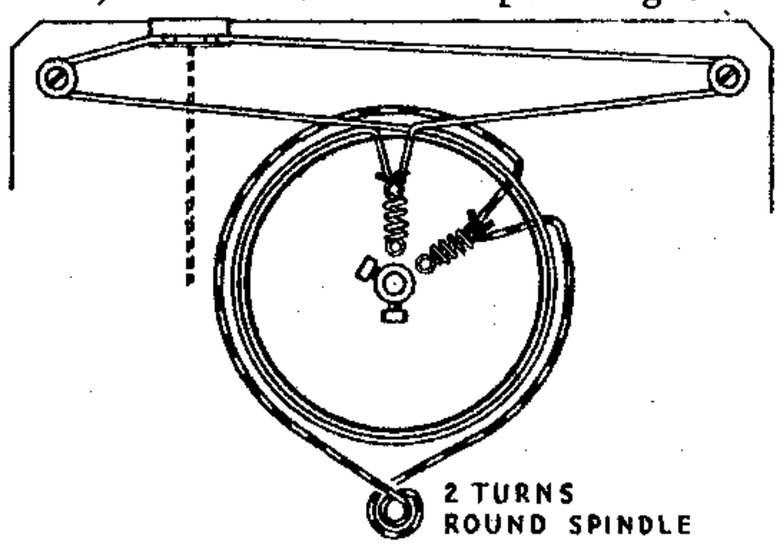
Valve V4.—This is a 2 V Cossor 2P directly heated triode, which derives its heater supply from a separate secondary winding (**c, d**) of the mains transformer **T2.**

Drive Cord Replacements

There are two cords used in the tuning drive, one from the control spindle to the drum, and another from the drum to the scale pointer.

The course taken by these cords is very simple, and can be seen easily from the sketch below, where the whole system is represented as seen from the rear. The position shown is that adopted by the drum and pointer when the gang is at maximum capacitance.

The whole operation of replacing both cords can be easily carried out without dismantling the scale assembly, but it should be noted that the drive cord from the spindle goes in the front groove of the drum, while that from the pointer goes in the rear groove. In order to distinguish between the two cords, one is shown plain in our sketch, while the other is shown in alternate black and white links. The two cords are, of course, actually of the same material.



Sketch showing the positions of the drive cords, as seen from the rear. One is dotted to distinguish it from the other.

The pointer should be fitted last, being clamped to the cord by pressing the tongues on the carriage round the cord. The gang should be at maximum, and the pointer should cover the small white "breaks" in the coloured lines running along the length of the top and bottom scales.

CIRCUIT ALIGNMENT

I.F. Stages.—Connect signal generator via a 0.1 μF capacitor to control grid (top cap) of **V2** and chassis, short-circuit **C34** to stop the oscillator, feed in a 465 kc/s (645.2 m) signal, and adjust the cores of **L16** and **L17,** softening the wax by the application of a warm screwdriver. Transfer signal generator to top cap of **V1,** and similarly adjust cores of **L14, L15.**

The existing lead to each top cap should be left in position, and the response curve of the I.F. stages should be symmetrical, with a perceptible flat top when viewed on an oscilloscope. After these adjustments, remove short-circuit from **C34.**

I.F. Rejector.—Connect signal generator to **A** and **E** leads, tune to top of M.W. band, feed in a strong 465 kc/s signal, and adjust core of **L1** for minimum output.

R.F. and Oscillator Stages.—With gang at maximum, pointer should cover the small white "breaks" in the coloured horizontal scale lines near the right-hand ends of the top and bottom scales. Connect signal generator leads to **A** and **E** leads on set, via a suitable dummy aerial. This may consist on M.W. and L.W. of a 0.0002 μF capacitor, and on S.W. of a 400 Ω resistor.

L.W.—Switch set to L.W., and tune to 1,200 m on scale. Feed in a 1,200 m (250 kc/s) signal, and adjust **C37,** then **C32,** for maximum output. Feed in a 1,875 m (160 kc/s) signal, tune it in, and adjust **C38** for maximum output, while rocking the gang for optimum results. Repeat the L.W. adjustments.

M.W.—Switch set to M.W., and tune to 214 m on scale. Feed in a 214 m (1,400 kc/s) signal, and adjust **C36,** then **C31,** for maximum output. Tracking is fixed.

S.W.—Switch set to S.W., tune to 18 Mc/s on scale, and feed in an 18 Mc/s (16.67 m) signal. Adjust **C35,** then **C30** for maximum output, while rocking the gang for optimum results. **C35** must be adjusted to the peak involving the smaller trimmer capacitance.

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