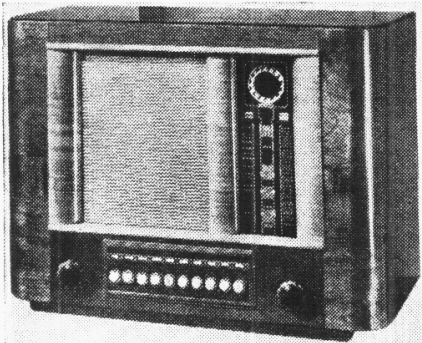


"TRADER" SERVICE SHEET

38

# BUSH PB53,

## SUG52, RG52 AND RG52G



The Bush PB53 press-button AC superhet.

THE 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.

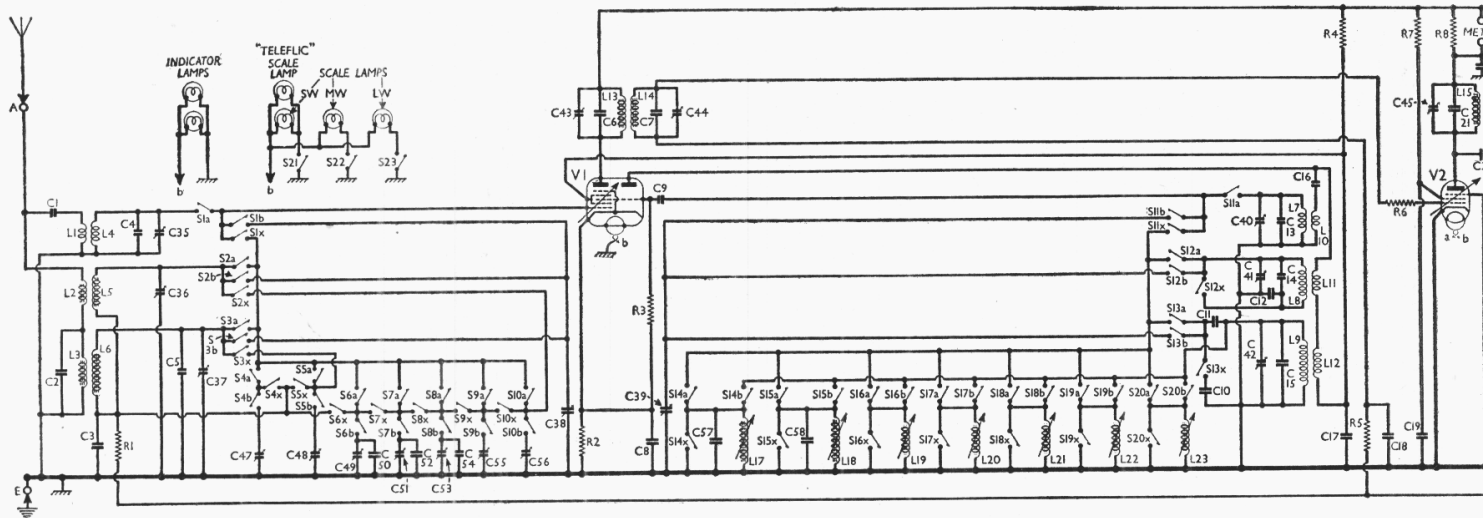
This method of numbering makes the action of the switches quite clear from a study of the diagram: if a button is depressed the "a's" and "b's" associated with that button close, while the "x's"

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, and 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."

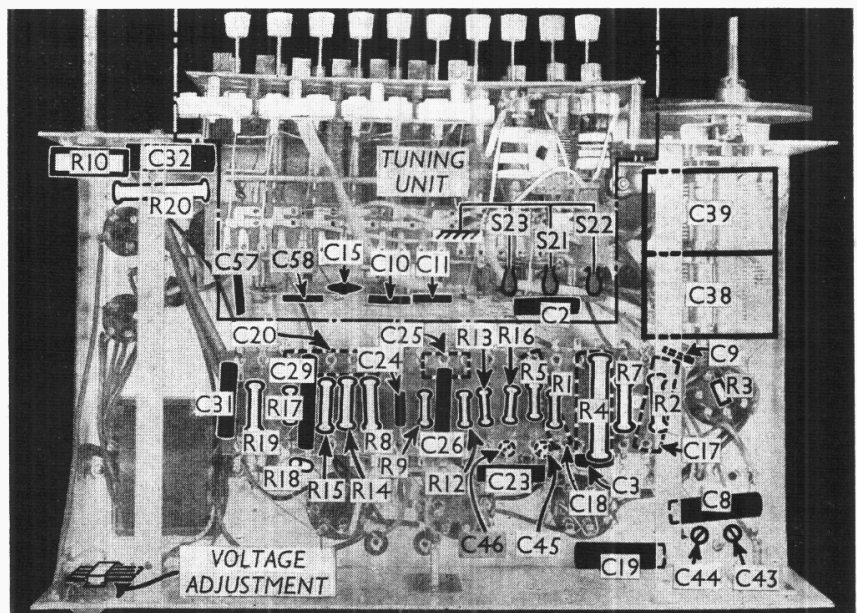
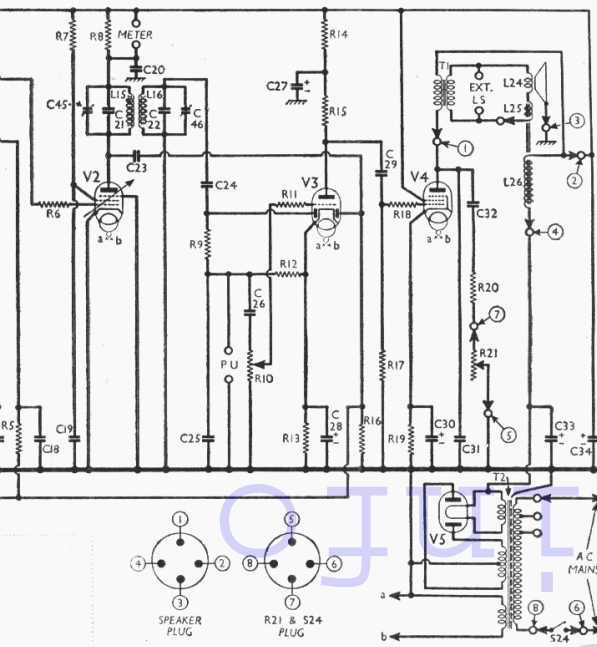
**Intermediate frequency 465KC/S.**

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 ..	0.000005
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 LW 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†	Aerial circuit MW automatic tuning trimmers ..	0.00015
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

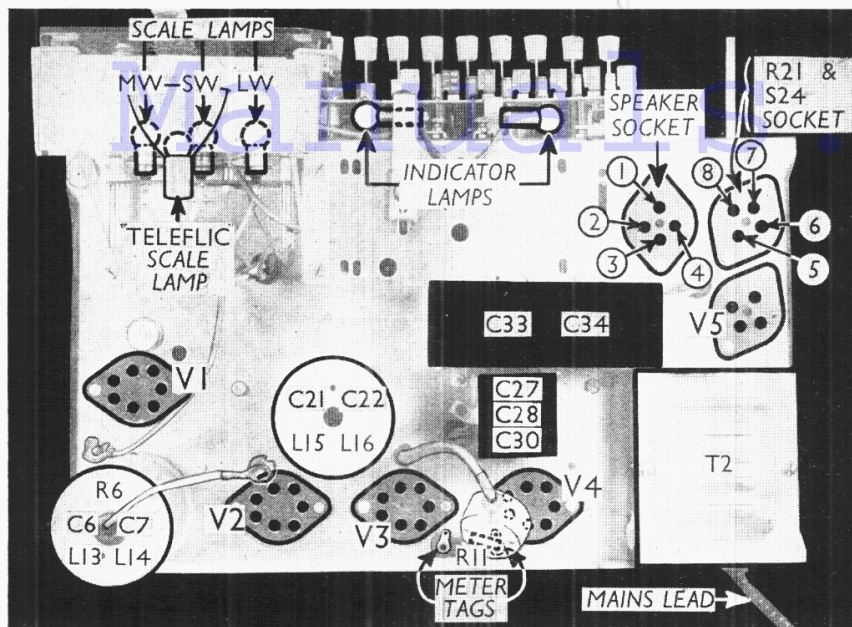
\* Electrolytic. † Variable. ‡ Pre-set.

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		Approx. 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	Oscillator circuit MW automatic tuning coils .. { 1.0 0.7	
L22		
L23	Speaker speech coil .. 2.8	
L24		
L25	Hum neutralising coil .. 0.5	
L26	Speaker field coil .. 600.0	
	Speaker input { Pri. .. 250.0 Sec. .. 0.8	
T1	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.

OTHER COMPONENTS (Continued)		Approx. Values (ohms)
T2	Mains trans. { Pri., total .. 21·0 Heater sec. .. 0·1 Rect. heat. sec. 0·1 HT sec., total 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	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

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 unscreened 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 Teleflac 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 Ω) 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.



**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**

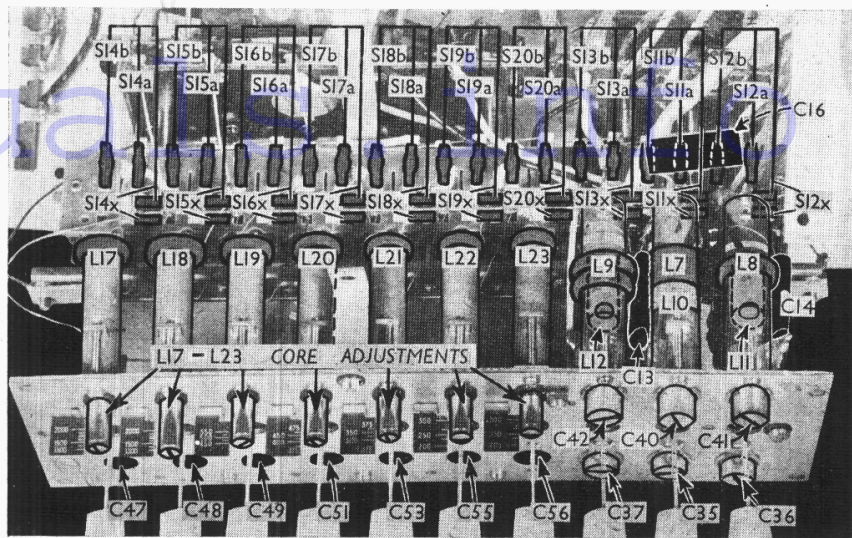
The console model SUG52 only differs in slight details, such as the omission of the Telefic dial and its lamp, the use of a different scale plate and a modified pointer drive. **L24** is earthed by a lead connected between the left-hand Ext. LS socket and the right-hand (earthed) pick-up socket.

**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 **C56** are therefore omitted, and the switch groups **S10** and **S20** are used for other purposes.

**R12** is replaced by two 250,000  $\Omega$  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  $\Omega$  (instead of 0.8  $\Omega$ ), **L24** becomes 6.2  $\Omega$  (instead of 2.8  $\Omega$ ) and **L25** becomes 0.3  $\Omega$ . The external speaker should have a resistance of 10  $\Omega$ .

The RG52 and RG52G models are fitted with a Garrard AC7A unit. Pick-up, 2,000  $\Omega$  resistance; motor, 800  $\Omega$  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  $\Omega$  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 **C46** 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 **C36** (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).

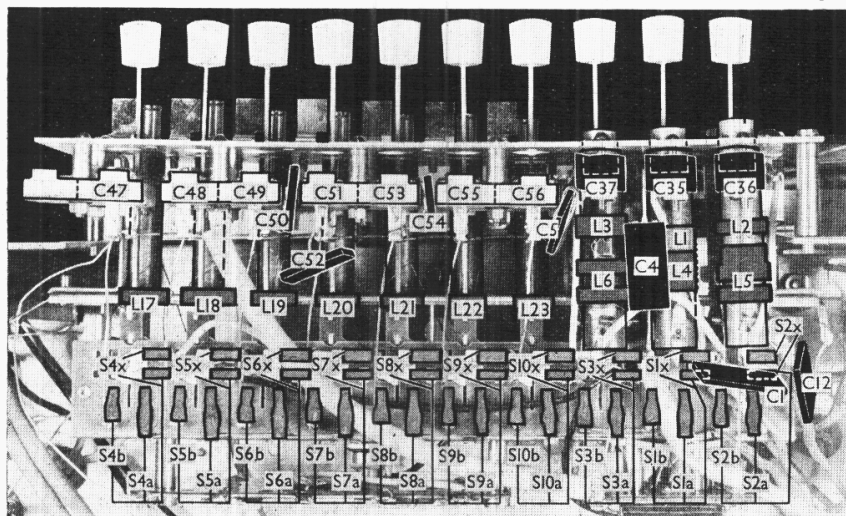
Connect the aerial and earth to the receiver and press the button to be used for the desired station. Turn the core adjustment for the associated oscillator coil (above the button) until the index mark is at the approximate wavelength on the small calibrated scale. Then carefully turn the adjustment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