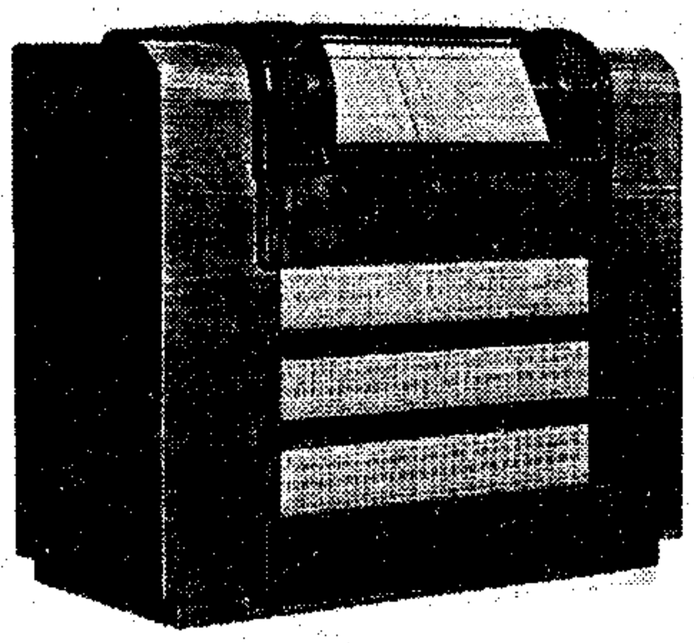
EKCO BAW98

5-VALVE BATTERY SUPERHET



THE 41·5 MC/S television sound channel (referred to below as TS) and a range of 19-50 m (SW) are covered by the Ekco BAW98 5-valve battery superhet, in which the valve arrangement comprises a variable-mu hexode mixer, a triode oscillator, a variable-mu hexode IF amplifier, a double-diode triode and a double pentode output valve in a QPP stage. Provision is made for both a gramophone pick-up and an extension speaker and there is a switch for cutting out the internal speaker.

Release date: August, 1937.

It is regretted that permission to publish the circuit diagrams of Ekco sets is still not available, but the information given is sufficient to enable any competent engineer to effect repairs.

CIRCUIT DESCRIPTION

Aerial input on MW and LW via coupling condenser **C1** to tapping on **L3** (MW) and coupling coil **L2** (LW) to inductively-coupled band-pass filter. Primary coils **L3, L4** are tuned by **C28** via **S8** (MW) or **S9** (LW); secondaries **L9, L10** are tuned by **C34.** IF filter **C2, L1** is connected across **L2** and has an adjustable iron core. On television sound, referred to as TS, and SW bands, input is via **S1** and coupling coil **L5** (TS) or **S2** and **L6** (SW) to single-tuned circuits **L7, C34** (TS) or **L8, C34** (SW). Provision for connection of dipole aerial at socket **A** and unmarked socket immediately below it. Socket **E** should remain connected to earth. Image suppression by condenser **C30** between **L9** and **C1.**

Tuned circuits are connected via switches **S10** (TS), **S11** (SW), **S12** (MW) or **S13** (LW) to CG of first valve (**V1, Mullard metallised VP2B**), a variable-mu RF hexode, which operates as frequency changer with suppressor grid injection in conjunction with triode oscillator valve (**V2, Cossor metallised 210HF** or **Mullard PM1HL** or **Ekco T21**). Oscillator anode coils **L11** (TS and SW), **L12** (MW) and **L13** (LW) are tuned by **C36**; parallel trimming by **C37** (SW), **C38** (MW) and **C39** (LW); series tracking by **C7** (MW) and **C8** (LW), these last two condensers being shunted by resistances **R5** and **R6** to provide a path for HT current to **V2** anode. Reaction by grid coils **L14** (TS and SW), **L15** (MW) and **L16** (LW) connected in series, **S7** short-circuiting **L15** and **L16** on TS and SW, and **S8** short-circuiting **L16** on MW. Coupling between **V1** suppressor grid and **V2** anode is effected by **C6.**

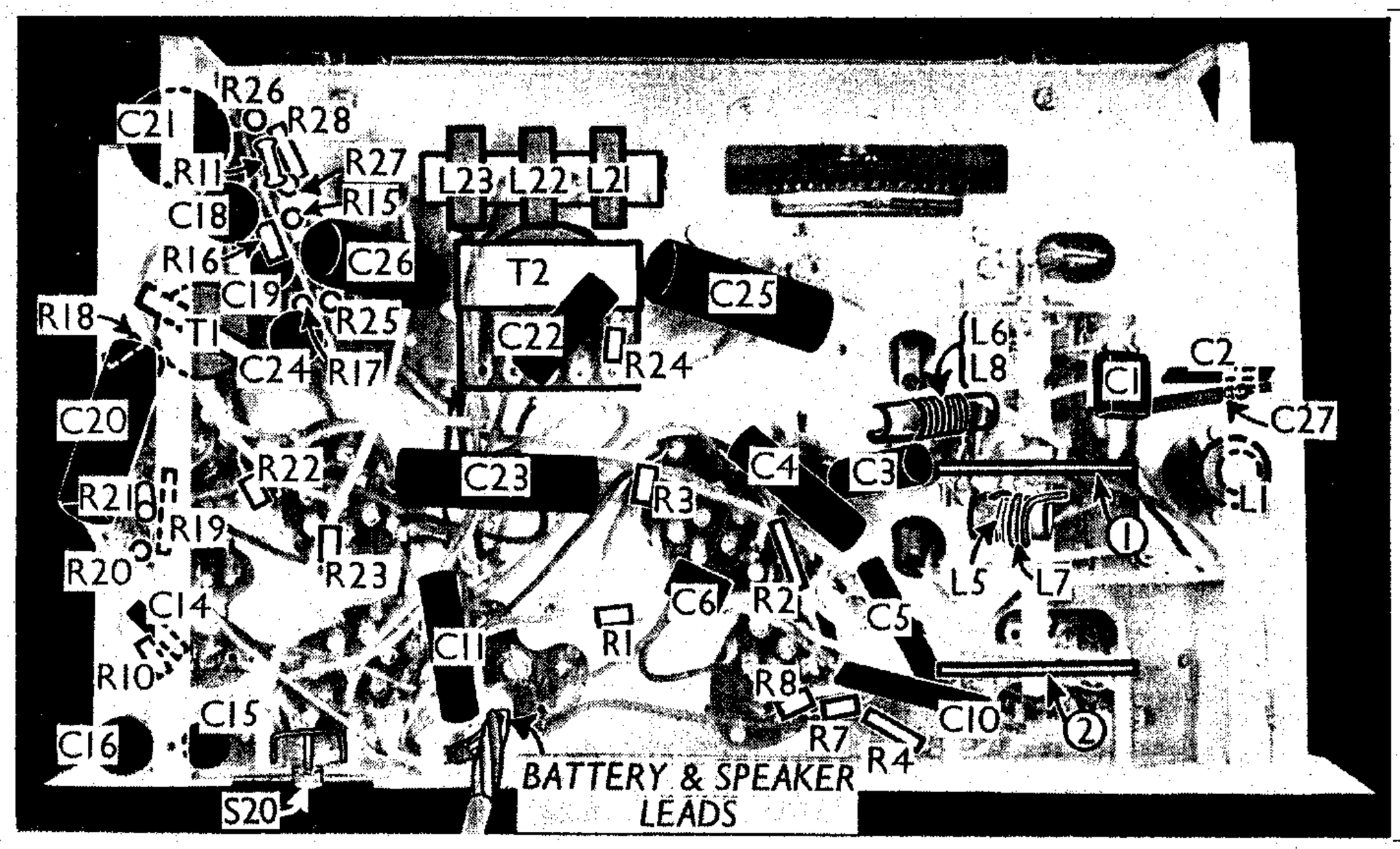
Third valve (**V3, Mullard metallised VP2B**) is a variable-mu RF hexode, with second and fourth grids strapped, operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformers **C40, L17, L18, C41** and **C42, L19, L20, C43.**

Intermediate frequency 126·5 KC/S.

Diode second detector is part of double diode triode valve (**V4, Mullard metallised TDD2A** or **Ekco DT21**). Audio frequency component in rectified output is developed across load resistance **R10,** the low potential end of which is connected to LT positive line, and passed via AF coupling condenser **C15** and manual volume control **R14** to CG of triode section which operates as AF amplifier, **R13** being shunted across **R14.** Variable tone control by RC filter **C17, R12** also across **R14.** Provision for connection of gramophone pick-up, again across **R14.** IF filtering by **C13, R9, C14; R9** being connected between **L20** and **R10,** and **C13, C14** being each connected between one side of **R9** and chassis.

Second diode of **V4,** fed from **V3** anode via **C12,** provides DC potential which is developed across load resistance **R20** and fed back through decoupling circuits as GB to FC and IF valves, giving AVC.

Parallel-fed transformer coupling by **R18, C20** and **T1,** via grid stoppers **R22, R23,** between **V4** triode and quiescent



Under-chassis view. **C27** is a small semi-variable condenser. The core of **L1** is adjustable through a hole in the chassis deck. Diagrams of the switch units are on the back of this sheet. **L5** and **L7** are the aerial coils for the television sound band.

push-pull output valve (**V5, Mazda QP230**). Fixed tone correction by **C22, R24** between anodes.

The output transformer **T2** has three windings; a centre-tapped primary connected between the anodes of **V5,** a secondary from which the speaker is operated and a tertiary which provides negative feed-back. Provision is made for the connection of a low impedance external speaker across part of secondary winding, while the internal speaker is connected across the whole of that winding via a whistle filter circuit **C25, L21, L22, L23, C26** and a switch **S20** for muting purposes, if desired, when the external speaker is being used. One side of the secondary winding, one side of the speech coil and one side of the tertiary winding are connected to chassis.

The other side of the last goes via **C24, R25** and **R17** to one side of **R15,** the other side of which is taken to chassis, so that a fraction of the signal voltage across the tertiary is developed across **R15; C24, R25** modifying the frequency response. The response is further modified by **C19, R16** connected in series across **R15.** Switch **S19** is also connected across **R15.** The low potential end of **R14** returns to chassis via a decoupling condenser **C18** and **R15** so that any voltage across **R15** is injected into the grid circuit of **V4** triode to introduce negative feed-back. On TS and SW. bands, **S19** closes, connecting **C18** directly to chassis, so that no feed-back occurs on these bands. On gramophone, however, negative feed-back can be introduced or dispensed with at will by operating the waveband switch control.

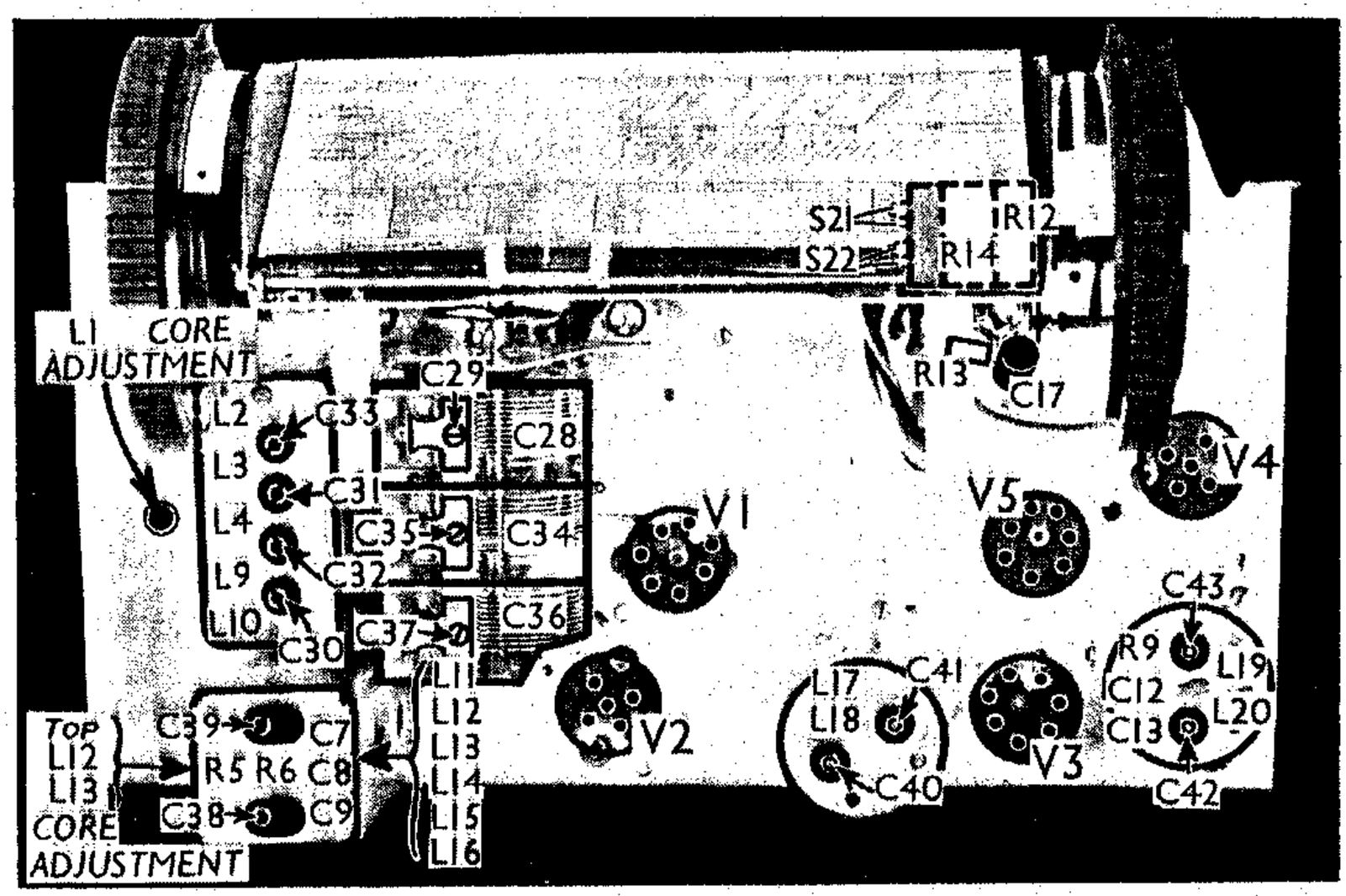
Fixed GB for **V1** and **V3,** GB for **V4** triode and **V5** and AVC delay potential are obtained automatically from drop along **R26** in negative HT lead to chassis, the appropriate potentials being tapped off at the junctions of resistances **R11, R27** and **R28** which form a potential divider across **R26, R11** being connected to chassis. Its junction with **R27,** at which point is connected one end of **R14,** provides GB for **V4** triode, fixed GB for **V1** and **V3,** and AVC delay; the junction of **R27** and **R28** provides GB for **V5,** being connected to the centre-tap of **T1** secondary. The further end of **R28** is connected to HT negative lead together with one end of **R26.**

DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, remove the two screws (with washers) holding the chassis to the shelf, the two round-head wood screws holding the front of the chassis to the cabinet, and the two screws (with lock washers) holding the brackets on the scale assembly to the top of the cabinet.

Next unsolder the speaker leads and remove the two screws (with lock washers) holding the shelf to the back of the cabinet. Now remove the shelf and let the back of the chassis drop downwards, when the chassis can be withdrawn from the cabinet.

Removing Speaker.—To remove the speaker from the cabinet, slacken the four clamps holding the speaker to the sub-baffle and *when replacing*, see that the terminal panel is at the bottom.



Plan view of the chassis. The cores of **L12** and **L13** are adjustable through holes in the side of the can.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 CG decoupling	250,000
R2	V1, V3 SG's HT feed	150,000
R3	V1 injector grid resistance	500,000
R4	V2 anode HT feed resistances	10,000
R5		100,000
R6		100,000
R7	V2 CG resistance	100,000
R8	V2 CG stabiliser	150
R9	IF stopper	250,000
R10	V4 signal diode load	250,000
R11	Part of auto GB pot. divider	200,000
R12	Variable tone control	1,500,000
R13	Manual volume control shunt	500,000
R14	Manual volume control	1,000,000
R15	Parts negative feed-back coupling	500
R16		150
R17		9,000
R18	V4 triode anode load	50,000
R19	AVC line decoupling	1,000,000
R20	V4 AVC diode load	750,000
R21	V1, V2, V3 and V4 HT feed	5,000
R22	V5 grids RF stoppers	100,000
R23		100,000
R24	Part of fixed tone corrector	50,000
R25	Part of negative feed-back	20,000
R26	Auto GB resistance	1,280
R27	Parts of auto GB potential divider	3,000,000
R28		500,000

	CONDENSERS	Values (μF)
C1	Aerial MW coupling	0·001
C2	Aerial IF filter tuning	0·00015
C3	V1 CG decoupling	0·04
C4	V1, V3 SG's RF by-pass	0·1
C5	V2 anode decoupling	0·02
C6	V1 injector grid coupling	0·00005
C7	Osc. circuit MW tracker	0·002
C8	Osc. circuit LW tracker	0·0008
C9	Osc. circuit LW fixed trimmer	0·00006
C10	V2 CG condenser	0·00004
C11	V3 CG decoupling	0·04
C12	Coupling to V4 AVC diode	0·000015
C13	IF by-pass condensers	0·0002
C14		0·0002
C15	AF coupling to V4 triode	0·01
C16*	V1, V2, V3 and V4 HT line decoupling	4·0
C17	Part of variable tone control	0·005
C18	V4 CG decoupling	0·25
C19	Part of neg. feed-back coupling	0·1
C20	AF coupling to T1	0·25
C21*	V5 CG's decoupling	2·0
C22	Part of fixed tone corrector	0·0025
C23*	HT reservoir condenser	10·0
C24	Part of neg. feed-back circuit	0·2
C25	Parts of whistle filter	0·1
C26		0·3

Continued in next column

	CONDENSERS (*Continued*)	Values (μF)
C27‡	Band-pass pri. LW trimmer	—
C28†	Band-pass primary tuning	—
C29‡	Band-pass pri. MW trimmer	—
C30‡	Image suppressor	—
C31‡	Aerial circuit SW trimmer	—
C32‡	Band-pass sec. MW trimmer	—
C33‡	Band-pass sec. LW trimmer	—
C34†	Band-pass sec., and SW and TS tuning	—
C35‡	Aerial circuit TS trimmer	—
C36†	Oscillator circuit tuning	—
C37‡	Osc. circuit SW trimmer	—
C38‡	Osc. circuit MW trimmer	—
C39‡	Osc. circuit LW trimmer	—
C40‡	1st IF trans. pri tuning	—
C41‡	1st IF trans. sec. tuning	—
C42‡	2nd IF trans. pri. tuning	—
C43‡	2nd IF trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial IF filter coil		37·0
L2	Aerial LW coupling coil		180·0
L3	Band-pass primary coils		2·5
L4			27·0
L5	Aerial TS coupling coil		Very low
L6	Aerial SW coupling coil		0·4
L7	Aerial TS tuning coil		Very low
L8	Aerial SW tuning coil		0·05
L9	Band-pass secondary tuning coils		2·5
L10			27·0
L11	Oscillator TS and SW tuning coil		0·05
L12	Oscillator MW tuning coil		3·0
L13	Oscillator LW tuning coil		8·0
L14	Oscillator TS and SW reaction		0·4
L15	Oscillator MW reaction		1·8
L16	Oscillator LW reaction		4·5
L17	1st IF trans.	Pri.	80·0
L18		Sec.	80·0
L19	2nd IF trans.	Pri.	80·0
L20		Sec.	80·0
L21	Parts of whistle filter		3·6
L22			2·6
L23			2·0
L24	Speaker speech coil		24·0
T1	Intervalve trans.	Pri.	475·0
		Sec., total	3,500·0
T2	Output trans.	Pri., total	1,350·0
		Sec., total	3·2
		Tert.	65·0
S1-S18	Waveband switches		—
S19	Negative feed-back switch		—
S20	Speaker switch		—
S21	HT circuit switch	ganged R14	—
S22	LT circuit switch		—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating with an HT battery reading 150 V on load. 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 Current (mA)
V1 VP2B . .	117	0·6	32	0·4
V2 210HF	40	0·6	—	—
V3 VP2B . .	117	0·5	32	0·2
V4 TDD2A	72	0·8	—	—
V5 QP230. .	132†	2·6†	135	1·5

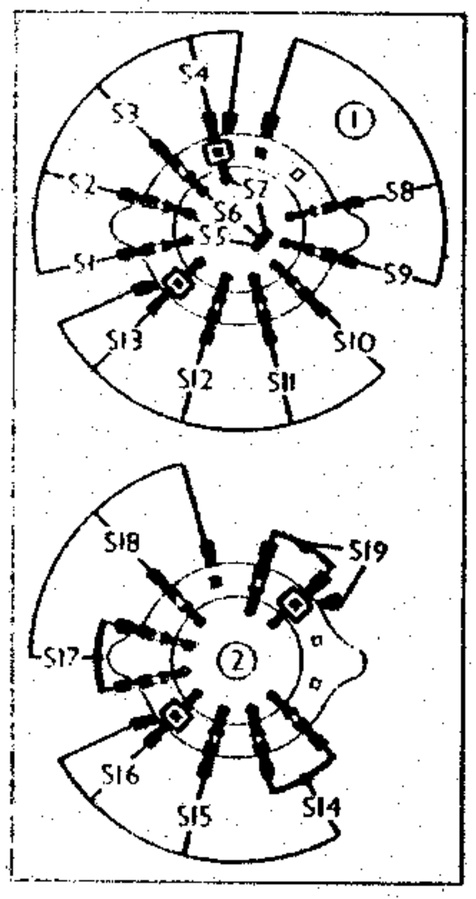
† Each anode.

GENERAL NOTES

Switches.—**S1-S18** are the waveband switches, and **S19** the negative feed-back switch, in two rotary units beneath the chassis, indicated in our under-chassis view, and shown in detail in the diagrams below, where they are as seen looking at the rear of the underside of the chassis.

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

Switch	LW	MW	SW	TS
S1	—	—	—	C
S2	—	—	C	—
S3	—	C	—	—
S4	C	—	—	—
S5	—	—	—	C
S6	—	—	C	C
S7	—	C	C	—
S8	—	C	—	—
S9	C	—	—	—
S10	—	—	—	C
S11	—	—	C	—
S12	—	C	—	—
S13	C	—	—	—
S14	—	—	C	C
S15	—	C	—	—
S16	C	—	—	—
S17	—	—	C	C
S18	—	C	—	—
S19	—	—	C	C



Diagrams of the switch units, as seen from the rear of the underside of the chassis.

S20 is the internal speaker switch, which is mounted at the rear of the chassis near the external speaker sockets, and controlled by a small milled knob. When this is unscrewed, the internal speaker speech coil circuit is broken, thus muting the speaker.

S21 and **S22** are the QMB battery circuit switches, ganged with the volume control **R14.**

Coils.—**L1** is mounted beneath the chassis, and has an adjustable iron core, reached through a hole in the chassis deck. **L2, L3, L4, L9, L10** and **L11-L16** are in two screened units on the chassis deck. The first of these units contains four trimmers reached through holes in the top of the can. The second contains two trimmers (reached through holes in the top of the can) and the three fixed condensers **C7-C9,** while the cores of **L12** and **L13** are adjustable through holes in one side of the can. **L5, L7** and **L6, L8** are on small tubular formers, supported directly on their switch units beneath the chassis.

L17, L18 and **L19, L20** are the IF transformers in two further screened units on the chassis deck. They contain their associated trimmers, while the second also includes **R9, C12** and **C13.**

The filter coils **L21-L23** are on a single former beneath the chassis, and are unscreened.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (4 O) external speaker. The internal speaker can be muted by unscrewing **S20.**

Condensers C9, C27.—These are small condensers formed of wires spiralled over insulated wires. **C9** is inside the oscillator coil unit, while **C27** is beneath the chassis near the switch units. The latter is adjustable by sliding the spiralled winding over the straight wire.

Batteries.—LT, 2 V 24 or 30 AH accumulator cell, Pertrix SU30 or SU24; Exide CZK3, LCA3 or RPB3; Dagenite PML9; Ever Ready T284; Hellesens T284. HT, 147 V or 150 V dry battery, Pertrix 114 or 414; Drydex H.1054; Ever Ready W.1183; Hellesens W/B98; Siemens 1344.

Battery Leads and Voltages.—Black lead, spade tag, LT negative; red/white lead, spade tag, LT positive 2 V; white lead and plug, HT negative; red lead and plug, HT positive 147 or 150 V. GB is automatic.

Chassis Divergencies.—**R2** and **R9** may be 100,000 O each. In our chassis they are 150,000 O and 250,000 O respectively. A 0·00003 μF condenser may be fitted from triode anode of **V4** to chassis.

Possible Faults.—The following hints are given by the makers. If the drive slips, this can be caused by excessive load on the drive. Temporarily detach the drive cord from the cursor carrier and check that the latter slides easily on the bar. If necessary, apply a trace of grease. Check that the carrier is clear of the escutcheon. If not, it must be adjusted, after removing the escutcheon. If the cursor will not move to the ends of the scale, the carrier is probably displacing the drive cord so that it does not run in line with the pulleys.

If instability occurs, the metal coating of **V3** may be disconnected from pin 5 on the base; alternatively, **C11** or **C16** may be O/C.

Crackle on the SW band may be due to a defect in **C3,** or the metal braiding to the gang may be touching chassis at some point other than the soldered connection.

Boomy MW reproduction may be due to the spring leaf of **C38** vibrating in sympathy with the signal. Tune to a weak MW station at about 220 m, remove trimmer nut, insert a hooked piece of thick wire through the hole in the coil can, and lift trimmer leaf to increase its resiliency. Replace trimmer nut, and adjust for maximum output from the selected station to restore MW calibration.

Excessive HT consumption (appreciably greater than 10mA) may be due to **C21** or **C23** short-circuited, or to **R22, R23** or **R28** open-circuited. It should be noted that reversal of the HT battery will cause a breakdown of **C23,** and will burn out **R26.**

CIRCUIT ALIGNMENT

See that cursor line covers the 550 m mark when gang is at maximum. Volume control should be at maximum.

IF Stages.—Connect signal generator to **E** socket, and via a 0·02 μF condenser to grid (top cap) of **V1,** leaving existing clip in position. Switch set to LW, turn gang to indicate 1,950 m on scale, feed in a 126·5 KC/S signal, and adjust **C40, C41, C42** and **C43** for maximum output.

RF and Oscillator Stages.—Connect signal generator to **A** and **E** sockets, and feed in a 15 MC/S signal. Switch set to SW and tune to 15 MC/S on scale. Fully unscrew **C37,** then screw it in slowly. Two peaks will be obtained, of which the *first* reached is correct. Adjust to this accurately.

Feed in a 20·75 MC/S signal (its second harmonic being 41·5 MC/S), at full generator output. Then switch to TS, tune to TS mark on scale, and adjust **C35** for maximum output.

Switch to SW, feed in a 15 MC/S signal, tune to 15 MC/S on scale, and adjust **C31** for maximum output.

Switch set to MW, tune to 250 m on scale, and feed in a 1,200 KC/S signal. Fully unscrew **C38** and then screw it in slowly, adjusting accurately to the *first* peak reached. Now adjust **C32** and **C29** for maximum output. Tune to 500 m on scale, feed in a 600 KC/S signal, and adjust iron core of **L12** for maximum output, while rocking the gang for optimum results. Repeat the adjustments at 250 and 500 m.

Switch set to LW, tune to 1,100 m on scale, feed in a 272·5 KC/S signal, and adjust **C39, C33** and **C27** for maximum output. **C27** is adjusted by sliding the spiralled wire on the insulating sleeve over the straight wire.

Tune to 1,700 m on scale, feed in a 176·5 KC/S signal, and adjust core of **L13** for maximum output, while rocking the gang.

Leaving set tuned to 1,700 m, feed in a 126·5 KC/S signal at full generator output, and adjust core of **L1** for *minimum* output. Reduce generator output, and adjust to 272·5 KC/S. Tune to 1,100 m on scale, and repeat LW alignment as above.

Switch set to MW, feed in a 1,000 KC/S signal at full generator output. Tune receiver to image of generator frequency (about 400 m) and adjust **C30** for *minimum* output.

Tune to 250 m, feed in a 1,200 KC/S signal, and re-adjust **C32** for maximum output.