BUSH SSW33

3-BAND A.C. SUPERHET

A SHORT-WAVE range of 17-53 metres is covered by the Bush SSW33 4-valve (plus rectifier) A.C. all-wave superhet. Provision is made for both a gramophone pick-up and an extension speaker and a plug and socket device allows the internal speaker to be cut out of circuit when desired.

A similar chassis is fitted in the RG33 radio-gramophone, and in the automatic version of the RG33, but with the addition of pick-up switching.

CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. via coupling coils **L1** (M.W.) and **L3** (L.W.) to capacity coupled band-pass filters. Primaries **L2** (M.W.), **L4** (L.W.) are tuned by **C28**; secondaries **L7** (M.W.), **L8** (L.W.) are tuned by **C32**; coupling by small condenser **C2** (M.W.), **C3** (L.W.) and common capacity **C1.** On S.W. band aerial input is via coupling coil **L5** to single tuned circuit comprising coil **L6** and tuning condenser **C32.**

First valve (**V1, Mullard metallised TH4**) is a triode-hexode operating as frequency changer with internal coupling. Oscillator grid coils **L9** (S.W.), **L11** (M.W.), and **L13** (L.W.) are tuned by **C33**; parallel trimming by **C34** (S.W.), **C35** (M.W.), **C10, C36** (L.W.); series tracking by **C8** (S.W.), **C9, C37** (M.W.), **C38** (L.W.); oscillator anode reaction coils **L10** (S.W.), **L12** (M.W.), **L14** (L.W.).

Second valve is a variable-mu H.F. pentode (**V2, Mullard metallised VP4B**) operating as intermediate frequency amplifier with special triple-tuned transformer couplings **C39, L15, L16, C40, L17, C41** and **C42, L18, L19, C43, L20, C44.**

Intermediate frequency 465 KC/S.

Diode second detector is part of double diode triode valve (**V3, Mullard metallised TDD4**). Audio-frequency component in rectified output is developed across load resistance **R15** and passed via coupling condenser **C15,** manual volume control **R13** and I.F. stopper **R26** to C.G. of triode section which operates as L.F. amplifier. Provision for connection of gramophone pick-up.

Second diode of **V3,** fed from **V2** anode via **C21,** provides D.C. potential which is developed across **R19** and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic volume control. Delay voltage is obtained from drop along **V3** cathode resistance **R16.**

Resistance-capacity coupling by **R18, C20, R22, R23** between **V3** triode and pentode output valve (**V4, Mazda AC2/Pen**). Variable tone control by R.C. filter **R25, C23** in anode circuit. Provision for connection of low impedance external speaker across secondary of internal speaker transformer **T1.** Plug and socket arrangement enables internal speaker speech coil circuit to be broken.

H.T. current is supplied by I.H.C. full-wave rectifying valve (**V5, Mullard IW4/350**). Smoothing by speaker field coil **L23** and dry electrolytic condensers **C24** and **C25.**

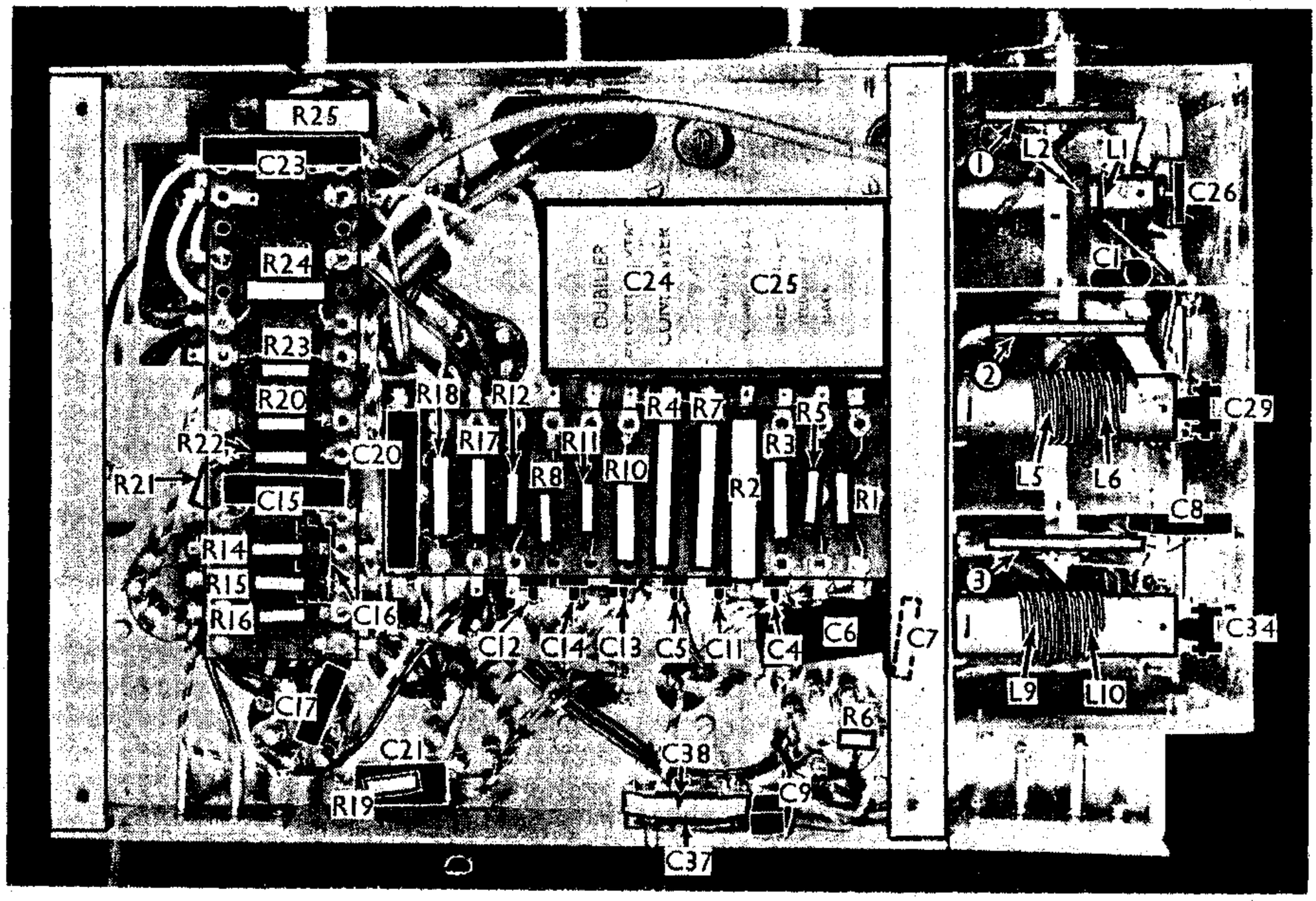
COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Band-pass bottom coupling ..	0·03
C2	Band-pass M.W. top coupling	Very low
C3	Band-pass L.W. top coupling	Very low
C4	V1 hexode S.G.'s by-pass ..	0·1
C5	V1, V2 anodes decoupling ..	0·1
C6	V1 cathode by-pass	0·1
C7	V1 osc. C.G. condenser ..	0·00005
C8	Oscillator S.W. tracker ..	0·0043
C9	Oscillator M.W. tracker ..	0·0004
C10	Oscillator L.W. trimmer ..	0·0001
C11	V1 osc. anode decoupling ..	0·1
C12	V2 C.G. decoupling	0·1
C13	V2 S.G. by-pass	0·1
C14	V2 cathode by-pass	0·1
C15	L.F. coupling to V3 triode ..	0·005
C16	I.F. by-pass	0·0001
C17	V3 signal diode coupling ..	0·0001
C18*	V3 cathode by-pass	50·0
C19*	V3 triode anode decoupling ..	2·0
C20	V3 to V4 L.F. coupling ..	0·03
C21	V3 A.V.C. diode coupling ..	0·0001
C22*	V4 cathode by-pass	50·0
C23	Part of T.C. filter	0·02
C24*	H.T. smoothing ..	8·0
C25*	H.T. smoothing ..	16·0
C26†	Band-pass M.W. pri. trimmer	—
C27†	Band-pass L.W. pri. trimmer	—
C28†	Band-pass pri. tuning	—
C29†	Aerial circuit S.W. trimmer ..	—
C30†	Band-pass M.W. sec. trimmer	—
C31†	Band-pass L.W. sec. trimmer	—
C32†	Band-pass sec. tuning ..	—
C33†	Osc. tuning	—
C34‡	Osc. S.W. trimmer	—
C35‡	Osc. M.W. trimmer	—
C36‡	Osc. L.W. trimmer	—
C37‡	Osc. M.W. tracker	—
C38‡	Osc. L.W. tracker	—
C39‡	1st I.F. trans. pri. tuning ..	—
C40‡	1st I.F. trans. tert. tuning ..	—
C41‡	1st I.F. trans. sec. tuning ..	—
C42‡	2nd I.F. trans. pri. tuning ..	—
C43‡	2nd I.F. trans. tert. tuning ..	—
C44‡	2nd I.F. trans. sec. tuning ..	—

* Electrolytic. † Variable. ‡ Pre-set.

Circuit diagram of the Bush SSW33 3-band A.C. superhet. The radio-gram models have similar circuits, but switching is incorporated for the pick-up. Note the triple-tuned I.F. transformers.

Under - chassis view. Only the coils and trimmers on the upper formers are identified here, but all the H.F. and oscillator coils and their trimmers are indicated in the side-chassis view below. Note the three switch units in the coil compartments. Their diagrams are on page VIII. There is a block of six paper condensers below the central component panel.



RESISTANCES		Values (ohms)
R1	V1 hexode C.G. decoupling ..	1,000,000
R2	V1 hexode S.G.'s H.T. potential divider.	20,000
R3		20,000
R4	V1 and V2 anodes decoupling	5,000
R5	V1 fixed G.B. resistance ..	100
R6	V1 osc. C.G. resistance ..	30,000
R7	V1 osc. anode decoupling ..	15,000
R8	V2 C.G. decoupling	1,000,000
R9	V2 C.G. stabiliser	250
R10	V2 S.G. H.T. feed	50,000
R11	V2 fixed G.B. resistance ..	100
R12	A.V.C. line decoupling ..	1,000,000
R13	Manual volume control ..	500,000
R14	I.F. stopper	250,000
R15	V3 signal diode load	1,000,000
R16	V3 G.B. resistance	1,000
R17	V3 anode decoupling	10,000
R18	V3 anode load	50,000
R19	V3 A.V.C. diode load	1,000,000
R20	V4 C.G. I.F. stoppers	200,000
R21		100,000
R22	V4 C.G. resistances ..	100,000
R23		500,000
R24	V4 G.B. resistance	250
R25	Variable tone control	50,000
R26	V3 triode C.G. I.F. stopper ..	100,000

OTHER COMPONENTS			Approx. Values (ohms)
L1	Aerial M.W. coupling coil ..		1·0
L2	Band-pass M.W. primary coil		2·5
L3	Aerial L.W. coupling coil ..		15·0
L4	Band-pass L.W. primary coil		8·5
L5	Aerial S.W. coupling coil ..		0·15
L6	Aerial S.W. tuning coil ..		0·05
L7	Band-pass M.W. secondary coil		2·5
L8	Band-pass L.W. secondary coil		8·0
L9	Osc. S.W. tuning coil		0·05
L10	Osc. S.W. reaction coil ..		0·15
L11	Osc. M.W. tuning coil ..		1·35
L12	Osc. M.W. reaction coil ..		1·5
L13	Osc. L.W. tuning coil ..		2·0
L14	Osc. L.W. reaction coil ..		2·5
L15	1st I.F. trans.	Primary ..	7·0
L16		Tertiary ..	7·0
L17		Secondary ..	7·0
L18	2nd I.F. trans.	Primary ..	7·0
L19		Tertiary ..	7·0
L20		Secondary	7·0
L21	Speaker speech coil		1·7
L22	Hum neutralising coil		0·1
L23	Speaker field coil		2,000·0
T1	Speaker input trans.	Pri. ..	800·0
		Sec. ..	0·4
T2	Mains trans.	Pri. total ..	25·0
		Heater sec. ..	0·1
		Rect. heat. sec.	0·2
		H.T. sec. total	580·0
S1-3	Scale lamp switches		—
S4-24	Waveband switches		—
S25	Mains switch, ganged R13 ..		—

DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, remove the five control knobs (recessed grub screws) and the four bolts (with washers) holding the chassis to the bottom of the cabinet. Then free the speaker leads from the two cleats on the side of the cabinet, when the chassis can be withdrawn to the extent of the speaker leads, which is adequate for normal purposes.

To free the chassis entirely, unsolder the speaker leads and *when replacing* connect them as follows, numbering the tags from bottom to top :—1, red ; 2, yellow ; 6, blue.

Removing Speaker.—To remove the speaker from the cabinet unsolder the leads from the transformer and remove the nuts and washers from the four bolts holding it to the sub-baffle. *When replacing*, see that the transformer is on the right and connect the leads from the chassis as described above. Connect the leads from the extension speaker panel as follows, numbering the tags from bottom to top :—3, brown ; 4, green ; 5, black.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 220 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 1,200 V scale of an Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TH4*	205	3·5	80	6·1
V2 VP4B	205	6·6	135	2·5
V3 TDD4	100	2·5	—	—
V4 AC/2Pen	240	22·0	260	4·9
V5 IW4/350	335†	—	—	—

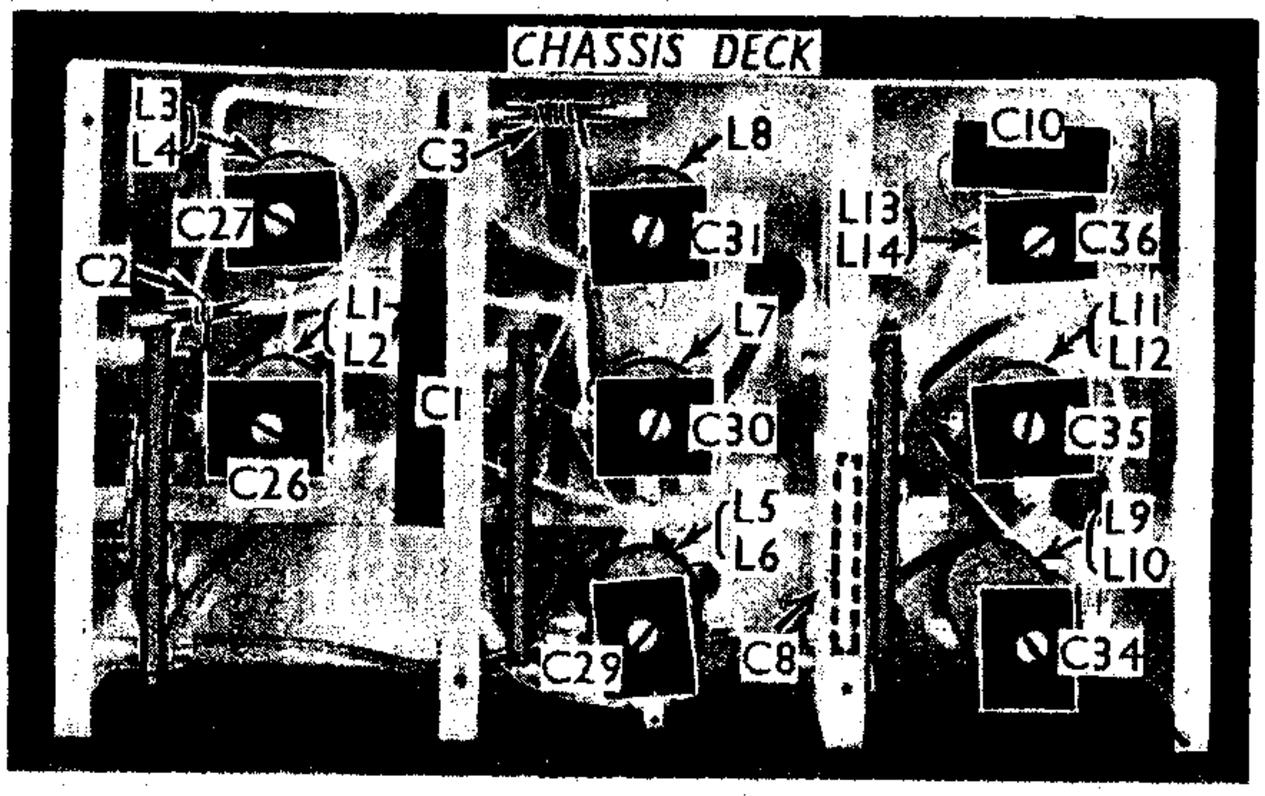
* Oscillator anode, 160 V, 8·7 mA.
† Each anode, A.C.

GENERAL NOTES

Switches.—S1-S24 are in rotary units. Diagrams on page VIII are drawn looking at the under-side of the chassis, in the

Continued overleaf

Side - chassis view of the coil units, with the cover plate removed. Note the small fixed condensers C2, C3.



BUSH SSW33 —*Continued*

directions indicated by the arrows in the under-chassis view. Note the shorting contracts riveted to the rotating portions of the first and third units.

The table below gives the switch positions for the various control settings, O indicating open and C, closed.

Switch	S.W.	M.W.	L.W.
S1	C	O	O
S2	O	C	O
S3	O	O	C
S4	C	O	O
S5	O	C	O
S6	C	O	O
S7	O	O	C
S8	O	C	O
S9	O	O	C
S10	O	C	O
S11	O	O	C
S12	C	O	O
S13	O	C	O
S14	O	O	C
S15	C	O	O
S16	O	C	O
S17	C	O	O
S18	O	O	C
S19	O	C	O
S20	C	O	O
S21	O	C	O
S22	C	O	O
S23	O	O	C
S24	O	C	O

S25 is the Q.M.B. mains switch, ganged with the volume control **R13.**

Coils.—The signal frequency and oscillator coils, **L1-L14,** are in a partitioned screened unit, with the wavechange switches and several other components. This unit projects above and below the chassis deck. The coils are indicated in detail in our side-chassis view, the metal side plate of the unit having been removed. In all there are eight coil formers, each carrying one or two coils, and each having a trimmer mounted at its end.

The I.F. transformers, **L15-L17** and **L18-L20,** are in two screened units on the chassis deck. Note that each contains three coils and three trimmers. The trimmers are adjustable through holes in the backs of the cans, and in our plan chassis view, they are numbered from top to bottom in each case.

Scale Lamps.—These are three Ever Ready M.E.S. types, rated at 6·2 V, 0·3 A. They are switched by **S1-S3.**

External Speaker.—Provision is made, by a panel at the top of the back of the cabinet, for the use of a low impedance (about 2 O) external speaker. The internal speaker speech coil may be disconnected by a plug and socket device, also on the panel.

Condensers C18, C19, C22.—These are three dry electrolytics in a single container, mounted on the chassis deck, and having a common negative (black) lead. The red lead is the positive of **C19** (2μF), the yellow lead to **R15** and **R16** the positive of **C18** (50 μF), and the yellow lead to **R24** the positive of **C22** (50 μF).

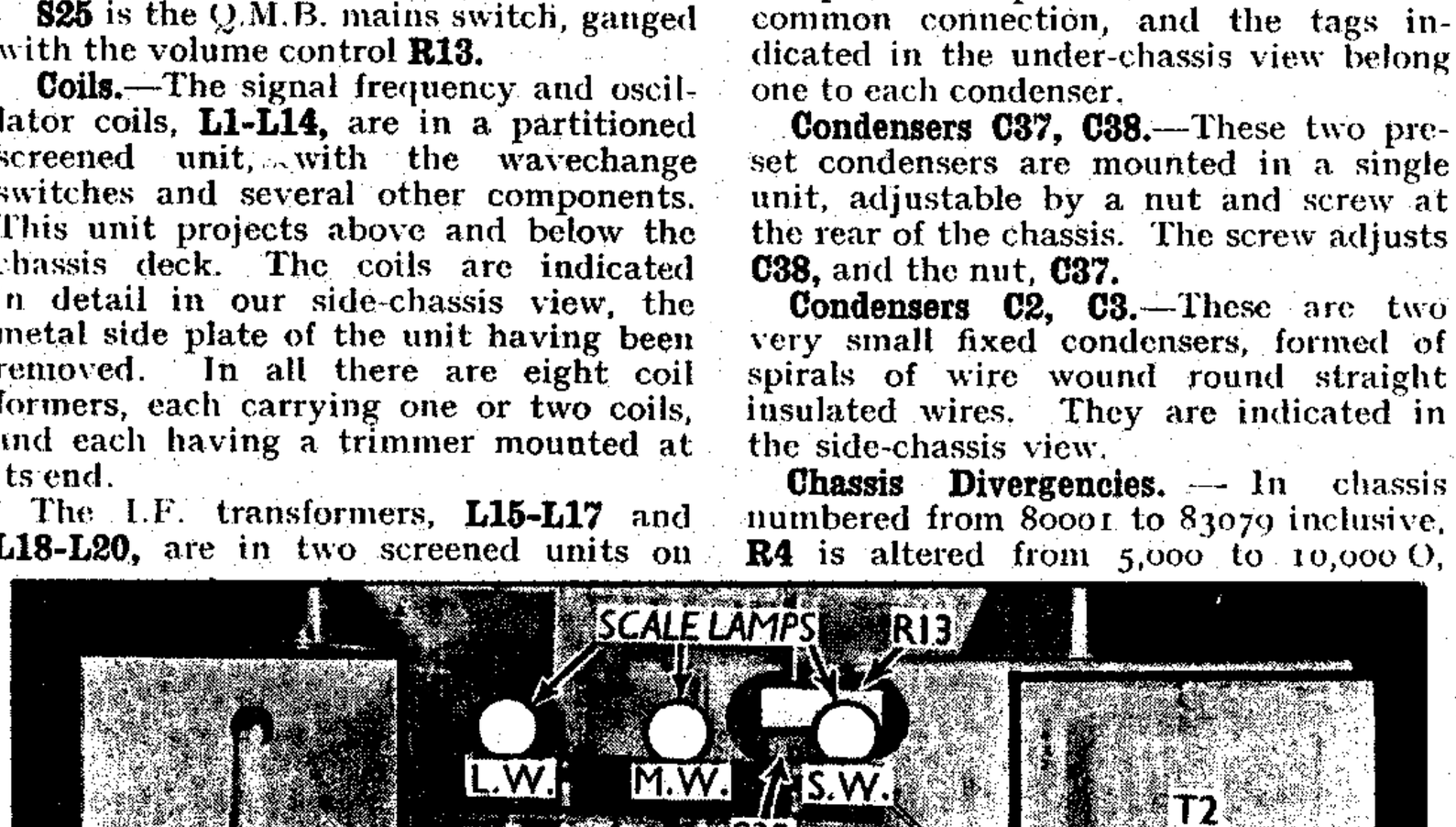
Condensers C24, C25.—These are two dry electrolytics in a single carton with a common negative (black) lead. The yellow lead is the positive of **C24** (8 μF) and the red the positive of **C25** (16 μF).

Condensers C4, C5, C11, C12, C13, C14.—These are six 0·1 μF paper types in a metal case, mounted beneath one of the component strips. The case forms one common connection, and the tags indicated in the under-chassis view belong one to each condenser.

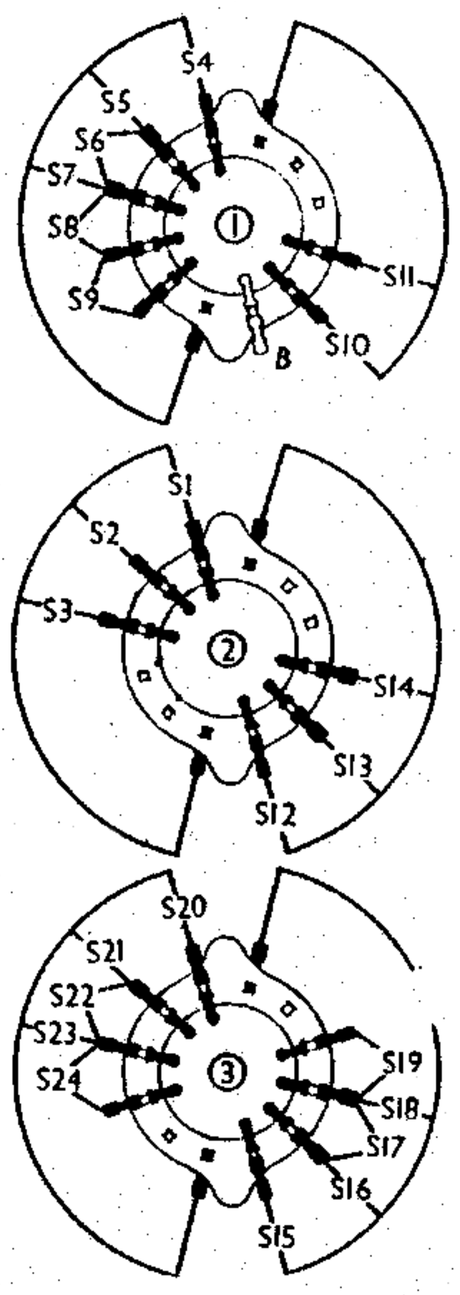
Condensers C37, C38.—These two preset condensers are mounted in a single unit, adjustable by a nut and screw at the rear of the chassis. The screw adjusts **C38,** and the nut, **C37.**

Condensers C2, C3.—These are two very small fixed condensers, formed of spirals of wire wound round straight insulated wires. They are indicated in the side-chassis view.

Chassis Divergencies. — In chassis numbered from 80001 to 83079 inclusive, **R4** is altered from 5,000 to 10,000 O,



Plan view of the chassis. R26 is inside the screened cap of V3. The I.F. trimmers are numbered from top to bottom.



The three switch units, as seen from the underside of the chassis, looking in the directions of the arrows in the under-chassis view. Note the extra switches formed by the shorting contacts on the rotors of units 1 and 3.

while the lead joining **C39** and **L15** to the bottom of **R4** is removed and taken direct to the H.T. + line. The anode voltage of **V1** in this case is increased beyond the figure given in our valve table.

In our chassis (a late model) there is an I.F. stopper of 100,000 O (**R26**) in the grid circuit of **V3,** not shown in the makers' diagram. This is mounted inside the screened connector to the top cap of **V3.**

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set to L.W., turn gang condenser to maximum, and connect signal generator to control grid (top cap) of **V1,** and chassis. Feed in a 465 KC/S signal, and adjust **C44, C43, C42** and **C41, C40, C39** for maximum output in each case, keeping the input low.

H.F. and Oscillator Stages.—Connect signal generator to A and E sockets, via a suitable dummy aerial, which may consist of an inductance of 20 μH, a capacity of 200 μμF and a resistance of 15 O in series on M.W. and L.W., and a 400 O resistance only on S.W.

S.W.—Switch set to S.W., feed in an 18 m. signal. Set pointer to 18 m. on scale and adjust **C34** for maximum output. Two peaks will be obtained, that which requires the lesser trimmer capacity being correct. Next adjust **C29** for maximum output.

M.W.—Switch set to M.W., feed in a 200 m. signal, tune to 200 m. on scale, and adjust **C35** for maximum output on the peak requiring the lesser trimmer capacity. Feed in a 300 m. signal, tune to 300 m. on scale, and adjust **C26** and **C30** for maximum output. Feed in a 500 m. signal, tune to 500 m. on scale, and adjust **C37** (nut) for maximum output. Check again on 300 m.

L.W.—Adopt procedure as for M.W., but adjust **C36** on 1,000 m., **C27** and **C31** on 1,500 m. and **C38** (screw) on 1,800 m. Check again on 1,500 m.

Printed by Sanders Phillips & Co., Ltd., Chryssell Road, London, S.W.9.