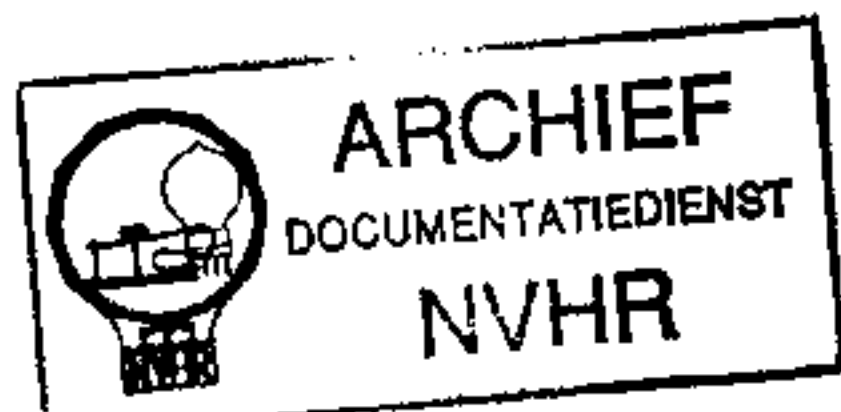
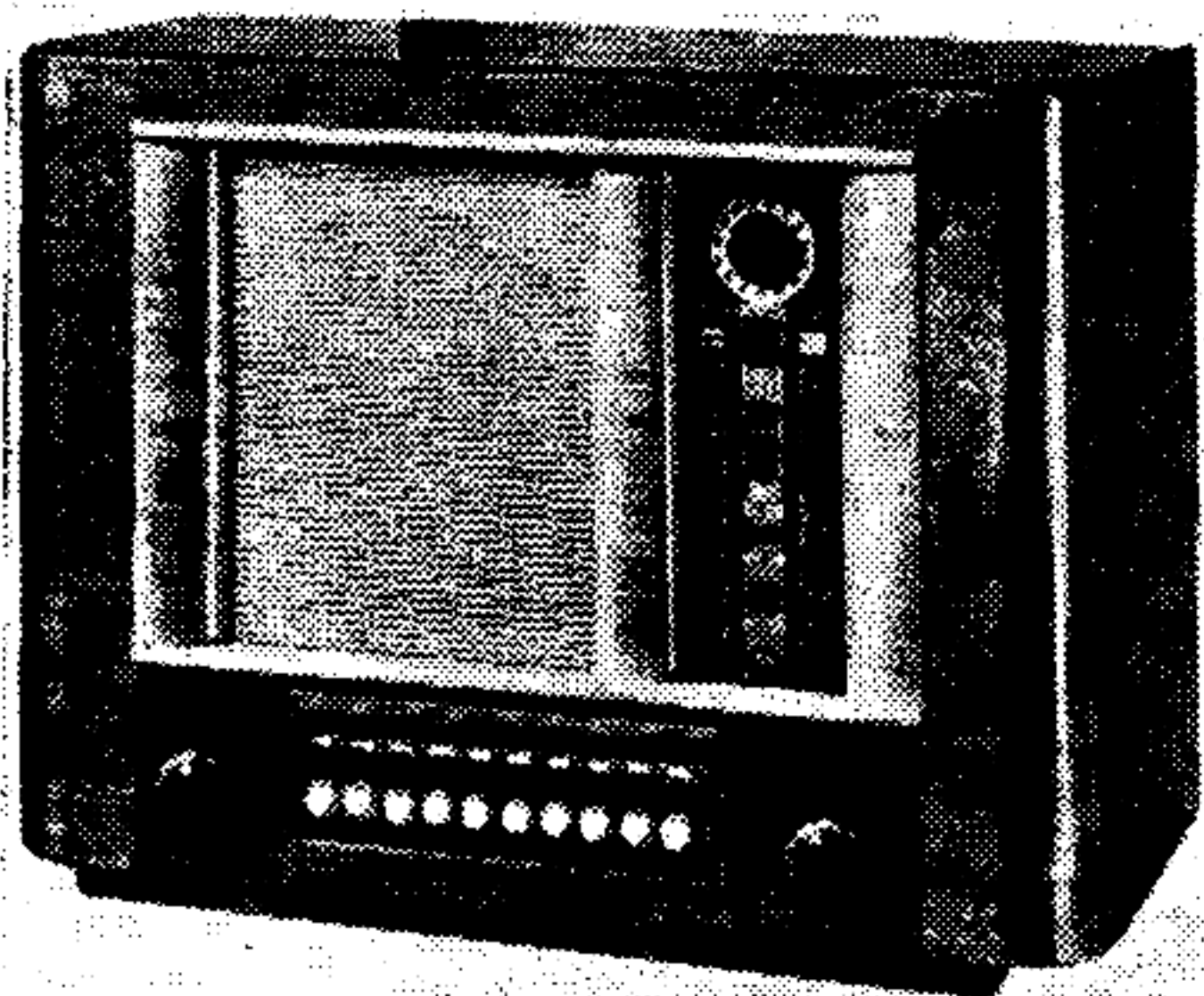


Ned. Ver. v. Historie v/d Radio



# BUSH PB53, SUG52, RG52 AND RG52G



The Bush PB53 press-button AC superhet.

**T**HE Bush PB53 includes press-button tuning for seven stations, employing trimmers for the aerial circuit and permeability tuning for the oscillator circuit, and press-buttons for manual wave-changing. The receiver is a 4-valve (plus rectifier) AC 3-band superhet with a short-wave range of 16.5-51m and is suitable for mains of 200-250 V, 40-100 C/S.

A very similar chassis is fitted in the SUG52 console and the differences are explained under "Model SUG52 Modifications," while the chassis of the RG52 and RG52G radiograms and record changing radiograms are also very similar, the differences being explained under "Model RG52 and RG52G

Modifications." This *Service Sheet* was prepared on a PB53.

Release date for PB53 and SUG52: June, 1938. Release date for RG52 and RG52G: July, 1938.

## CIRCUIT DESCRIPTION

The aerial circuit coupling coils are permanently connected as shown in the diagram, no switches being used for waveband changing. On SW, input is via condenser **C1** and coupling coil **L1** to single-tuned circuit **L4**, **C38**, manual tuning only being employed on this band.

MW coupling coil **L2**, and LW coupling coil **L3** with its shunt **C2**, are connected in series with each other across the aerial circuit in parallel with **C1**, **L1**, and couple the aerial to single-tuned circuits **L5**, **C38** (MW manual) and **L6**, **C38** (LW manual).

Waveband switching for manual tuning in this receiver is effected by press-button switches similar to those used for the automatic tuning. These switches are arranged in groups of three and in the diagram each group has been given a number, while each arm of each group has a letter **a**, **b** or **x** added as a suffix to its number, so that the SW group is numbered **S1a**, **S1b** and **S1x**, the MW group **S2a**, **S2b** and **S2x** and so on throughout the waveband and automatic switching.

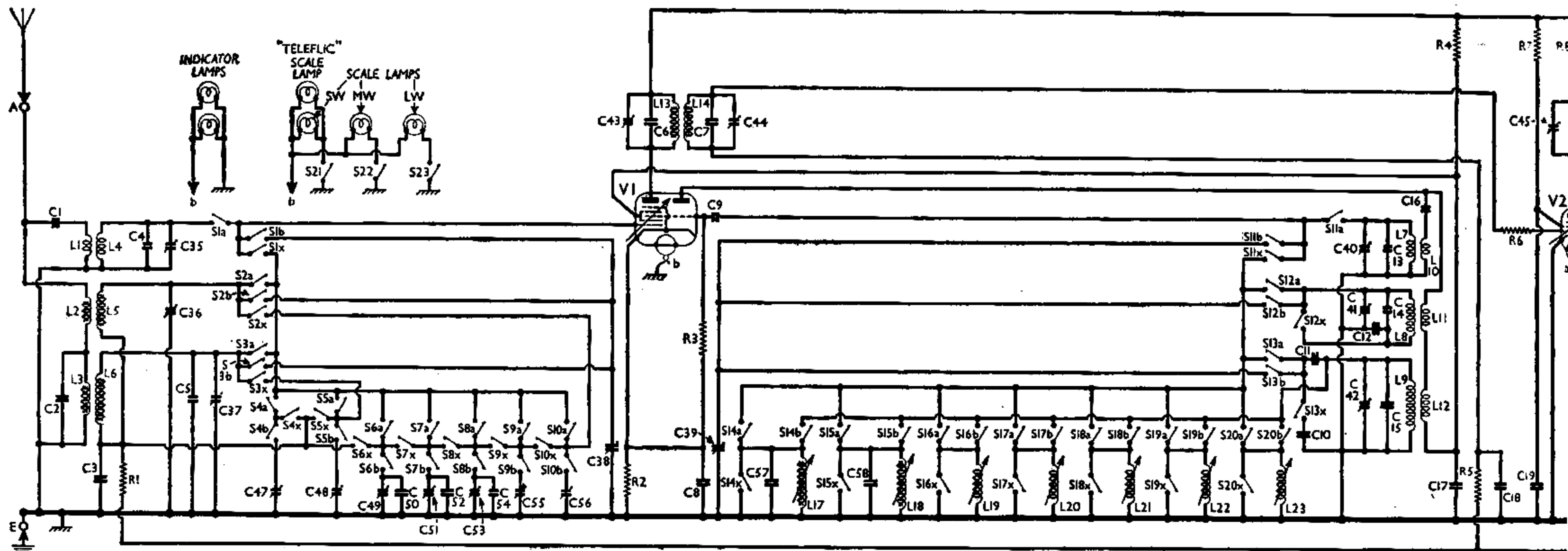
This method of numbering makes the action of the switches quite clear from a study of the diagram: if a button is depressed the "a's" and "b's" associated with that button close, while the "x's"

open, and when the button is released the converse is the case. It will be seen, therefore, that if the SW button is depressed, **S1a** and **S1b** close, connecting **L4**, **C38** and **V1** hexode CG together, while **S1x** is open; if the MW button is then depressed, the SW button is released, so that **S1x** closes together with **S2a** and **S2b**, connecting **L5** to **V1** hexode CG and **C38**.

When an automatic tuning button is depressed, **S1x**, **S2x** and **S3x** are closed, connecting **V1** CG, **L5** and **L6** to the automatic selector switches. At the same time the appropriate trimmer is connected to **L5** or **L6**, according to which button is depressed.

First valve (**V1**, Mullard metallised **TH4B**) is a triode hexode operating as frequency changer with internal coupling. Triode oscillator grid coils (manual tuning only) **L7** (SW), **L8** (MW) and **L9** (LW) are tuned by **C39**; parallel trimming by **C13**, **C40** (SW), **C14**, **C41** (MW) and **C15**, **C42** (LW); series tracking by **C12** (MW) and **C11** (LW). Reaction by coils **L10** via coupling condenser **C16** (SW), **L11** and **L12** (MW and LW).

The LW oscillator circuit, slightly modified by switching, operates also as master oscillator for automatic tuning, the tuning trimmers in this case being inductances with variable iron cores, connected in turn across the master oscillator tuning coil **L9** according to which button is depressed. The modification referred to is that, as the button controlling **S11** switches is now in the "Out" position, **S11a** and **S11b** are open while **S11x** is



Circuit diagram of the Bush PB53. The SUG52 has an identical circuit, while the RG52 and RG52G radiograms have similar circuits, the modifications being given overleaf. The speaker, and the tone control and mains switch, are connected to the chassis by 4-pin plugs and sockets. The connections of these are indicated by numbers in circles and arrows, and diagrams, looking at the undersides of the plugs, are inset.

closed, so that the LW manual tracker C11 becomes connected in series with C10 across the master oscillator circuit, the two together forming an additional trimmer.

Second valve (V2, **Cossor metallised MVS/Pen/B**) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary iron-cored transformer couplings C43, C6, L13, L14, C7, C44 and C45, C21, L15, L16, C22, C46.

Provision is made for connection of a voltmeter across anode feed resistance R8 for automatic circuit station setting as explained under "General Notes."

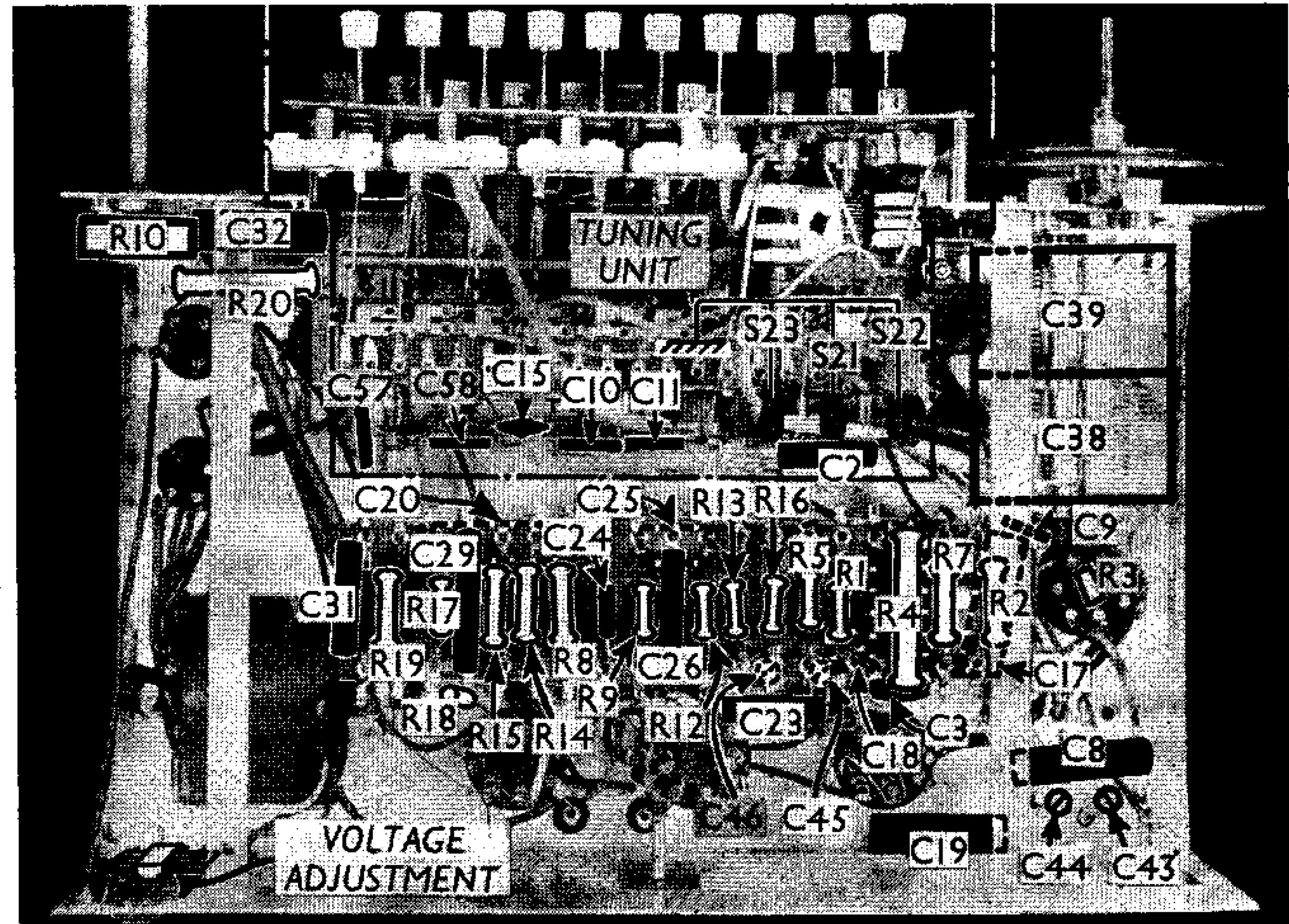
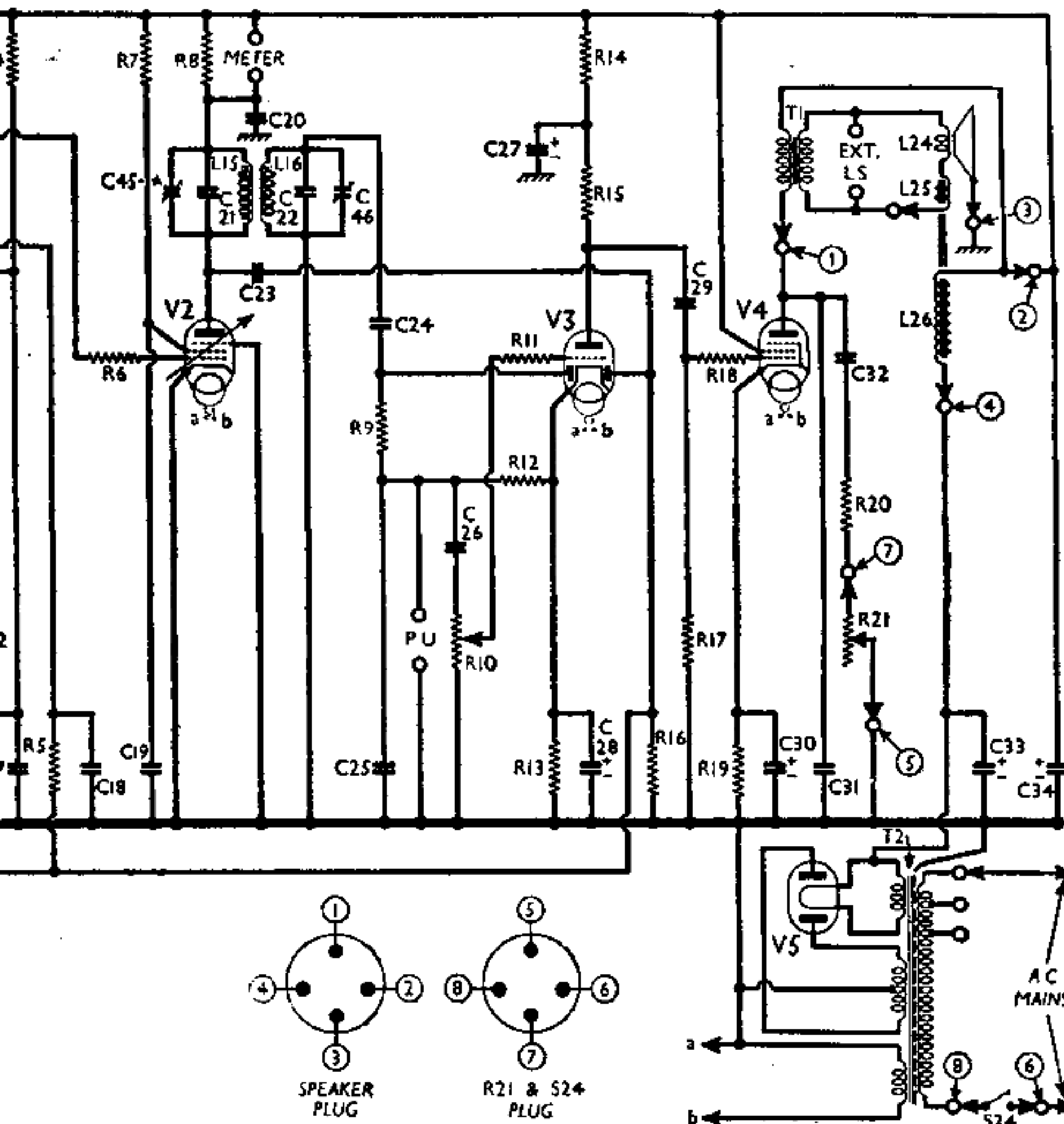
**Intermediate frequency 465KC/S.**

Diode second detector is part of double-diode triode valve (V3, **Mullard metallised TDD4**), being parallel-fed via C24 from L16. Audio frequency component in rectified output is developed across load resistance R12 and passed via AF coupling condenser C26, manual volume control R10 and grid stopper R11 to CG of triode section which operates as AF amplifier. IF filtering by R9, C25. Provision for connection of gramophone pick-up across R10.

Second diode of V3, fed from V2 anode via C23, provides DC potential which is developed across load resistance R16 and fed back through decoupling circuits as GB to FC (except on SW) and IF valves, giving AVC. Delay voltage is obtained from drop along R13 in cathode lead to chassis.

Resistance-capacity coupling by R15, C29, R17, via stopper resistance R18, between V3 triode and pentode output valve (V4, **Mullard PenB4**). Fixed tone correction by C31 and variable tone control by C32, R20 and R21, both in anode circuit. Provision for connection of low impedance external speaker across secondary of T1.

HT current is supplied by full-wave rectifying valve (V5, **Mullard DW4/350**). Smoothing is effected by speaker field L26 and dry electrolytic condensers C33, C34.



**COMPONENTS AND VALUES**

CONDENSERS		Values (μF)
C1	Aerial SW series condenser ..	0.00005
C2	Aerial LW circuit shunt ..	0.0008
C3	V1 hexode CG decoupling ..	0.5
C4	Aerial SW fixed trimmer ..	0.00005
C5	Aerial LW fixed trimmer ..	0.00003
C6	1st IF trans. pri. trimmer ..	0.00018
C7	1st IF trans. sec. trimmer ..	0.00018
C8	V1 cathode by-pass ..	0.05
C9	V1 osc. CG condenser ..	0.00003
C10	Auto osc. part trimmer (with C11) ..	0.00034
C11	Osc. circuit LW tracker (manual); part osc. circuit trimmer (auto) ..	0.000316
C12	Osc. circuit MW tracker ..	0.000556
C13	Osc. circ. SW fixed trimmer ..	0.000015
C14	Osc. circ. MW fixed trimmer ..	0.00001
C15	Osc. circ. LW fixed trimmer ..	0.000135
C16	V1 osc. anode SW coupling ..	0.00005
C17	V1 SG and osc. decoupling ..	0.05
C18	V2 CG decoupling ..	0.05
C19	V2 SG decoupling ..	0.05
C20	V2 anode decoupling ..	0.05
C21	2nd IF trans. pri. trimmer ..	0.00018
C22	2nd IF trans. sec. trimmer ..	0.00018
C23	Coupling to V3 AVC diode ..	0.0001
C24	Coupling to V3 signal diode ..	0.0001
C25	IF by-pass ..	0.0001
C26	AF coupling to V3 triode ..	0.01
C27*	V3 triode anode decoupling ..	2.0
C28*	V3 cathode by-pass ..	50.0
C29	V3 triode to V4 AF coupling ..	0.03
C30*	V4 cathode by-pass ..	50.0
C31	Fixed tone corrector ..	0.003
C32	Part of variable tone control ..	0.05
C33*	HT smoothing ..	16.0
C34*	HT smoothing ..	16.0
C35†	Aerial circuit SW trimmer ..	0.00001
C36†	Aerial circuit MW trimmer ..	0.00001
C37†	Aerial circuit LW trimmer ..	0.00001
C38†	Aerial circuit tuning ..	—
C39†	Oscillator circuit tuning ..	—
C40†	Osc. circuit SW trimmer ..	0.00001
C41†	Osc. circuit MW trimmer ..	0.00001
C42†	Osc. circuit LW trimmer ..	0.00001
C43†	1st IF trans. pri. tuning ..	0.00006
C44†	1st IF trans. sec. tuning ..	0.00006
C45†	2nd IF trans. pri. tuning ..	0.00006
C46†	2nd IF trans. sec. tuning ..	0.00006
C47†	Aerial circuit LW automatic tuning trimmers ..	0.00045
C48†	Aerial circuit LW automatic tuning trimmers ..	0.00045
C49†	Aerial circuit LW automatic tuning trimmers ..	0.00015
C50	Aerial circuit MW automatic tuning trimmers ..	0.00025
C51†	Aerial circuit MW automatic tuning trimmers ..	0.00015
C52	Aerial circuit MW automatic tuning trimmers ..	0.00016
C53†	Aerial circuit MW automatic tuning trimmers ..	0.00015
C54	Oscillator circuit automatic tuning trimmers ..	0.00006
C55†	Oscillator circuit automatic tuning trimmers ..	0.00015
C56†	Oscillator circuit automatic tuning trimmers ..	0.00015
C57	Oscillator circuit automatic tuning trimmers ..	0.000316
C58	Oscillator circuit automatic tuning trimmers ..	0.000316

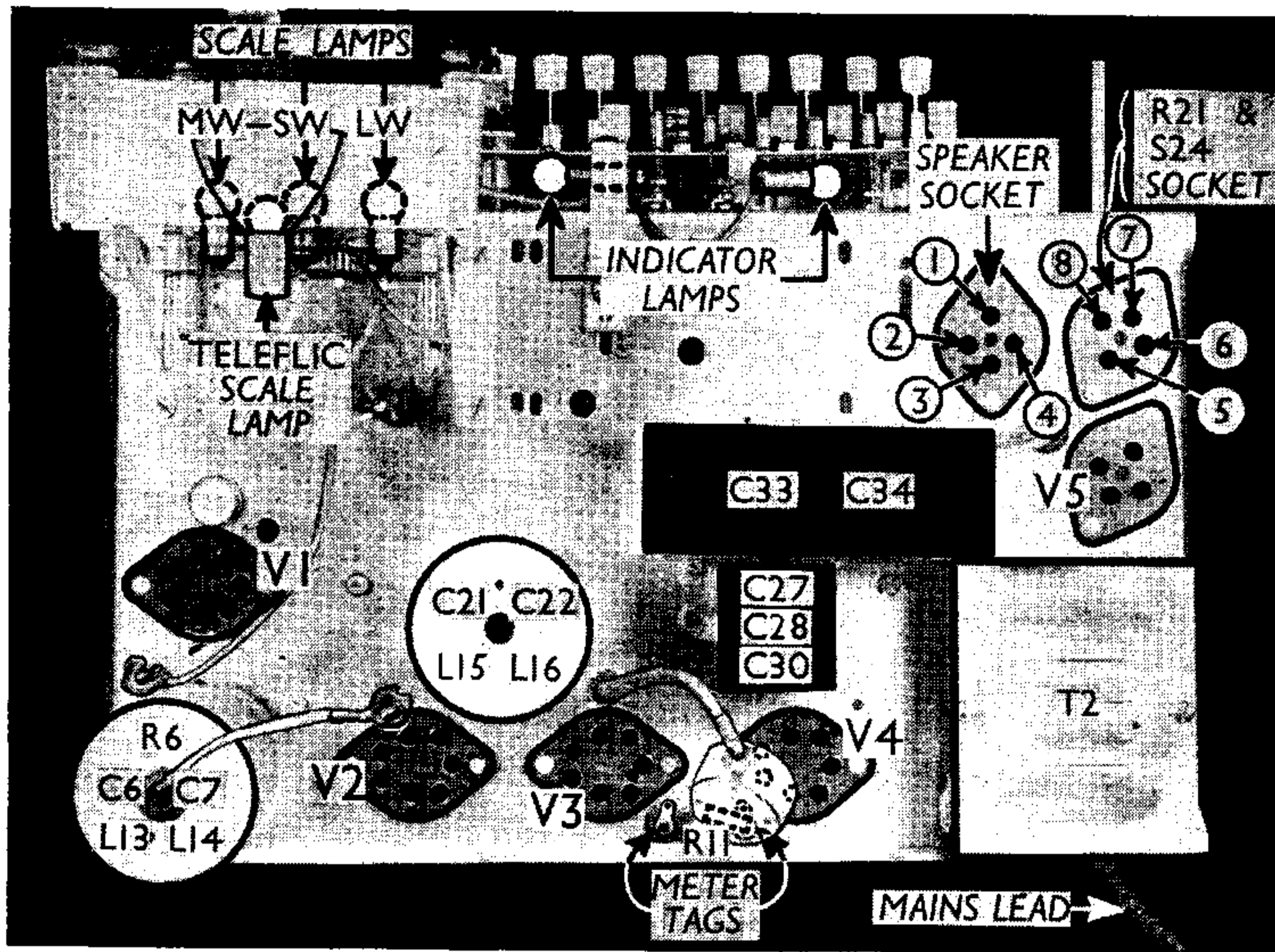
\* Electrolytic. † Variable. ‡ Pre-set.

Under-chassis view. A larger illustration of the tuning unit is given overleaf.

RESISTANCES		Values (ohms)
R1	V1 hexode CG decoupling ..	1,000,000
R2	V1 fixed GB resistance ..	100
R3	V1 osc. CG resistance ..	30,000
R4	V1 SG and osc. anode HT feed ..	20,000
R5	V2 CG decoupling ..	2,000,000
R6	V2 grid stabiliser ..	50
R7	V2 SG HT feed ..	100,000
R8	V2 anode HT feed ..	10,000
R9	IF stopper ..	250,000
R10	Manual volume control ..	500,000
R11	V3 triode grid stopper ..	100,000
R12	V3 signal diode load ..	500,000
R13	V3 GB and AVC delay ..	1,000
R14	V3 triode anode decoupling ..	10,000
R15	V3 triode anode load ..	50,000
R16	V3 AVC diode load ..	1,000,000
R17	V4 CG resistance ..	500,000
R18	V4 grid stopper ..	100,000
R19	V4 GB resistance ..	170
R20	Part of variable tone filter ..	2,000
R21	Variable tone control ..	25,000

OTHER COMPONENTS		App-ox. Values (ohms)
L1	Aerial SW coupling coil ..	0.1
L2	Aerial MW coupling coil ..	0.6
L3	Aerial LW coupling coil ..	30.0
L4	Aerial SW tuning coil ..	0.05
L5	Aerial MW tuning coil ..	1.3
L6	Aerial LW tuning coil ..	14.0
L7	Osc. circuit SW tuning coil ..	0.1
L8	Osc. circuit MW tuning coil ..	1.6
L9	Osc. circuit LW tuning coil ..	3.0
L10	Oscillator SW reaction ..	0.2
L11	Oscillator MW reaction ..	1.1
L12	Oscillator LW reaction ..	2.2
L13	1st IF trans. { Pri. .. 4.0 Sec. .. 4.0	
L14		
L15	2nd IF trans. { Pri. .. 4.0 Sec. .. 4.0	
L16		
L17	Oscillator circuit LW automatic tuning coils .. { 2.0 2.0	
L18		
L19	Oscillator circuit MW automatic tuning coils .. { 1.4 1.2	
L20		
L21	Speaker speech coil .. 2.8	
L22		
L23	Hum neutralising coil .. 0.5	
L24		
L25	Speaker field coil .. 600.0	
L26		
T1	Speaker input { Pri. .. 250.0 Sec. .. 0.8	

Continued overleaf



Plan view of the chassis. The individual contacts of the speaker, and the tone control and switch sockets are numbered to agree with the circuit.

is "out," the associated **a** and **b** switches are *open*, and the **x** switches *closed*. When a button is "in," its **a** and **b** switches are *closed* and its **x** switches are *open*.

Numbering the buttons from left to right looking at the front of the receiver, the first seven buttons control pre-set stations, the eighth is the LW button, the ninth the SW and the tenth on the right, the MW.

The switch groups controlled by the various buttons are: Button 1, **S4** and **S14**; 2, **S5** and **S15**; 3, **S6** and **S16**; 4, **S7** and **S17**; 5, **S8** and **S18**; 6, **S9** and **S19**; 7, **S10** and **S20**; 8, **S3** and **S13**; 9, **S1** and **S11**; 10, **S2** and **S12**.

In addition to the actual press-button switches, there are three scale lamp switches, **S21-S23**, controlled by the three right-hand (wavechange) buttons. These switches are formed by the metal plungers of the three press-buttons (which are earthed) and three spring contacts into which the plungers slide when the buttons are depressed.

**S24** is the QMB mains switch, ganged with the tone control **R21**, which is fitted at the left-hand side of the cabinet, and is connected to the chassis by a 4-pin plug and socket.

**Coils.**—All the coils, with the exception of the IF transformers, are on unshielded tubular formers, built into a unit, together with the press-button switches and the various trimmers. **L1, L4; L7, L10; L8, L11** and **L9, L12** are air-cored. **L2, L5** and **L3, L6** have fixed iron-dust cores, while **L17-L23** have adjustable iron-dust cores for permeability trimming of the oscillator circuits of the seven pre-set station buttons.

The IF transformers **L13, L14** and **L15, L16** are in two screened units on the chassis deck with their associated trimmers. The variable trimmers are adjusted from beneath the chassis. The first IF transformer **L13, L14** also contains **R6**.

**Scale and Indicator Lamps.**—In all, six lamps are used in this receiver, and they are all Ever Ready MES types, rated at 6.2 V, 0.3 A. Three of them are for illuminating the manual tuning scale, and fit into a holder at the back of the scale. If one of these lamps has to be replaced, see that the holder is replaced the correct way round. The lamps are switched by **S21-S23**, ganged with the waveband press-buttons. The fourth lamp is in a reflector behind the Teleflc dial, and is switched by **S21** (on SW only).

The other two lamps are mounted in holders at the front of the chassis.

**External Speaker.**—Two sockets are provided on a strip at the rear of the cabinet for a low impedance (2.5 O) external speaker. A plug and socket device permits the internal speaker to be muted when desired.

**Speaker Plug.**—A 4-pin plug and socket device connects the speaker to the receiver chassis. An underneath view of the plug, with the pins numbered 1, to 4, is shown beneath the circuit diagram and the connections are indicated by circles and arrows in the diagram itself. The colour coding of the leads to the pins is: 1, yellow; 2, two reds; 3, black; 4, blue.

OTHER COMPONENTS (Continued)		Approx. Values (ohms)
T2	Mains trans. { Pri., total .. Heater sec. .. Rect. heat. sec. .. HT sec., total	21.0 0.1 0.1 250.0
S1a, b, x to S3a, b, x	Aerial circ. waveband and manual/auto switches ..	—
S11a, b, x to S13a, b, x	Osc. circuit waveband and manual/auto switches ..	—
S4a, b, x to S10a, b, x	Aerial circuit auto tuning trimmer selector switches	—
S14a, b, x to S20a, b, x	Oscillator circuit auto tuning coil selector switches ..	—
S21-S23	Scale lamps switches ..	—
S24	Mains switch, ganged R21	—

**DISMANTLING THE SET**

**Removing Chassis.**—Remove the two control knobs at front of cabinet (recessed screws), withdraw tone control plug from socket on chassis deck and free speaker leads from cleat on sub-baffle.

Now remove the four bolts (with claw washers) holding chassis to bottom of cabinet, when chassis can be withdrawn to extent of speaker leads, which is sufficient for normal purposes. *When replacing*, do not forget the felt washers on the control spindles.

To free chassis entirely, withdraw speaker plug from socket, and *when replacing*, make sure that tone control and speaker plugs are inserted in the correct sockets.

If it is desired to gain access to the underside of the press-button unit, unsolder from **R1** the green/black wire to **L6** and from the switches the three leads to scale lamps. Then remove the four bolts (with distance pieces) holding unit to front member of chassis and remove the two self-tapping screws holding brackets to chassis.

*When replacing*, connect scale lamp leads as follows, numbering the connections from left to right, when looking from back of chassis:—1, red; 2, yellow; 3, blue.

**Removing Speaker.**—Free leads from

cleats on sub-baffle and top of cabinet; withdraw plug from socket on chassis deck and remove extension speaker panel (four round-head wood screws). Now remove nuts and washers from the four screws holding speaker to sub-baffle. *When replacing*, see that transformer is on the left.

**VALVE ANALYSIS**

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 230 V, using the 230 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 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 TH4B	{ 245 Oscillator 70	{ 2.4 4.2	70	5.0
V2 MVS/Pen /B	178	5.5	76	1.5
V3 TDD4	90	2.3	—	—
V4 PenB4	226	62.0	245	7.4
V5 DW4/350	315†	—	—	—

† Each anode, AC.

**GENERAL NOTES**

**Switches.**—There are ten press-buttons, and each one controls six 2-pole shorting switches, three on each side of the unit. In our circuit diagram and other illustrations the switches are grouped in threes, so that in this way each button controls two numbered groups of three, the individual switches in each group being indicated by suffix letters **a, b** and **x**, following the group number.

The arrangement and operation of the switches is fully explained near the beginning of the Circuit Description, and it should be noted that when a button

**R21 and S24 Plug.**—A similar 4-pin plug and socket connects the tone control resistance R21 and mains switch S24 to the receiver chassis. This is indicated in the same way, the pins being numbered 5 to 8. The colour coding of the leads to the pins is: 5, black; 6, red; 7, yellow; 8, blue.

**Meter Tags.**—Two tags are fitted on an insulating strip at the rear of the chassis deck. They are provided to permit a voltmeter to be connected across R8, which serves as an indicator when setting the station selector buttons.

**Condensers C33, C34.**—These are two 16  $\mu$ F dry electrolytics in a single carton on the chassis deck, having a common negative (black) lead. The red lead to socket 4 of speaker connector is the positive of C33, and the red lead to socket 2 of speaker connector, is the positive of C34.

**Condensers C27, C28, C30.**—These are three dry electrolytics in a single carton on the chassis deck, having a common negative (black) lead. The red lead is the positive of C27 (2  $\mu$ F, 550 PV). The yellow lead to R13 beneath the chassis is the positive of C28 (50  $\mu$ F, 15 PV) and the yellow lead to V4 valveholder is the positive of C30 (50  $\mu$ F, 15 PV).

**Chassis Divergency.**—In some models a 5  $\mu$ F fixed condenser may be connected across C36. It was not included in our chassis.

### MODEL SUG52 MODIFICATIONS

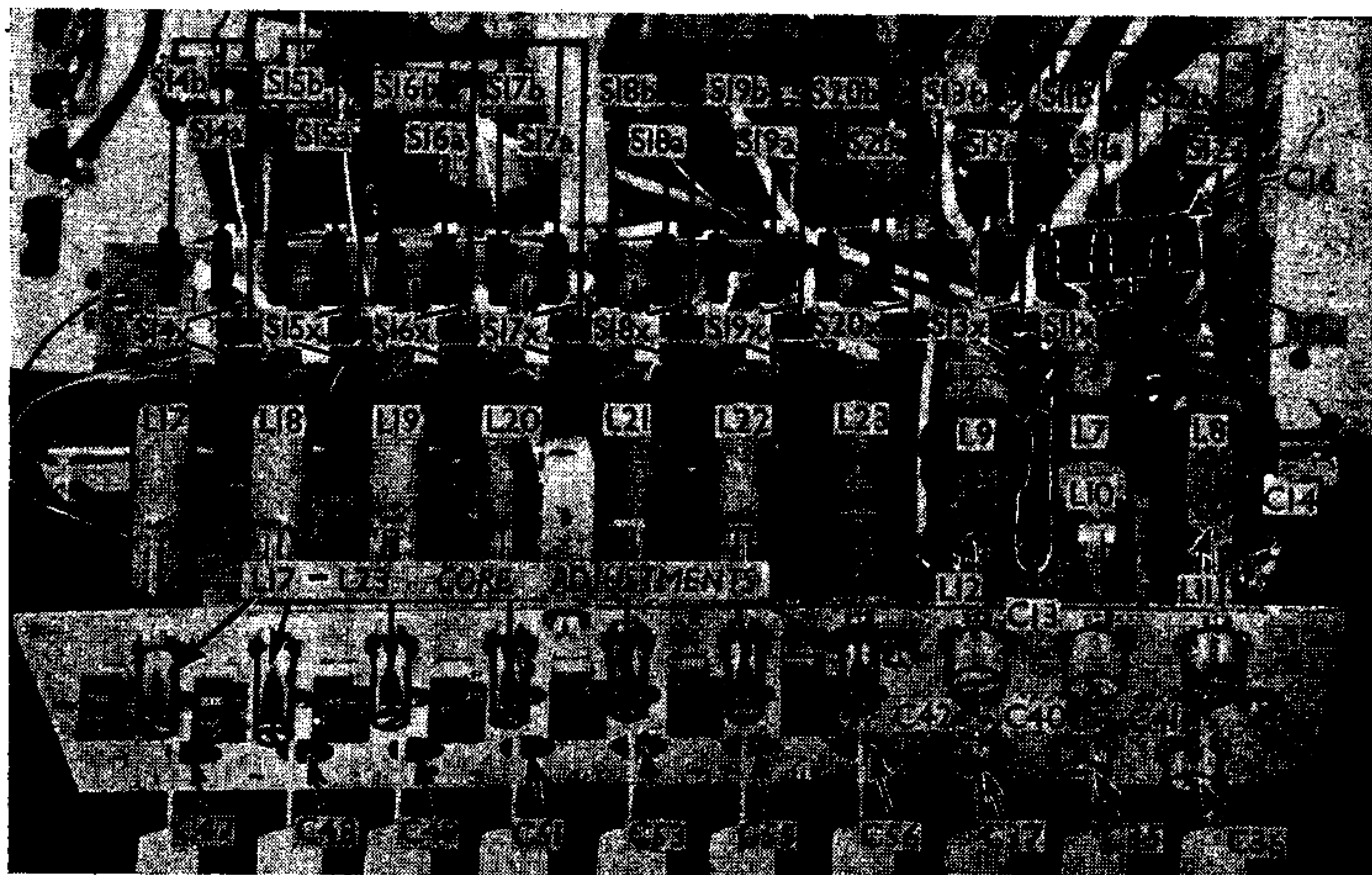
The console model SUG52 only differs in slight details, such as the omission of the Telefic dial and its lamp, the use of a different scale plate and a modified pointer drive. L24 is earthed by a lead connected between the left-hand Ext. LS socket and the right-hand (earthed) pick-up socket.

### MODEL RG52 AND RG52G MODIFICATIONS

All the radiogram models use the seventh button from the left for gram switching, so that only six pre-set stations are possible. L23 and C58 are therefore omitted, and the switch groups S10 and S20 are used for other purposes.

R12 is replaced by two 250,000 O resistors in series. One pick-up socket is earthed, and the other goes to the common contact of S20a, b, x. The junction of the two resistances replacing R12 goes to the other contact of S20b. The other contact of S20a is blank, while the other contact of S20x goes to chassis. Consequently, when the gram button is depressed, the top of the pick-up is connected to the junction of the two resistors and thus to the volume control.

Of the S10 a, b, x switches, the common contact



The tuning unit as seen from the top, when partially withdrawn from the chassis. The core and trimmer adjustments are all indicated.

goes to chassis, while the other contact of S10a goes to the bottom of R7. The other contacts are blank. On pressing the gram button, V2 SG is earthed, thus muting radio.

In the radiogram models, the volume control is at the right-hand side of the cabinet, and is connected to the chassis by a 4-pin plug and socket. Assuming the same pin numbering as in the speaker plug, pin 1 goes to one end of R10, pin 2 goes to the other end of R10 and its case and screening, pin 3 goes to the slider and pin 4 is blank.

The R52G and R52G auto models have a Rola G12 speaker, instead of the Rola G10-Z in all the other models. In this case, T1 secondary has a resistance of 6.4 O (instead of 0.8 O), L24 becomes 6.2 O (instead of 2.8 O) and L25 becomes 0.3 O. The external speaker should have a resistance of 10 O.

The RG52 and RG52G models are fitted with a Garrard AC7A unit. Pick-up, 2,000 O resistance; motor, 800 O resistance. The auto models have the Garrard RC4A record changing unit.

### ALIGNMENT OF MANUAL CIRCUITS

**IF Stages.**—Press MW manual tuning button, tune to 300 m on the scale, turn volume control to maximum, and tone control to "low." A damping circuit consisting of a 30,000 O resistor in series with a 0.05  $\mu$ F condenser in series must be used where indicated below.

Connect signal generator between control grid (top cap) of V2 and chassis, and feed in a 465 KC/S signal. Connect damping circuit between anode of V2 and chassis, and adjust C48 for maximum output. Connect damping between V3 signal diode (pin 1) and chassis, and adjust C45 for maximum output.

Connect signal generator between control grid (top cap) of V1 and chassis, connect damping between anode of V1 and chassis, and adjust C44 for maximum output. Connect damping circuit between control grid (top cap) of V2 and chassis, and adjust C43 for maximum output.

**RF and Oscillator Circuits.**—With gang at maximum, indicator should coincide with the tops of the wavelength scales. Remove the escutcheon plate from front of cabinet if chassis has not been removed. Turn volume control to maximum, and tone control to "low." Connect signal generator to A and E sockets.

**SW.**—Press SW button, and tune to 18 m on scale. Feed in an 18 m (16.67 MC/S) signal and adjust C40 (above SW button) and C35 (below SW button) for maximum output. Check calibration at 50 m.

**MW.**—Press MW button, and tune to 300 m on scale. Feed in a 300 m (1,000 KC/S) signal, and adjust C41 (above MW button) and C38 (below MW button) for maximum output. Check calibration at 500 m.

**LW.**—Press LW button, and tune to 1,500 m on scale. Feed in a 1,500 m (200 KC/S) signal, and adjust C42 (above LW button) and C37 (below LW button) for maximum output. Check calibration at 1,900 m.

### PRE-SET STATION SELECTION

Stations can be selected by buttons 1 to 7, numbering from the left. The wavelength ranges covered by each button are: 1 and 2, 1,200-2,000 m; 3, 450-550 m; 4, 375-475 m; 5, 275-375 m; 6 and 7, 200-300 m.

To select a station accurately, it is advisable to use a DC voltmeter (0-60 V), connected across the two tags on the chassis deck, as an indicator. Adjustments should always be made for *minimum* reading on the meter.

If the chassis is still in the cabinet, remove the escutcheon of the press-button unit (two instrument-head screws).

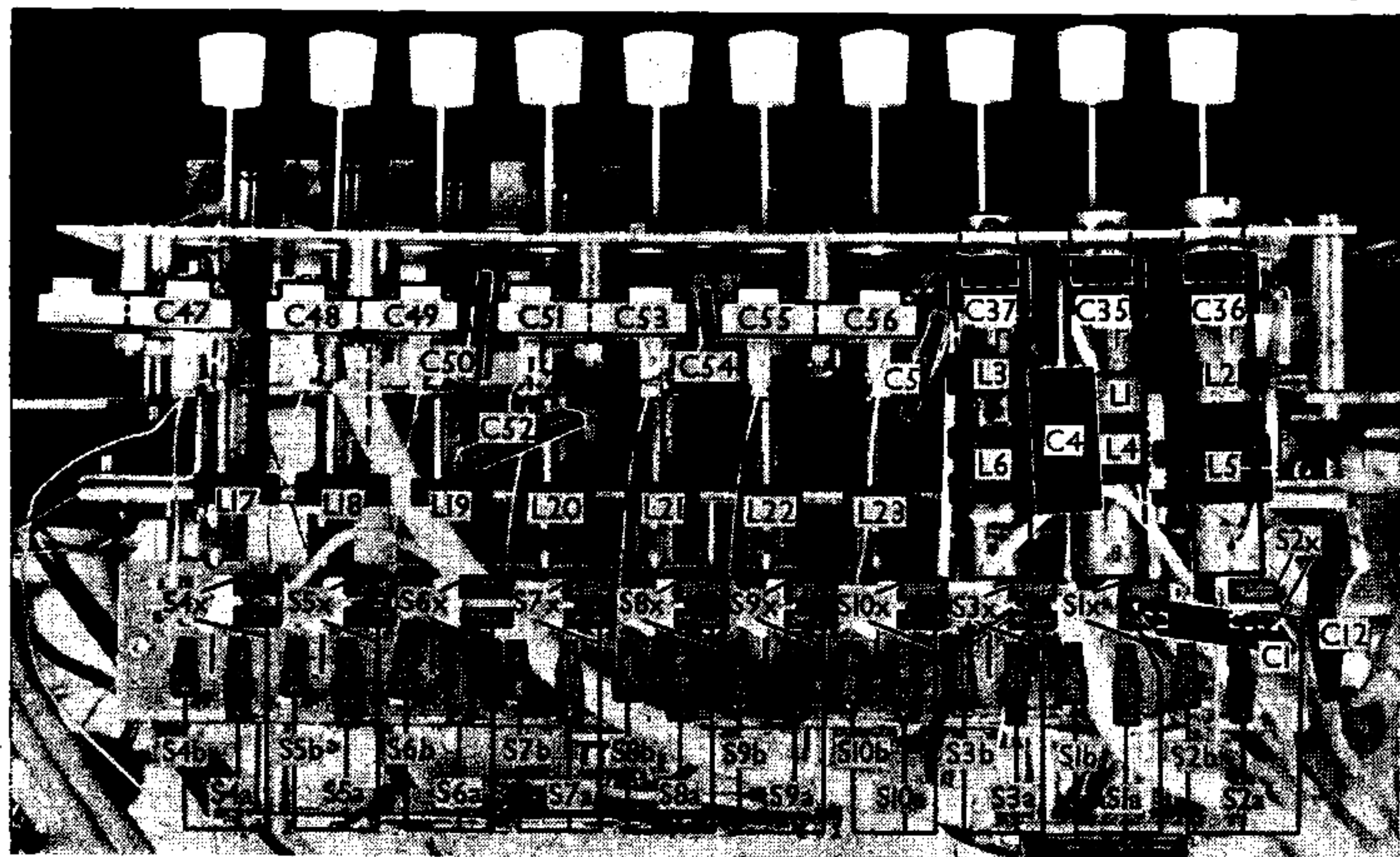
Connect the aerial and earth to the receiver and press the button to be used for the desired station. Turn the core adjustment for the associated oscillator coil (above the button) until the index mark is at the approximate wavelength on the small calibrated scale. Then carefully turn the adjustment until the loudest output from the desired station (*minimum* voltmeter reading) is obtained.

Adjust the associated aerial circuit trimmer (below the button) for maximum output (*minimum* voltmeter reading).

Re-adjust both trimmers carefully as a final check. **NOTE.**—Any adjustment of the manual tuning trimmer C42 will affect the tuning of the pre-selected stations. After manual circuit alignment, therefore, the cores of L17 to L23 must be re-adjusted.

Any adjustment of the MW manual tuning aerial trimmer C36 will necessitate readjustment of the MW pre-set station trimmers. Similarly any adjustment of the LW manual tuning aerial trimmer C37 will affect the setting of C47 and C48.

If a new TH4B valve has to be fitted, it may be found necessary to re-adjust the pre-set oscillator circuits. The best way to do this is to use the LW manual trimmer C42 for correction purposes. Press the sixth or seventh button, which controls a station near the bottom of the MW band, and adjust C42 until this station is at its maximum volume. When this is so, all the other pre-selected stations will be correct. The slight adjustment of C42 which is necessary will not affect the LW manual alignment appreciably.



The tuning unit as seen from the underside of the chassis.