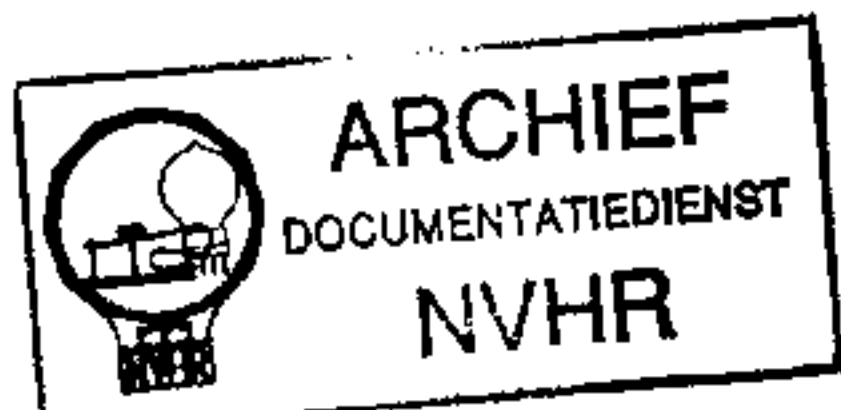
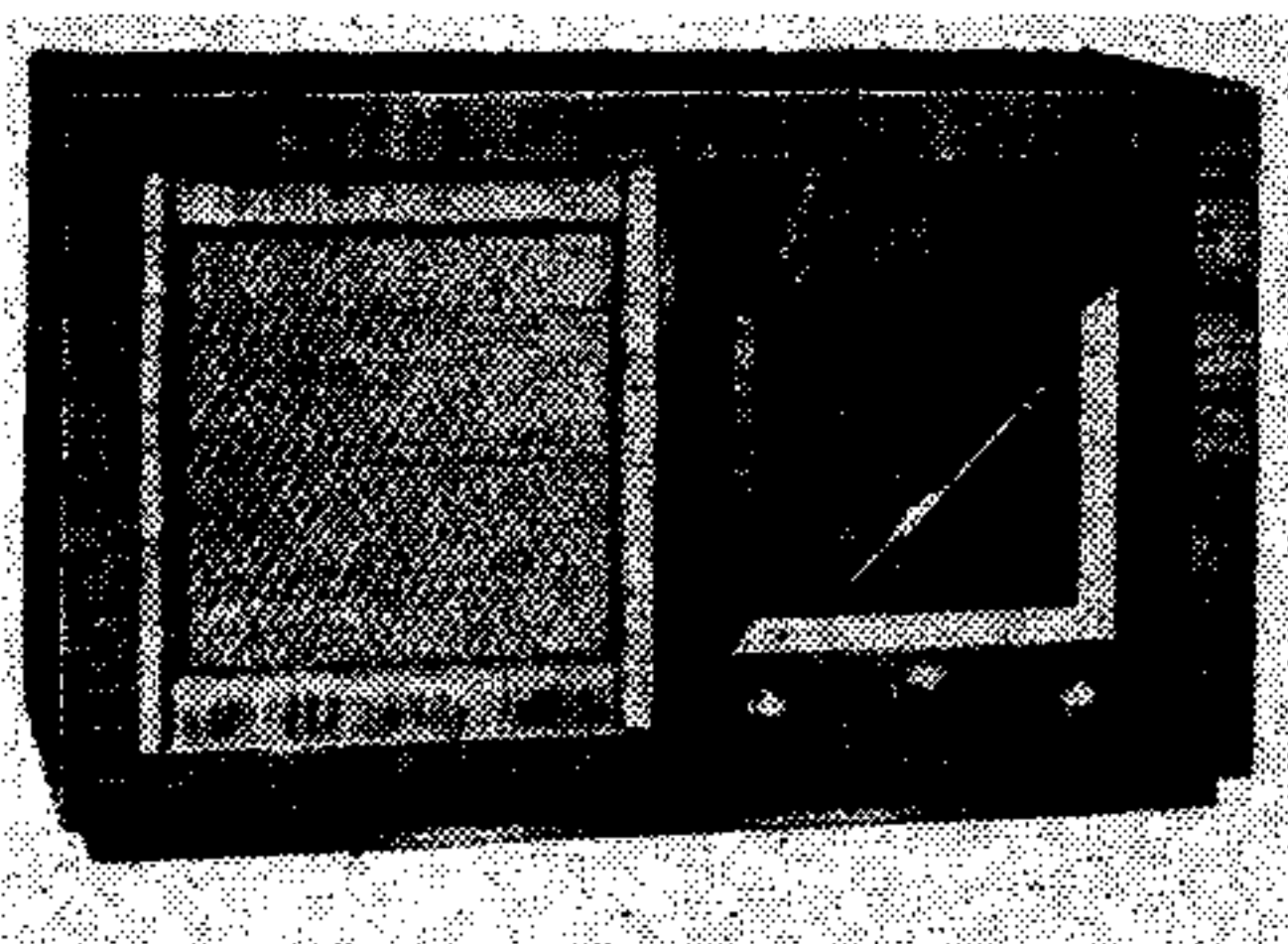


Ned. Ver. v. Historie v/d Radio



FERGUSON 101

AC SUPERHET



CIRCUIT DESCRIPTION

The aerial coupling arrangements in the Ferguson 101 do not follow normal practice. The primary of a transformer L1, L2, C2 is permanently connected across the aerial circuit, and on LW, low impedance secondary winding L2 is connected via switch S1 in the low potential end of the LW aerial tuning circuit L5, C27, and thus injects the signal into the circuit.

On MW, S1 opens, while S2 and S4 close, so that the "top" of L5 is connected to chassis, and the "bottom" of it is connected via S2, C1 to the aerial, and the coil becomes "inverted." Since it is wound on the same former as L4, it is magnetically coupled to it, and thus transfers the signal to the MW tuning circuit L4, C27.

On SW, S1 and S2 are open, and S3 is closed, providing a normal coupling via the series condenser C3 to the SW tuning circuit L3, C27. On the MW and SW bands, L1 remains in circuit, but it behaves as a high impedance choke shunt.

First valve (V1, Mullard metallised EGH35) is a triode-heptode operating as frequency changer with internal coupling. Triode oscillator anode tuning coils L8 (SW), L9 (MW) and L10 (LW) are tuned by C30 (SW), C31 (MW) and C32 (LW); series tracking by C7 (SW), C28 (MW) and C29 (LW).

Reaction coupling is established by including the trackers in the grid and anode return paths to chassis on all bands, so that they form a common coupling impedance. This coupling is augmented on the SW band by the reaction coil L6, and similarly on the MW band by the coil L7, and series resistances R4 (SW) and R5 (LW) are included in the reaction circuits to prevent parasitic oscillations.

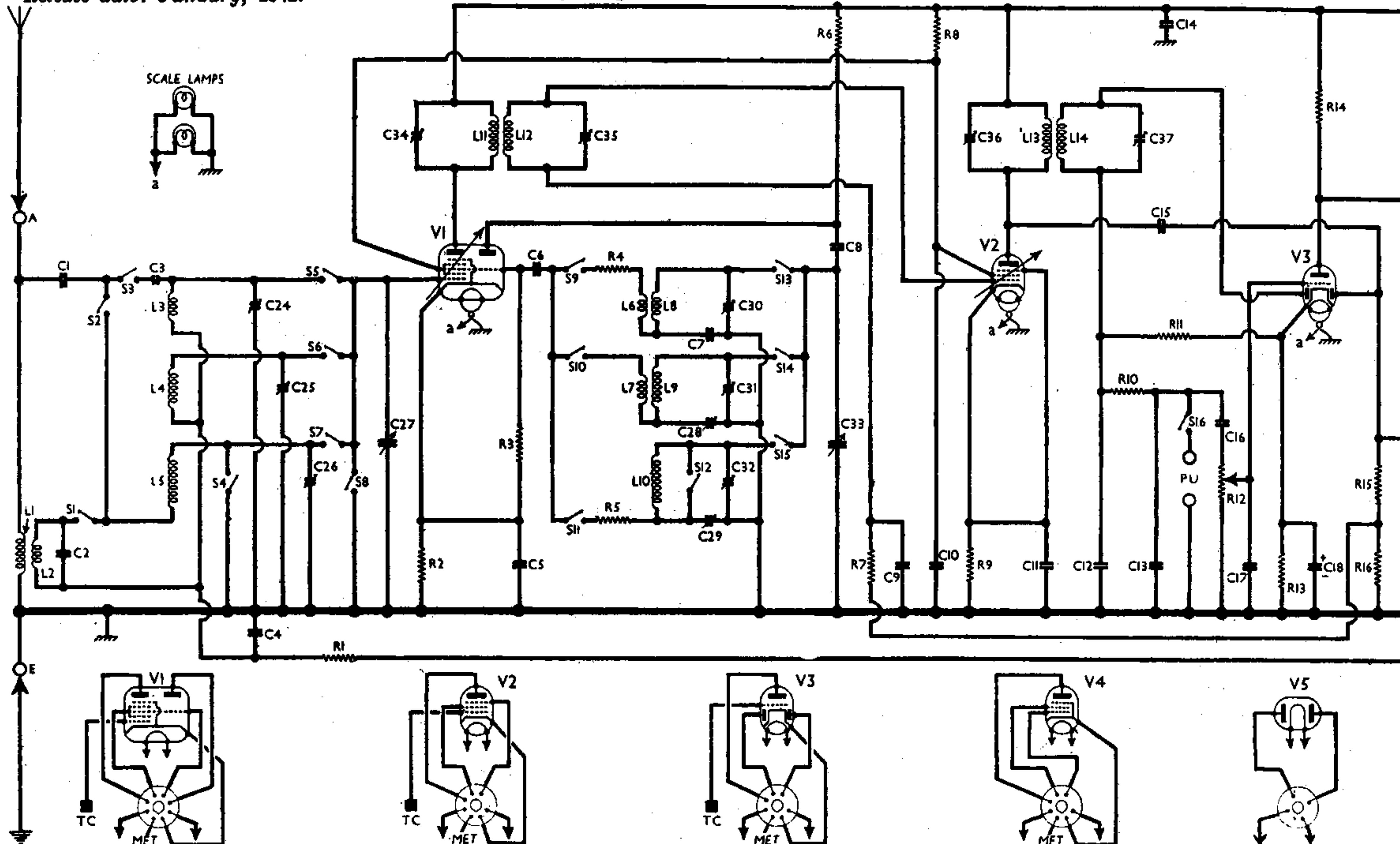
Second valve (V2, Mullard metallised EF39) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings C34, L11, L12, C35 and C36, L13, L14, C37.

Intermediate frequency 470 KC/S.

THE Ferguson 101 is a 4-valve (plus rectifier) 3-band superhet, designed to operate from AC mains of 200-250 V, 40-100 C/S. The short-wave range is 13.5-50 m.

Provision is made for the connection of a gramophone pick-up and a high impedance external speaker, and the pick-up may be left connected permanently.

Release date: January, 1941.



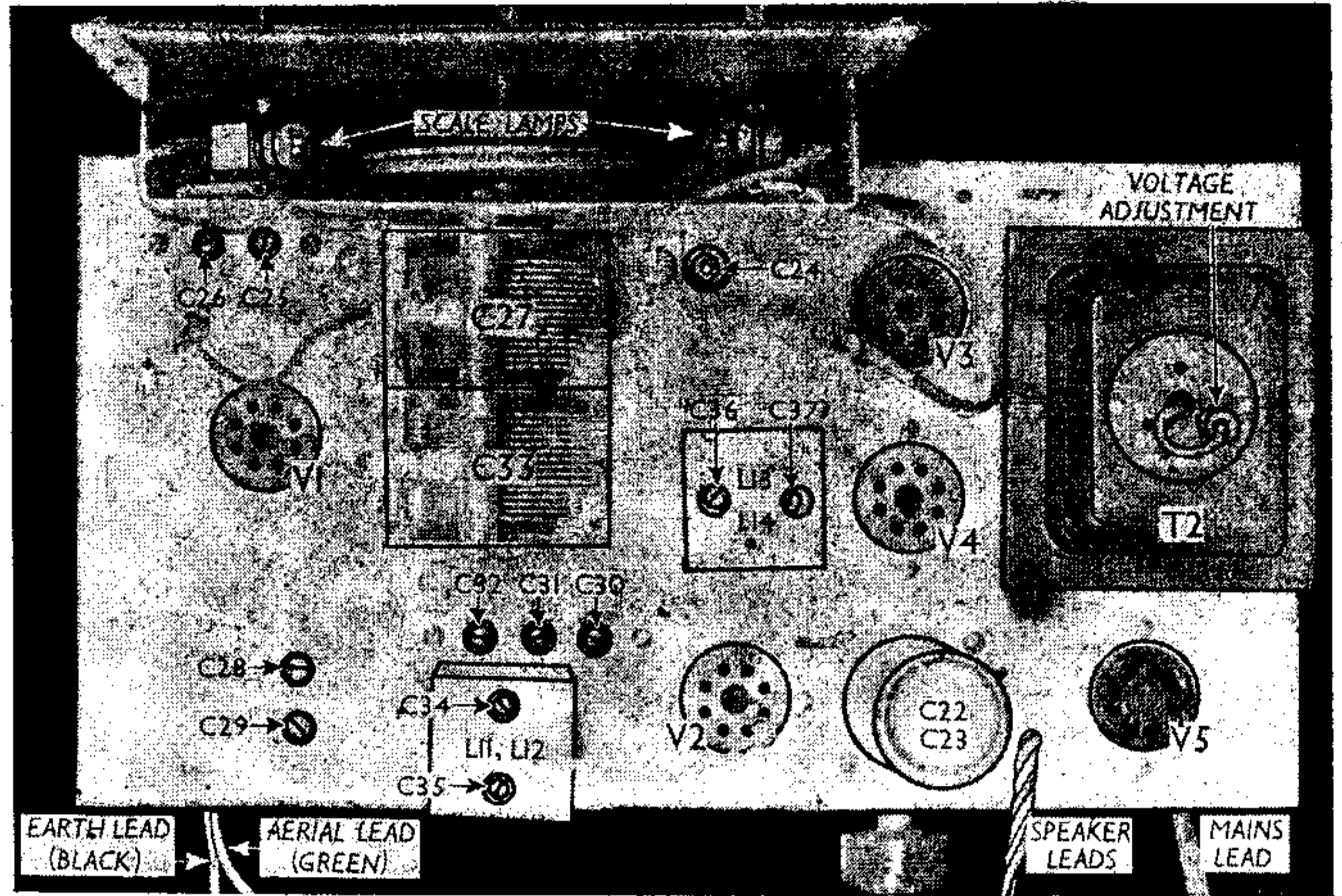
Circuit diagram of the Ferguson 101 3-band AC superhet. The aerial coupling circuits are rather unusual, but they are fully described in the text. In the oscillator circuits, the trackers C7, C28 and C29 also provide reaction coupling. Beneath the circuit are diagrams showing the internal connections of the valves V1, V2, V3, V4, and V5.

Diode second detector is part of double diode triode valve (V3, Mullard metallised EBC33). Audio frequency component in rectified output is developed across load resistance R11 and passed via IF filter circuit comprising condensers C12, C13 and resistance R10, AF coupling condenser C16, manual volume control R12 and further IF by-pass condenser C17 to CG of triode section, which operates as AF amplifier.

Provision for connection of gramophone pick-up by sockets across C16, R12, via switch S16. In the gram position of the waveband control, S4 and S8 close to mute radio, while S16 closes to connect the pick-up, which may consequently be left permanently connected.

Second diode of V3, fed from V2 anode via C15, provides DC potentials which are developed across load resistances R15, R16 and fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control. Delay voltage, together with GB for triode section, is obtained automatically from drop along resistance R13 in cathode lead to chassis.

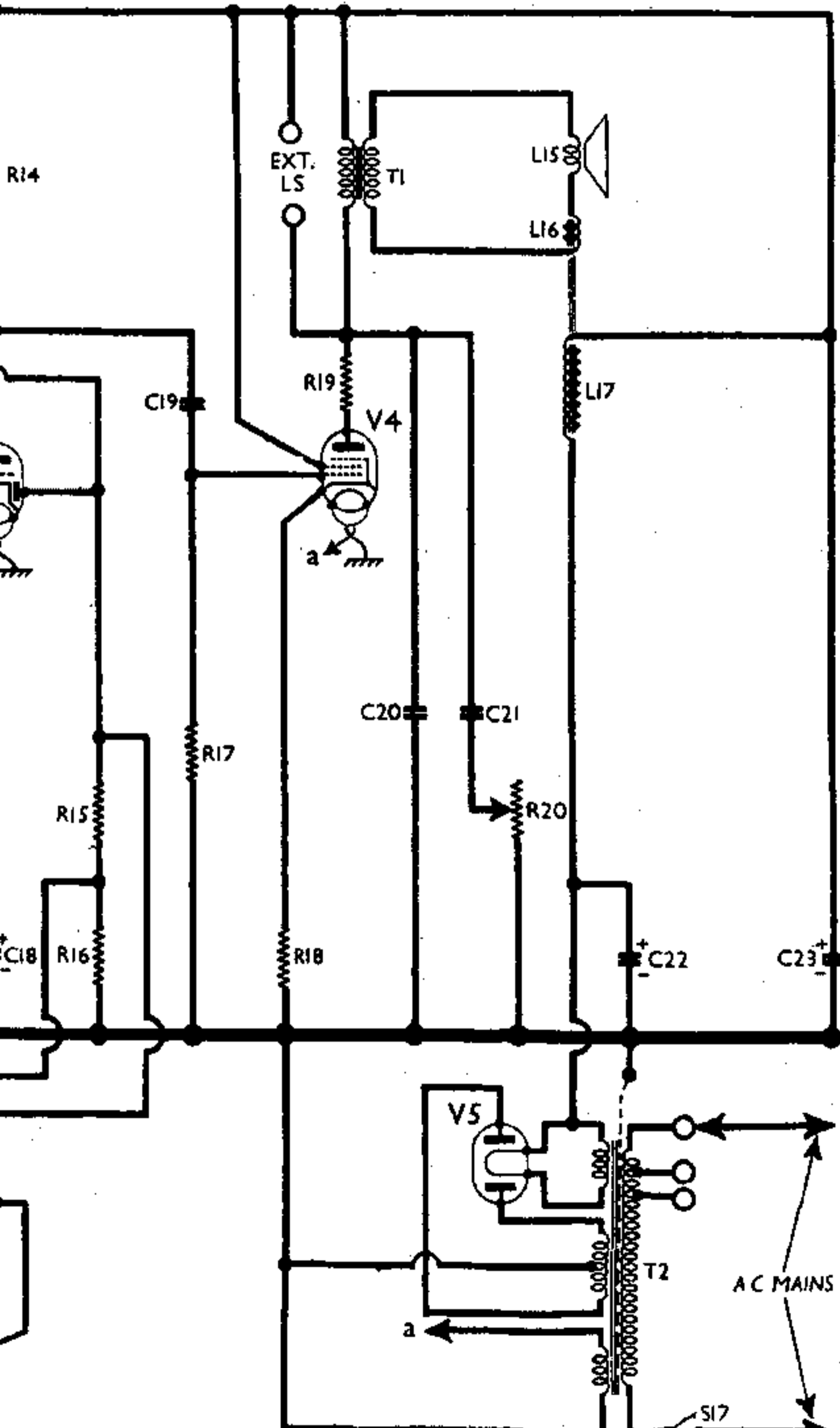
Resistance-capacity coupling by R14, C19 and R17 between V3 triode and pentode output valve (V4, Mullard EL33). Provision for connection of high impedance external speaker in anode circuit. Fixed tone correction by C20 in anode circuit, and variable tone control by C21 and R20, also in anode circuit. All these devices are connected at the remote end



Plan view of the chassis. All the trimmer and tracker adjustments are indicated here. Those of the aerial and oscillator circuits are reached through holes in the chassis deck, and those of the IF transformers through holes in the tops of the cans.

of the anode stopper resistance R19. A measure of negative feed-back is achieved by the omission of the usual cathode by-pass condenser.

HT current is supplied by full-wave rectifying valve (V5, Mullard "Amerty" 5Y3G). Smoothing by speaker field L17 in conjunction with dry electrolytic condensers C22 and C23. HT circuit RF filtering by C14.



bed in the "Circuit Description" above. In the the internal connections to the valve bases.

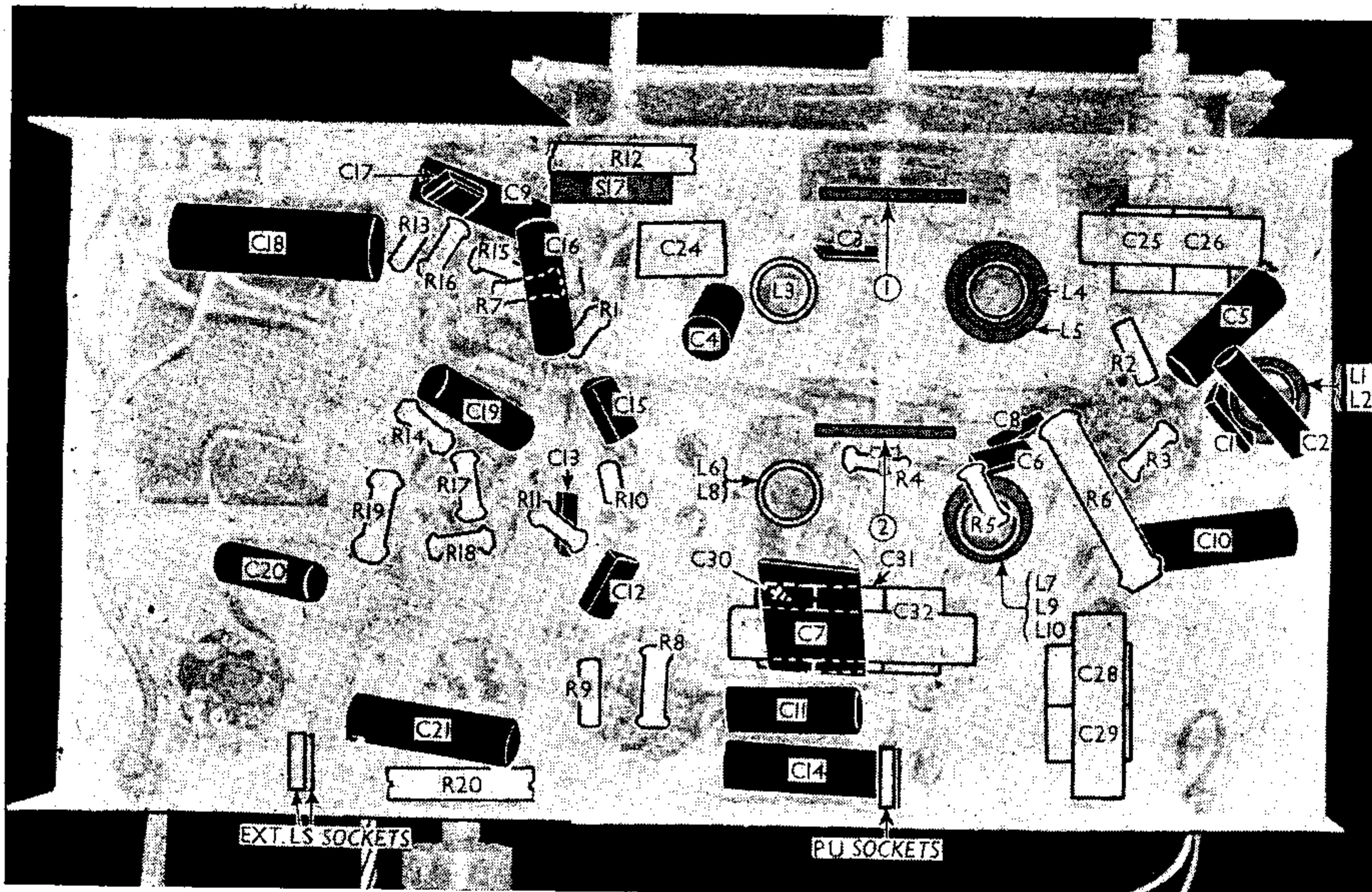
COMPONENTS AND VALUES

CONDENSERS		Values (μF)
C1	Aerial MW coupling ...	0.0005
C2	Part LW coupling ...	0.002
C3	Aerial SW coupling ...	0.00001
C4	V1 heptode CG decoupling ...	0.1
C5	V1 cathode by-pass ...	0.1
C6	V1 osc. CG condenser ...	0.0001
C7	Osc. circuit SW tracker ...	0.005
C8	V1 osc. anode coupling ...	0.0001
C9	V2 CG decoupling ...	0.1
C10	V1, V2 SG's decoupling ...	0.1
C11	V2 cathode by-pass ...	0.1
C12	IF by-pass condensers ...	0.00025
C13		0.00025
C14	HT circuit RF by-pass ...	0.1
C15	Coupling to V3 AVC diode ...	0.0001
C16	AF coupling to V3 triode ...	0.02
C17	IF by-pass condenser ...	0.0001
C18*	V3 cathode by-pass ...	25.0
C19	V3 triode to V4 coupling ...	0.02
C20	Fixed tone corrector ...	0.005
C21	Part variable tone control ...	0.05
C22*	HT smoothing condensers ...	16.0
C23*		16.0
C24†	Aerial circ. SW trimmer ...	0.00003
C25†	Aerial circ. MW trimmer ...	0.00003
C26†	Aerial circ. LW trimmer ...	0.00011
C27†	Aerial circuit tuning ...	—
C28†	Osc. circuit MW tracker ...	0.0006
C29†	Osc. circuit LW tracker ...	0.00025
C30†	Osc. circuit SW trimmer ...	0.00003
C31†	Osc. circuit MW trimmer ...	0.00003
C32†	Osc. circuit LW trimmer ...	0.0002
C33†	Oscillator circuit tuning ...	—
C34†	1st IF trans. pri. tuning ...	—
C35†	1st IF trans. sec. tuning ...	—
C36†	2nd IF trans. pri. tuning ...	—
C37†	2nd IF trans. sec. tuning ...	—

* Electrolytic. † Variable. ‡ Pre-set.

RESISTANCES		Values (ohms)
R1	V1 heptode CG decoupling	550,000
R2	V1 fixed GB resistance ...	330
R3	V1 osc. CG resistance ...	50,000
R4	Osc. SW reaction damping	50
R5	Osc. LW reaction damping	10,000
R6	V1 osc. anode HT feed ...	27,000
R7	V2 CG decoupling ...	560,000
R8	V1, V2, SG's HT feed ...	50,000
R9	V2 fixed GB resistance ...	330
R10	IF stopper ...	82,000
R11	V3 signal diode load ...	500,000
R12	Manual volume control ...	2,000,000
R13	V3 fixed GB ; AVC delay	2,600
R14	V3 triode anode load ...	250,000
R15	V3 AVC diode load resistances	560,000
R16		560,000
R17	V4 CG resistance ...	560,000
R18	V4 GB resistance ...	150
R19	V4 anode stopper ...	100
R20	Variable tone control ...	100,000

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial circuit choke ...	330.0
L2	Aerial LW coupling ...	20.0
L3	Aerial SW tuning coil ...	Very low
L4	Aerial MW tuning coil ...	3.0
L5	Aerial LW tuning coil ...	26.0
L6	Oscillator SW reaction	0.1
L7	Oscillator MW reaction	1.0
L8	Osc. circ. SW tuning coil	Very low
L9	Osc. circ. MW tuning coil	2.0
L10	Osc. circ. LW tuning coil	5.25
L11	1st IF trans. { Pri. ...	8.5
L12		{ Sec. ...
L13	2nd IF trans. { Pri. ...	8.5
L14		{ Sec. ...
L15	Speaker speech coil ...	2.0
L16	Hum neutralising coil ...	0.1
L17	Speaker field coil ...	1,500.0
T1	Speaker input { Pri. ...	550.0
	{ Sec. ...	0.3
	{ Pri., total ...	29.0
T2	Mains { Heater sec ...	0.1
	{ Rect. heat sec ...	0.15
	{ HT sec., total ...	330.0
S1-S15	Waveband switches ...	—
S16	Gram PU switch ...	—
S17	Mains switch, ganged	—
	R12	—



Under - chassis view. The two switch units are indicated here by arrows and numbers in circles, and are seen in detail in the diagrams* in col. 3 below. The aerial coils L3, L4, L5 are separated by a metal screen from the oscillator coils L6-L10.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 235 V, using the 240-250 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the medium waveband, 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 ECH35	254 Oscillator	1.5 4.3	95	1.7
V2 EF39	254	6.1	95	1.8
V3 EBC33	43	0.6	—	—
V4 EL33	229	34.0	254	5.0
V5 5Y3G	340†	—	—	—

† Each anode, AC.

DISMANTLING THE SET

Removing Chassis.—Remove the three control knobs (pull-off) from the front of the cabinet;

remove the four round-head screws (with square claw washers) holding the chassis to the bottom of the cabinet.

The chassis may now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free chassis entirely, unsolder from the connecting panel on the speaker transformer the three leads connecting it to chassis.

When replacing, connect the speaker leads as follows, numbering the tags on the transformer from top to bottom:

- 1 and 2 (joined together) orange;
- 3, blue;
- 4, white.

Removing Speaker.—Unsolder the three leads as described above; remove the four brass hexagon nuts holding the speaker to the sub-baffle.

When replacing, the transformer should be at the top left-hand corner of the assembly, when viewed from the rear.

GENERAL NOTES

Switches.—S1-S15 are the waveband switches, and S16 the pick-up switch, ganged in two rotary units beneath the chassis. They are indicated in our under-chassis view, and shown in detail in the diagrams (col. 3) where they are viewed in the direction of the arrows in the under-chassis view.

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

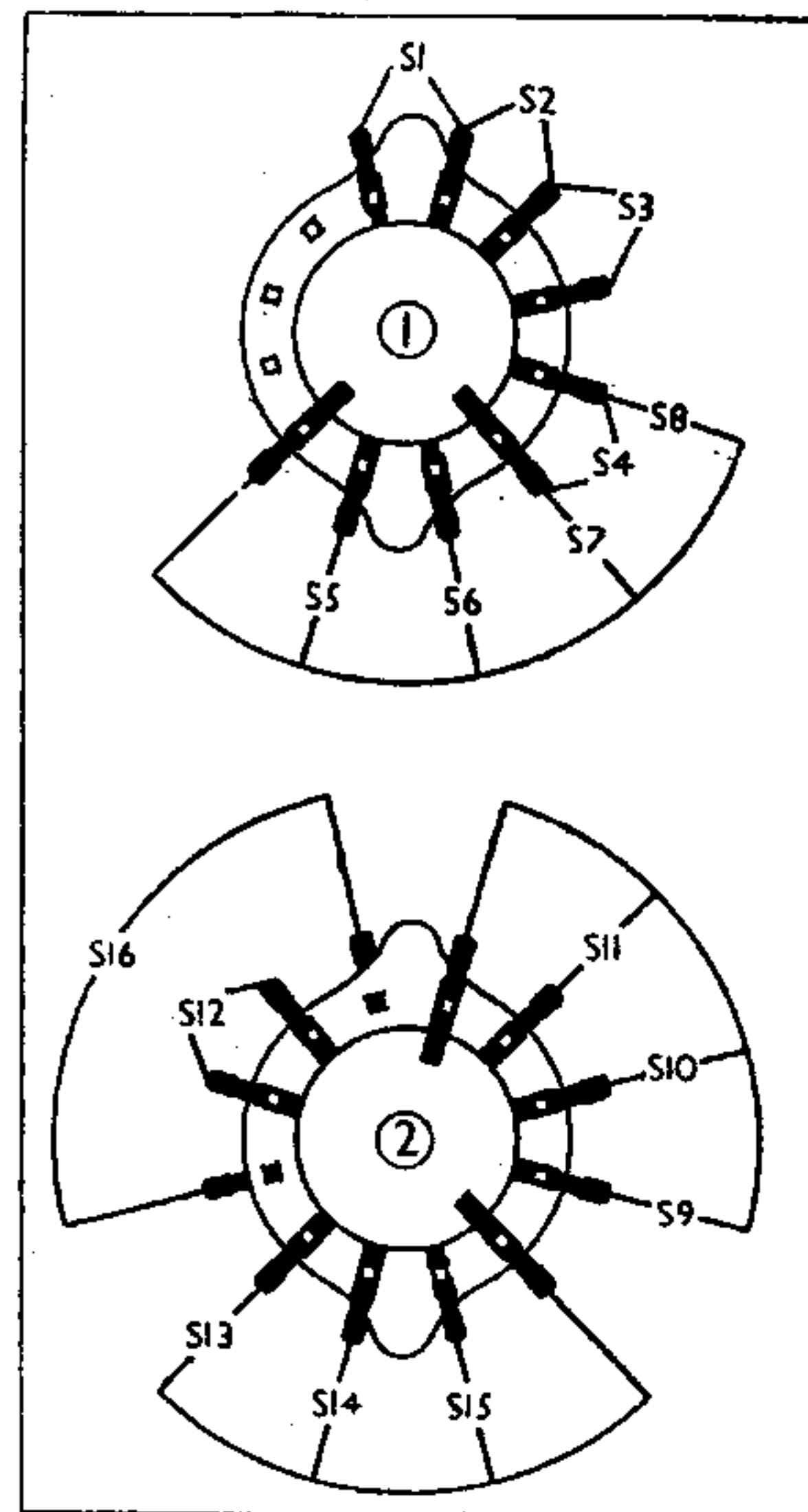
S17 is the QMB mains switch, ganged with the volume control R12.

Switch Table

Switch	SW	MW	LW	Gram.
S1	—	—	○	—
S2	—	—	—	—
S3	○	—	—	—
S4	—	○	—	—
S5	○	—	—	—
S6	—	—	—	—
S7	—	○	—	—
S8	—	—	—	—
S9	○	—	—	—
S10	—	—	—	—
S11	—	—	—	—
S12	—	—	—	—
S13	○	—	—	—
S14	—	—	—	—
S15	—	—	—	—
S16	—	—	—	○

Coils.—The aerial coils L1, L2; L3; and L4, L5; are in three unscreened units beneath the chassis. The oscillator coils L6, L8 and L7, L9, L10 are in two unscreened

units, also beneath the chassis. L3-L5 are situated in front of the screening partition, and L6-L10 are behind it. In the case of the L6, L8 unit, L8 is the thick wire winding.



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

Gramophone Pick-up.—Two sockets on the rear of the chassis are provided for connection of a gramophone pick-up, which should have an impedance of about 2,000 Ω. Since a gramophone position

is provided on the waveband control, the leads from the pick-up may be left connected permanently.

External Speaker.—Two further sockets are provided at the rear of the chassis for a high impedance (about 5,000 Ω) external speaker. It should be noted that the sockets are in the HT positive circuit, and are "live."

Scale Lamps.—These are two Ever Ready MES types, rated at 6.2 V, 0.3 A, and are connected directly across the heater circuit.

Condenser C18.—This is a Plessey dry electrolytic in a tubular cardboard container. It is rated at 25 μ F, 25 V working, 35 V surge.

Condensers C22, C23.—These are two dry electrolytics in a single tubular cardboard container, mounted vertically in a clip on the chassis deck. They are each rated at 16 μ F, 450 V working. The three connecting tags, which are reached from beneath the chassis, are colour coded. The red spotted tag and the plain tag are the positive connections of the two condensers, and the black spotted tag is the common negative connection.

Pre-set Condensers.—The aerial and oscillator trimmers and trackers are made up in single, double and triple units.

They are mounted on the underside of the chassis deck, and their adjusting screws are accessible from above the deck, through holes punched in the chassis pressing. The units are indicated in our under-chassis view, therefore, and their adjustments in the plan view.

The IF transformer trimmers are in dual units, mounted inside the transformer assemblies. Their adjustments are reached through holes in the tops of the cans.

Valves.—All the valves in this receiver are fitted with octal bases. **V1-V4** are Mullard "Red E" types, but with octal bases, and this is indicated by the insertion of a figure 3 in the type number. Thus, EF39 is equivalent to EF9, the figure 3 indicating the octal base. **V5** is a normal Mullard "Amerty" type, from their American series.

CIRCUIT ALIGNMENT

IF Stages.—Switch set to SW, and turn gang and volume control to maximum. Remove the top cap connector of **V1** and connect a 500,000 Ω resistance between the connector and the top cap of the valve. Connect the signal generator, via a 0.0002 μ F condenser, between the grid (top cap) of **V1** and the earth lead.

Feed in a 470 KC/S signal, and adjust

C37, C36, C35 and C34 in turn for maximum output. Repeat these adjustments.

RF and Oscillator Stages.—With the gang at maximum, pointer should be horizontal. Connect signal generator, via a suitable dummy aerial, to aerial and earth leads.

SW.—Switch set to SW, tune to 15 m on scale, feed in a 15 m (20 MC/S) signal, and adjust **C30**, using the peak involving the lesser capacity, and then **C24**, in that order, for maximum output. There is no adjustable tracking on this band, but performance should be checked at 50 m (6 MC/S).

MW.—Switch set to MW, tune to 214 m on scale, feed in a 214 m (1,400 KC/S) signal, and adjust **C31**, then **C25**, for maximum output. Feed in a 500 m (600 KC/S) signal, tune it in, and adjust **C28** for maximum output while rocking the gang for optimum results. Repeat the 214 m adjustments.

LW.—Switch set to LW, tune to 1,250 m on scale, feed in a 1,250 m (240 KC/S) signal, and adjust **C32**, then **C26**, for maximum output. Feed in a 2,000 m (150 KC/S) signal, tune it in, and adjust **C29** for maximum output while rocking the gang for optimum results. Repeat the 1,250 m adjustments.