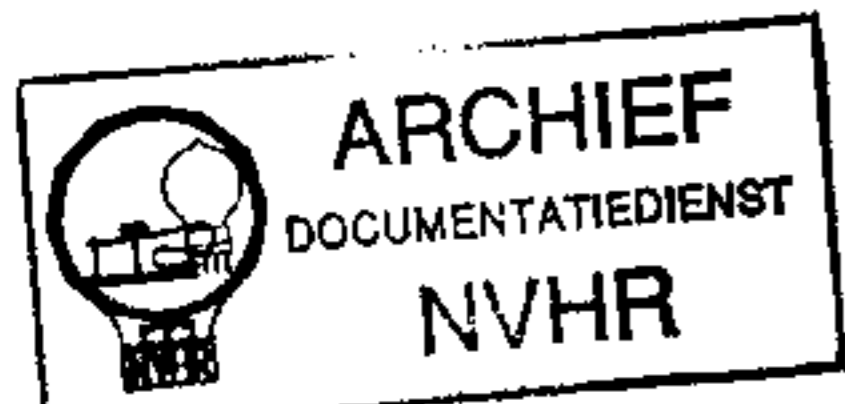
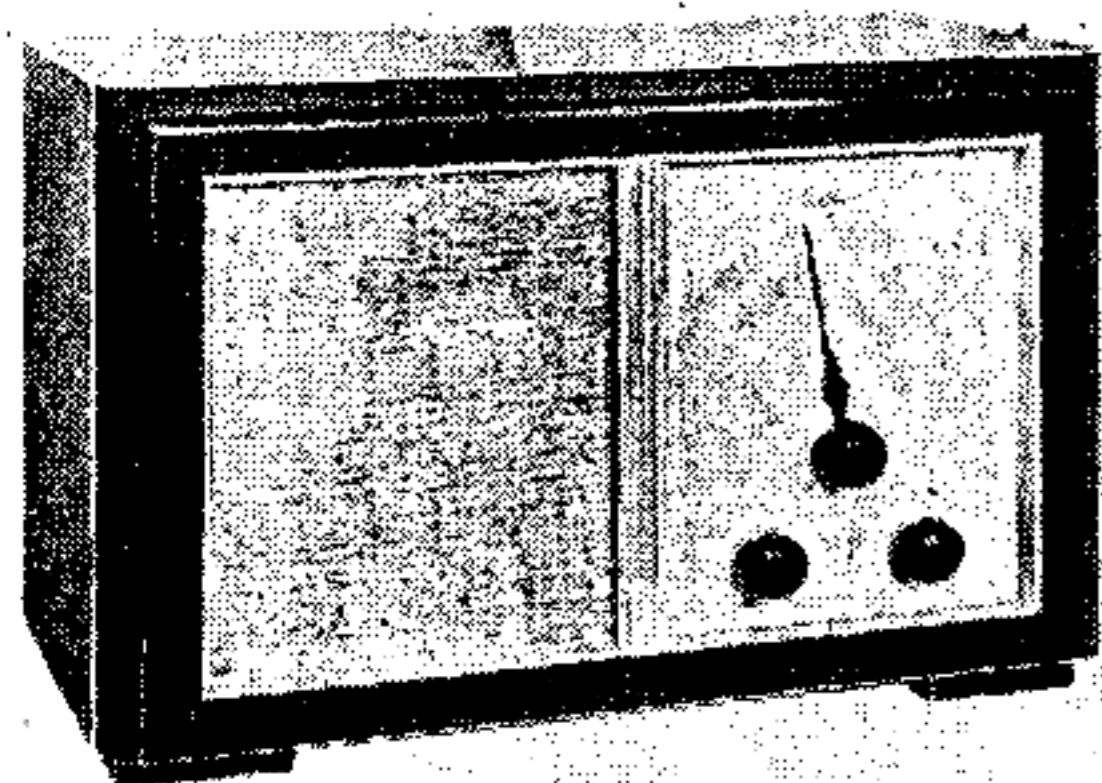


Ned. Ver. v. Historie v/d Radio



BEETHOVEN A415

3-BAND A.C. SUPERHET



The appearance of the Beethoven A415 A.C. superhet. The complete front, including speaker and scale as seen here, is withdrawn forward to dismantle the set.

SPECIAL consideration has been given to the subject of accessibility, from the point of view of service work, in the Beethoven A415. The chassis and speaker are mounted on the front panel of the cabinet, and can be removed complete as a working unit. Metal stays

permit the chassis to be turned over without damage.

The receiver is a 4-valve (plus rectifier) 3-band superhet with a band-pass input circuit on M.W. and L.W. bands. It is designed to operate from A.C. mains of 200-250 V. The S.W. range is 16-50 m.

Release date and original price: May, 1946; £16 16s, plus £3 12s 6d purchase tax.

CIRCUIT DESCRIPTION

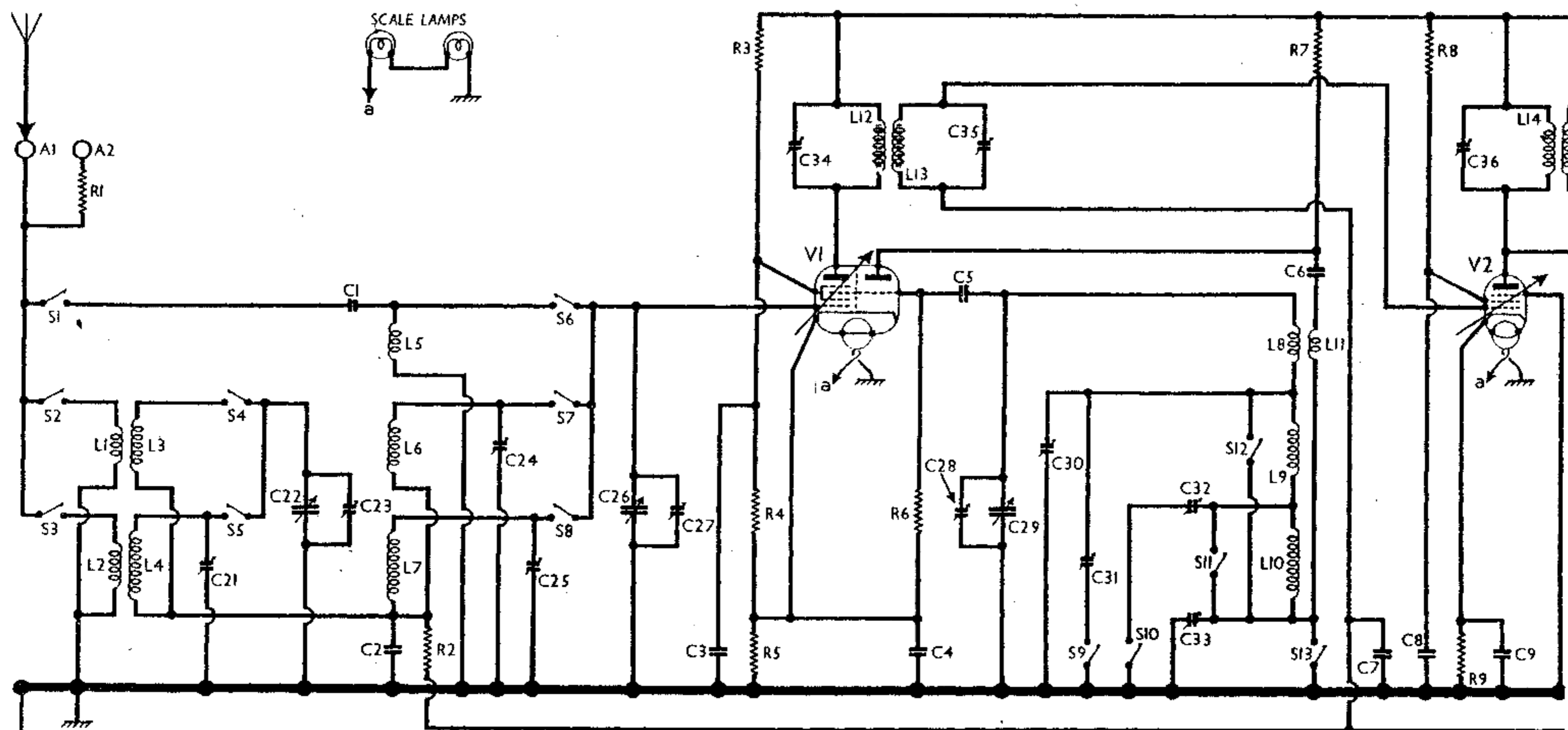
Two alternative aerial input sockets, **A1** and **A2**. On M.W. and L.W., input from **A1** is via coupling coils **L1** (M.W.) and **L2** (L.W.) to inductively coupled band-pass filter. Primary coils **L3** (M.W.) and **L4** (L.W.) are tuned by **C22**; secondary coils **L6** (M.W.) and **L7** (L.W.) are tuned by **C26**. Coupling by induction between primary and secondary windings.

On S.W., input from **A1** is via series capacitor **C1** to single tuned circuit **L5**, **C26**. From socket **A2**, input is fed via series resistor **R1** for the reception of strong transmissions.

First valve (**V1**, Mullard metallized **ECH35**) 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 **C29**. Parallel trimming by **C28** (S.W.), **C30** (M.W.) and **C31**, when **S9** closes (L.W.).

Since **S12** and **S13** close on S.W., there are no trackers in circuit on that band; on M.W., **S10** and **S11** close, so that **C32** and **C33** operate in parallel as trackers on that band; on L.W., **S9** closes only, and **C33** is the tracker on that band. Reaction coupling from anode via **C6** is applied inductively on S.W. by **L11**, **S13** connecting the earthy end of it to chassis, but on M.W. and L.W., reaction coupling is derived from the common impedance of the trackers in grid and anode circuits.

Second valve (**V2**, Mullard metallized **EF39**) is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C34**, **L12**, **L13**, **C35** and **C36**, **L14**, **L15**, **C37**.



Circuit diagram of the Beethoven A415 3-band A.C. superhet. In the oscillator circuit, **C32** and **C33** are connected in parallel while **C30** and **C31** are in parallel for L.W. On S.W., **S12** and **S13** close. This results in an unusual sequence of alignment and it is important that the instructions overleaf are carried out in the order given. Only the first I.F. transformer has its

Intermediate frequency 450.5 kc/s.

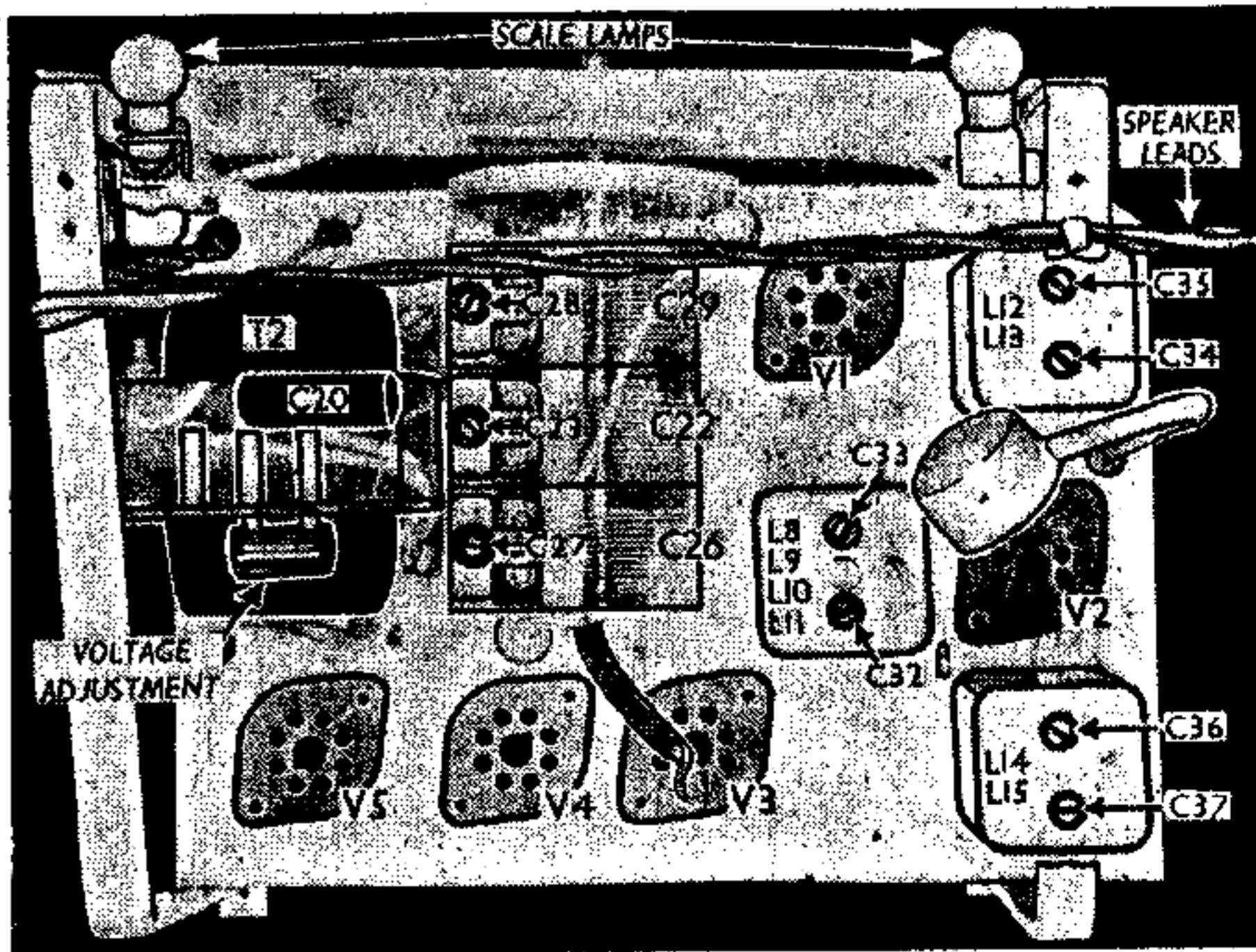
Diode second detector is part of double diode triode valve (V3, Mullard metalized EBC33). Audio frequency component in rectified output is developed across manual volume control R11, which also acts as diode load resistor, and passed via A.F. coupling capacitor C13 and C.G. resistor R12 to C.G. of triode section, which operates as A.F. amplifier. Provision for connection of gramophone pick-up across R11. I.F. filtering by C10, R10, C11 in diode circuit and C15 in triode anode circuit.

Second diode of V3, fed from V2 anode via C12, 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.) and I.F. valves, giving automatic volume control. Delay voltage, together with G.B. for triode section, is obtained from the drop along resistor R13 in V3 cathode lead to chassis.

Resistance-capacitance coupling by R15, C16 and R18, via grid stopper R19, between V3 triode and pentode output valve (V4, Mullard EL33). Fixed tone correction by C17 in anode circuit, and provision for the connection of a low impedance external speaker across the secondary winding of the internal speaker input transformer T1.

H.T. current is supplied by a full-wave rectifying valve (V5, Mullard AZ31). Smoothing by resistor R21 and electrolytic capacitors C18 and C19. Mains R.F. filtering by C20.

Plain view of the chassis. The steel bars seen rising above the chassis permit it to be rolled over or stood on end without damage, providing easy accessibility. The trackers C32, C33, at the top of the L8-L11 can, may be transposed in some cases. C32 is coded red, and C33 is coded blue.



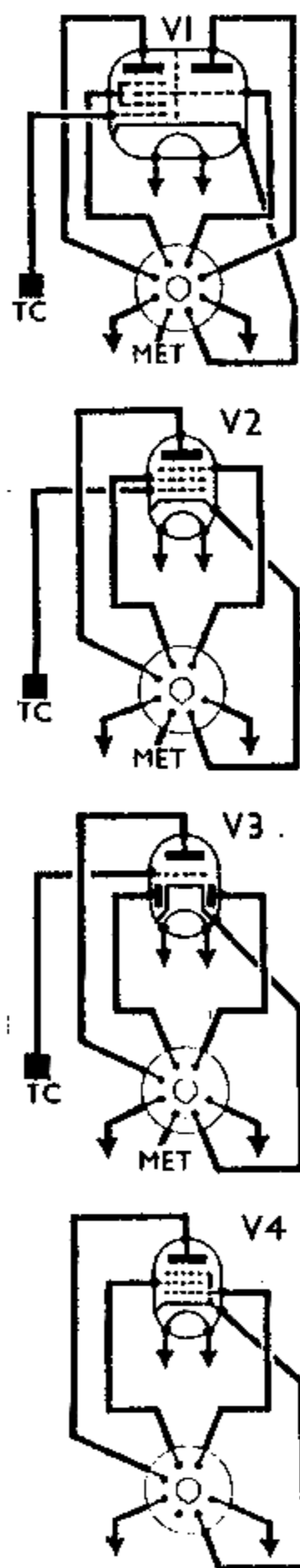
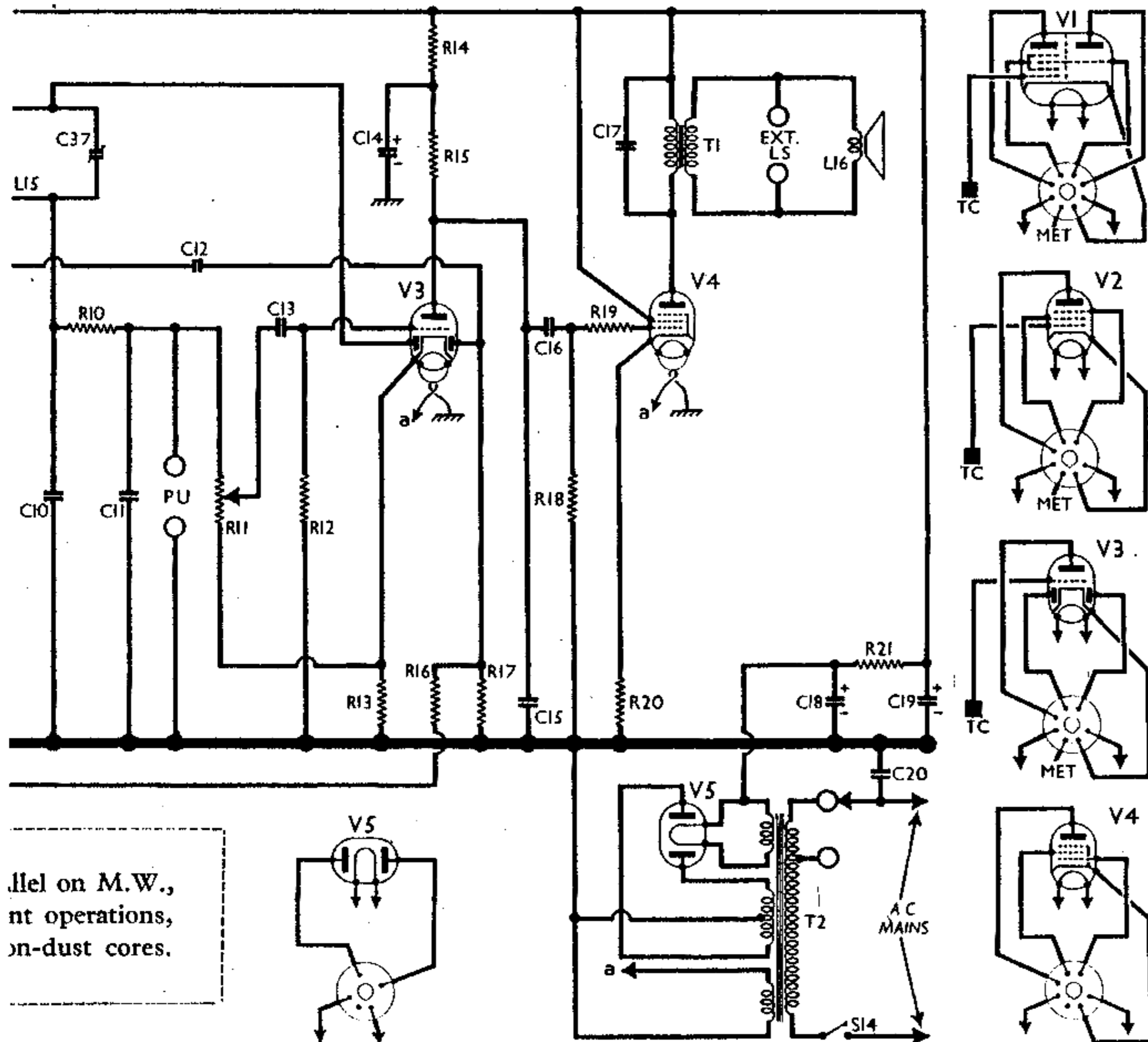
COMPONENTS AND VALUES

CAPACITORS		Values (μF)
C1	Aerial S.W. coupling ...	0 00005
C2	V1 hex. C.G. decoupling ...	0.1
C3	V1 S.G. decoupling ...	0.01
C4	V1 cathode by-pass ...	0.01
C5	V1 osc. C.G. capacitor ...	0.0001
C6	V1 osc. anode coupling ...	0.01
C7	V2 C.G. decoupling ...	0.1
C8	V2 S.G. decoupling ...	0.1

(Continued next column)

CAPACITORS (continued)		Values (μF)
C9	V2 cathode by-pass ...	0.01
C10	I.F. by-pass capacitors ...	0.00015
C11		0.00015
C12	V3 A.V.C. diode coupling	0.000005
C13	A.F. coupling to V3 triode	0.05
C14*	V3 anode decoupling ...	2.0
C15	V3 anode I.F. by-pass ...	0.0001
C16	A.F. coupling to V4 C.G. ...	0.05
C17	Fixed tone corrector ...	0.002
C18*	H.T. smoothing capacitors	16.0
C19*		16.0
C20	Mains R.F. by-pass ...	0.01
C21†	B.-P. pri. L.W. trimmer ...	—
C22†	Band-pass pri. tuning ...	—
C23†	B.-P. pri. M.W. trimmer ...	—
C24†	B.-P. sec. M.W. trimmer ...	—
C25†	B.-P. sec. L.W. trimmer ...	—
C26†	Band-pass sec. tuning ...	—
C27†	Aerial S.W. trimmer ...	—
C28†	Osc. circ. S.W. trimmer ...	—
C29†	Oscillator circuit tuning ...	—
C30†	Osc. circ. M.W. trimmer ...	—
C31†	Osc. circ. L.W. trimmer ...	—
C32†	Osc. circ. M.W. tracker ...	—
C33†	Osc. circ. L.W. tracker ...	—
C34†	1st I.F. trans. pri. tuning	—
C35†	1st I.F. trans. sec. tuning	—
C36†	2nd I.F. trans. pri. tuning	—
C37†	2nd I.F. trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Preset.



RESISTORS		Values (ohms)
R1	A2 series resistor ...	22,000
R2	V1 hex. C.G. decoupling ...	1,200,000
R3	V1 S.G. H.T. potential divider ...	33,000
R4		47,000
R5	V1 fixed G.B. resistor ...	100
R6	V1 osc. C.G. resistor ...	47,000
R7	V1 osc. anode H.T. feed ...	10,000
R8	V2 S.G. H.T. feed ...	47,000
R9	V2 fixed G.B. resistor ...	100
R10	I.F. stopper ...	33,000

(Continued overleaf)

RESISTORS (continued)		Values (ohms)
R11	Manual volume control ...	500,000
R12	V3 C.G. resistor ...	470,000
R13	V3 fixed G.B. resistor ...	3,300
R14	V3 H.T. decoupling ...	22,000
R15	V3 triode anode load ...	150,000
R16	A.V.C. line decoupling ...	1,200,000
R17	V3 A.V.C. diode load ...	1,200,000
R18	V4 C.G. resistor ...	470,000
R19	V4 C.G. stopper ...	180,000
R20	V4 fixed G.B. resistor ...	180
R21	H.T. smoothing resistor ...	1,200

OTHER COMPONENTS		Approx. Values (ohms)	
L1	Aerial M.W. coupling coil...	1.25	
L2	Aerial L.W. coupling coil...	4.0	
L3	Band-pass primary coils ...	3.5	
L4		18.5	
L5	Aerial S.W. tuning coil ...	Very low	
L6	Band-pass secondary coils {	3.5	
L7		18.5	
L8	Osc. S.W. tuning coil ...	Very low	
L9	Osc. M.W. tuning coil ...	4.5	
L10	Osc. L.W. tuning coil ...	8.0	
L11	Osc. S.W. reaction coil ...	0.7	
L12	1st I.F. trans. { Pri. ...	4.0	
L13		Sec. ...	4.0
L14	2nd I.F. trans. { Pri. ...	10.0	
L15		Sec. ...	10.0
L16	Speaker speech coil ...	2.5	
T1	Speaker input trans. { Pri. ...	650.0	
		Sec. ...	0.4
T2	Mains trans. { Pri., total ...	36.0	
		Heater sec. ...	0.15
		Rect. heat. sec. ...	0.2
		H.T. sec., total ...	1300.0
S1-S13	Waveband switches ...	—	
S14	Mains switch, ganged R11	—	

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 232 V, using the 230 V tap 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.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 ECH35	{ 213 Oscillator	{ 2.0 }	80	2.8
V2 EF39	213	8.5	87	2.5
V3 EB33	67	0.7	—	—
V4 EL33	200	25.0	213	3.1
V5 AZ31	300†	—	—	—

Each anode, A.C.

Voltages were measured on the 400 V scale of a model 7 Avometer, chassis being the negative connection.

DISMANTLING THE SET

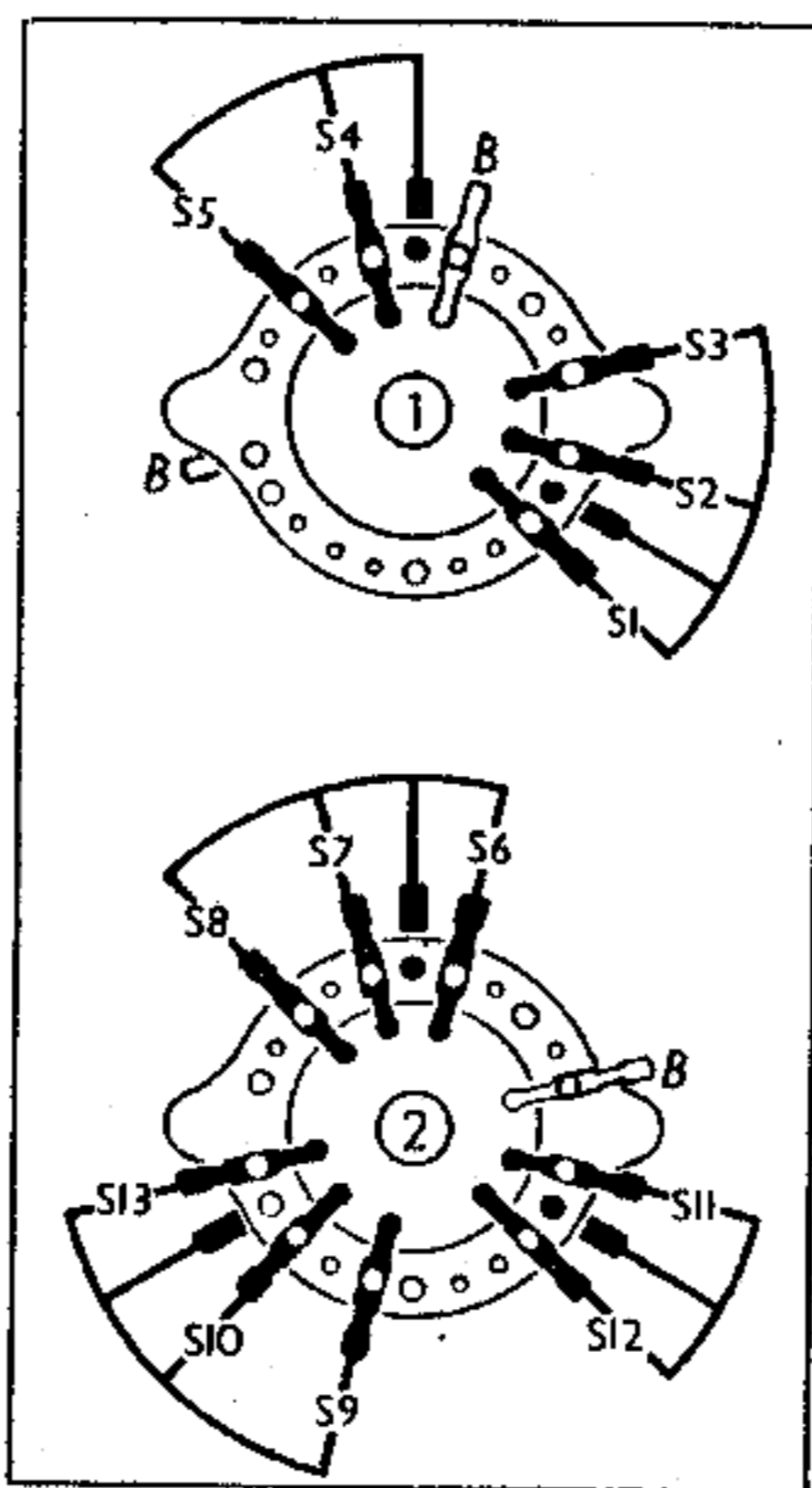
Removing Chassis.—Remove the two round-head wood screws holding the rear of the chassis to the base of the cabinet;

remove the three round-head screws (two at the top and one near the bottom on the right-hand side) holding the front panel to the front edge of the cabinet;

from beneath the cabinet remove a fourth (countersunk head) screw holding the front panel in position;

if the chassis is now pushed forward, the front panel, with chassis and speaker attached to it, can be withdrawn from the front of the cabinet.

When replacing, the long round-head set-screw goes in the left-hand bracket at the top of the cabinet, the two shorter ones going on the right.



Diagrams of the two waveband switch units, both drawn as seen when viewed from the rear of an inverted chassis. Blank tags are indicated by B. The associated switch table is in the next column.

Dismounting Chassis.—To separate the chassis from the front panel, remove the three control knobs (two recessed grub screws each);

from the two tags on the speaker input transformer unsolder the speaker leads; remove the wooden batten securing the bottom front edge of the chassis (two countersunk-head wood screws);

remove the two round-head wood screws holding the tops of the uprights at the front of the chassis to the front panel.

Removing Speaker.—Remove the four cheese-head screws (with spring washers) holding the speaker to the sub-baffle.

When replacing, the transformer should be at the top.

GENERAL NOTES

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

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

S14 is the Q.M.B. mains switch, ganged with the manual volume control R11.

Coils.—The band-pass circuit coils L1, L3, L6 and L2, L4, L7 are in two un-screened tubular units beneath the chassis. L5 forms a third un-screened unit beneath the chassis, mounted on its own wiring. The oscillator circuit coils L8-L11 are in a screened unit on the chassis deck. The two I.F. transformers L12, L13 and L14,

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	—	—

L15 are in two further screened units on the chassis deck with their associated trimmers. L12 and L13 have iron-dust cores.

Scale Lamps.—These are two Osram lamps, with M.E.S. bases and large clear spherical bulbs, rated at 4.5 V, 0.3 A. They are connected in series across the heater secondary of the mains transformer T2.

External Speaker.—Two sockets are provided on the internal speaker input transformer for the connection of a low impedance (about 2.5 Ω) external speaker.

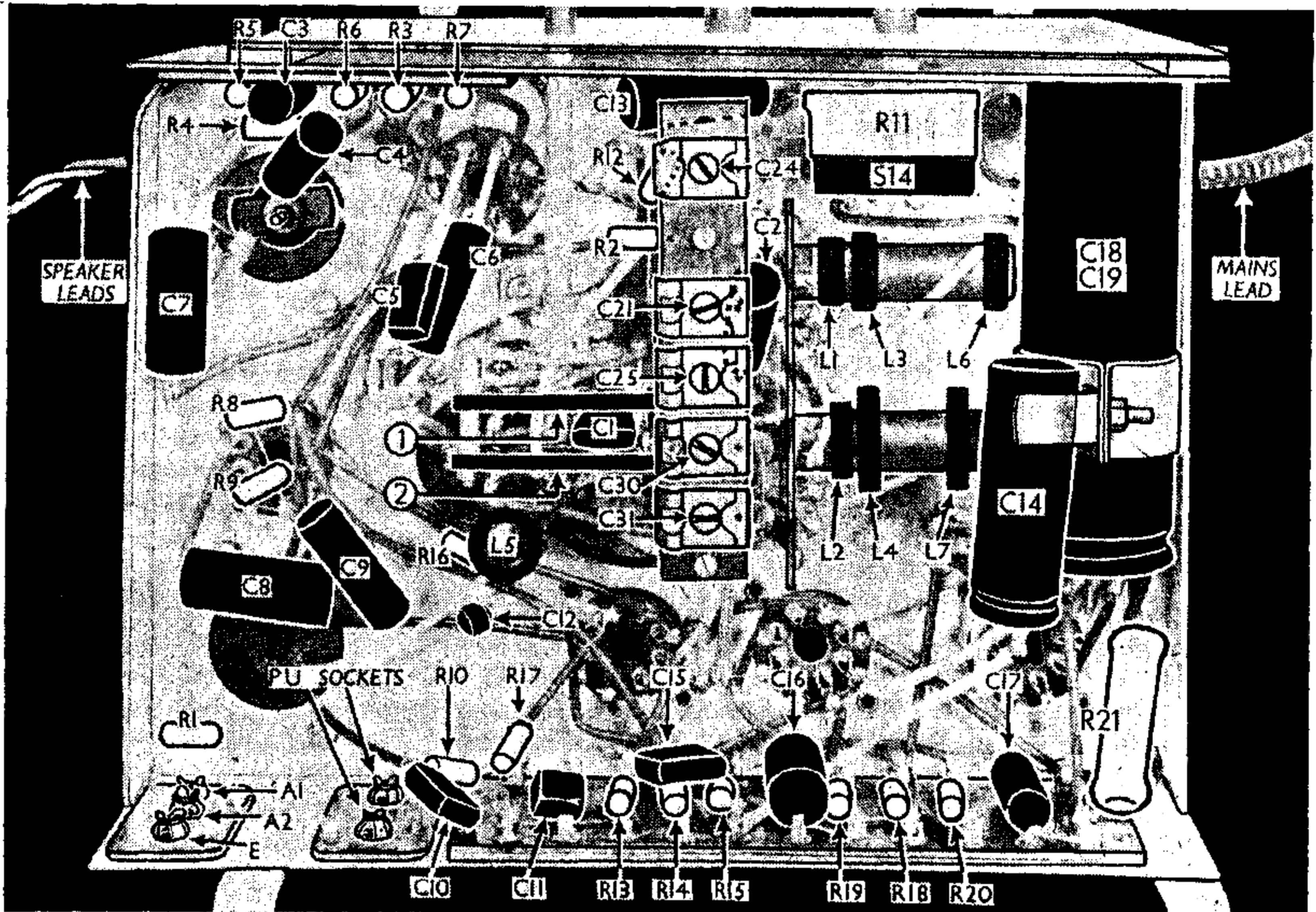
Capacitor C9.—This may be omitted in some chassis.

Capacitor C14.—This is an electrolytic type in a tubular metal container, mounted in a clip beneath the chassis. It is rated at 2 μF, 350 V D.C. working. The can forms the negative connection.

Capacitors C18, C19.—These are two electrolytics in a single tubular metal container mounted in a clip beneath the chassis deck. The red tag is the positive connection of C18, which is rated at 16 μF, 450 V D.C. working, and is a surge-proof type. The yellow tag is the positive of C19, which is rated at 16 μF, 450 V D.C. working, 500 V peak. The black tag is the common negative connection.

Resistor R21.—This is the H.T. smoothing resistor, beneath the chassis. It is rated at 1,200 Ω, 7 watts, and is wire-wound.

Under - chassis view. The aerial and earth sockets, and the pick-up sockets, are mounted on the rear member, but the external speaker sockets are mounted on the internal speaker connecting panel, on the input transformer. L₅ is mounted on its own wiring.



CIRCUIT ALIGNMENT

Although the I.F. adjustments alone can be carried out while the chassis remains in the cabinet, the chassis must be removed for R.F. adjustments. Removal is a very simple process, however, as the chassis and speaker are both mounted on the removable front panel. The construction then permits the chassis to be rested in such a desired position as to give convenient access to all adjustments.

I.F. Stages.—Connect signal generator lead to control grid (top cap) of V1 and chassis, and turn the volume control to maximum. Feed in a 450.5 kc/s (666 m) signal, and adjust C34, C35, C36 and C37 in turn for maximum output.

Oscillator Stage.—Owing to the interdependence of certain adjustments, the three bands cannot be aligned separately in the usual sequence, and for this reason it is important that the order adopted here should be followed. The signal generator leads remain connected to V1 top cap and chassis. With the gang at maximum, the pointer should lie along the horizontal line crossing the centre of the scale.

Switch set to S.W., tune to 19 Mc/s on scale, feed in a 19 Mc/s (15.79 m) signal, and adjust C28 for maximum output.

Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust C30 for maximum output.

Switch set to L.W., tune to 1,200 m on scale, feed in a 1,200 m (250 kc/s) signal, and adjust C31 for maximum output.

Feed in a 1,875 m (160 kc/s) signal, tune it in, and adjust C33 to give the

correct reading (spot on scale). Readjust C31 if necessary. C33 is painted blue.

Switch set to M.W., feed in a 500 m (600 kc/s) signal, tune it in, and adjust C32 to give the correct scale reading. C32 is painted red.

R.F. Stage.—Transfer signal generator leads to A1 and E sockets, via a suitable dummy aerial.

Switch set to S.W., feed in a 50 m (6 Mc/s) signal, tune it in, and adjust C27 for maximum output while rocking the gang for optimum results.

Switch set to M.W., tune to about 231 m (spot on scale), feed in a 231 m (1,300 kc/s) signal, and adjust C23 and C24 for maximum output.

Switch set to L.W., tune to 1,200 m on scale, feed in a 1,200 m (250 kc/s) signal, and adjust C21 and C25 for maximum output. Feed in a 1,875 m (160 kc/s) signal, tune it in, and readjust C33 for maximum output.

Switch set to M.W., feed in a 500 m (600 kc/s) signal, tune it in, and readjust C32 for maximum output.