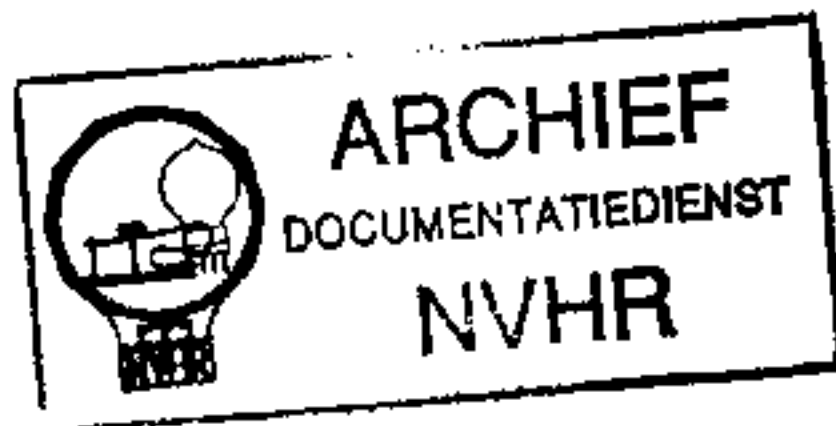
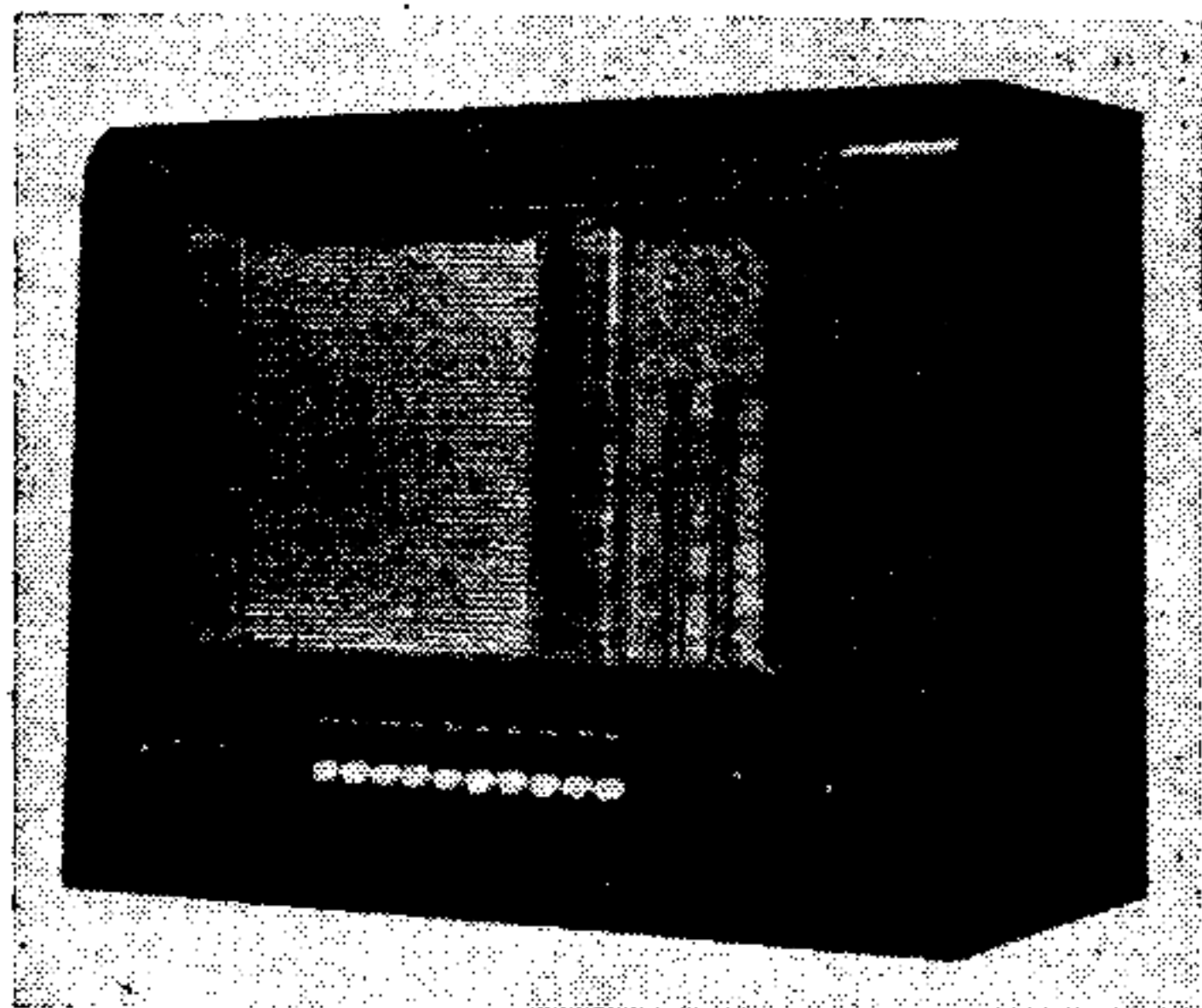


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BUSH PB63, SUG64, RG64 AND RG64G



The Bush PB63 Table Receiver.

THE Bush PB63 includes press-button tuning for six stations, employing trimmers for the aerial circuit and permeability tuning for the oscillator circuit, and press-buttons for manual wave-changing and gram. The receiver is a 5-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 SUG64 console and the differences are explained under "Model SUG64 Modifications," while the chassis of the RG64 and RG64G radiograms and record changing radiograms are also very similar, the differences being explained

under "Models RG64, RG64G and RG64G Auto."

This Service Sheet was prepared on a PB63.

Release Dates: PB63, May, 1939; SUG64, June, 1939; RG64, RG64G and RG64G Auto, July, 1939.

CIRCUIT DESCRIPTION

The aerial circuit coupling coils are permanently connected as shown in the diagram, no switches being used for waveband changing; there are three aerial sockets: A1 (direct); A2 (via filter circuit L1, C1, C2); A3 (via series condenser C3).

On SW, input from A1 is via condenser C4 and coupling coil L2 to single-tuned circuit L5, C44, manual tuning only being employed on this band.

MW coupling coil L3, and LW coupling coil L4 with its shunt C5, are connected in series with each other across the aerial circuit in parallel with C4, L2, and couple the aerial to single-tuned circuits L6, C44 (MW manual) and L7, C44 (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

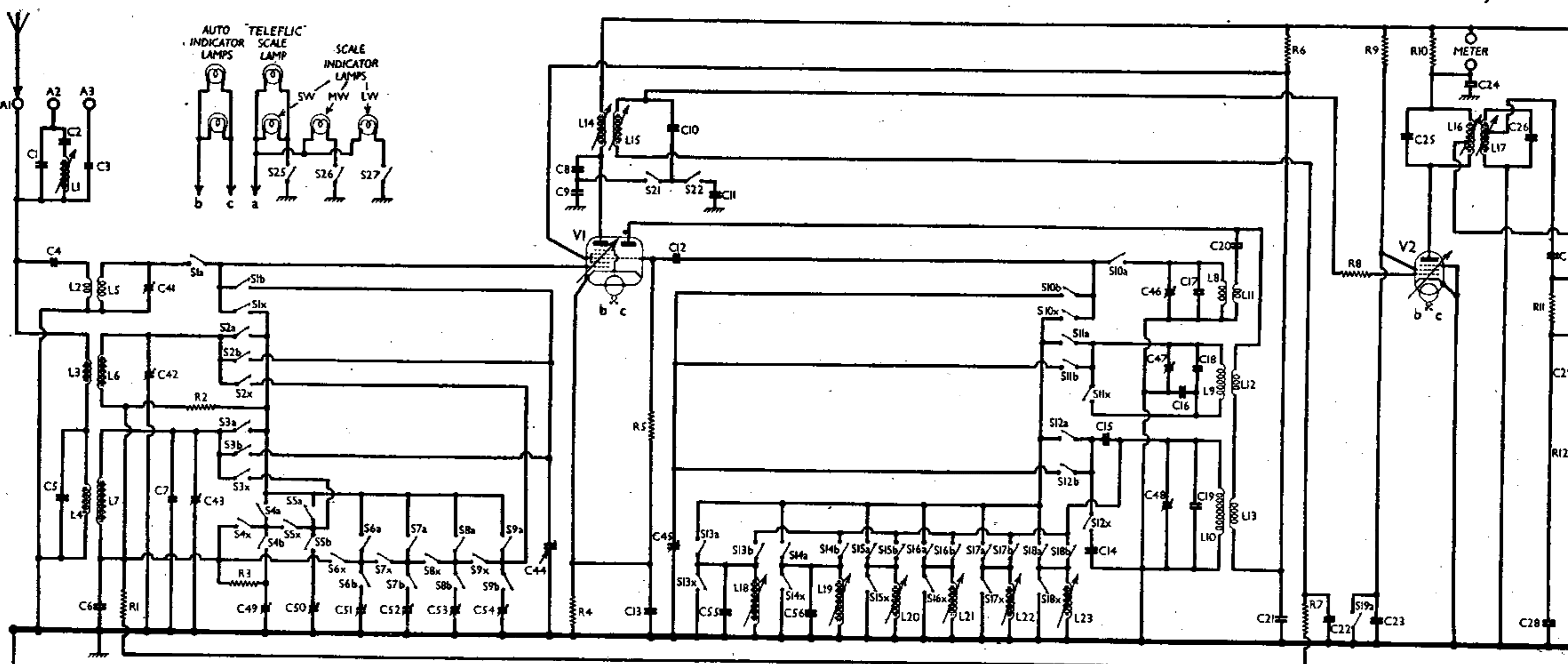
to its number, so that the SW group is numbered S1a, S1b and S1x, the MW group S2a, S2b and S2x and so on throughout the waveband and automatic switching.

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.

When an automatic tuning button is depressed, S1x, S2x and S3x are closed, connecting V1 CG, L6 and L7 to the automatic selector switches. At the same time the appropriate trimmer is connected to L6 or L7, according to which button is depressed.

First valve (V1, Mullard metallised TH4B) is a triode heptode operating as frequency changer with internal coupling. Triode oscillator grid coils (manual tuning only) L8 (SW), L9 (MW) and L10 (LW) are tuned by C45; parallel trimming by C17, C46 (SW), C18, C47 (MW) and C19, C48 (LW); series tracking by C16 (MW) and C15 (LW). Reaction by coils L11 via coupling condenser C20 (SW), L12 and L13 (MW and LW).

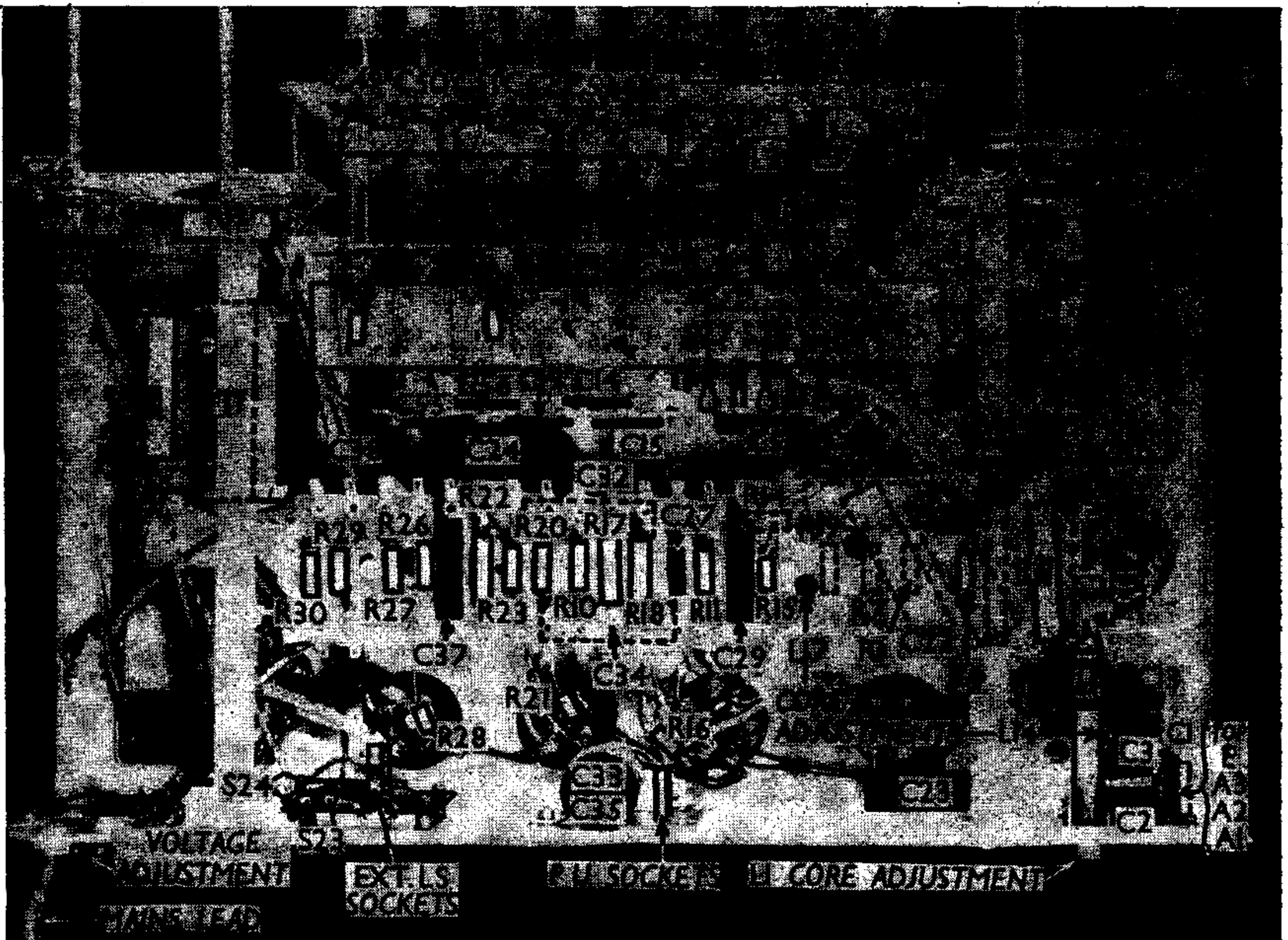
The LW oscillator circuit, slightly modified by switching, operates also as master oscillator for automatic tuning, the tuning trimmers in this case being inductances with variable iron cores,



Circuit diagram of the Bush PB63. The SUG64 console is similar, but with modifications given in column 3 overleaf, while the radiogram models are similar to the SUG64 (see column 4 overleaf). The terminals marked "Meter" are for use in selecting pre-set stations.

Under-chassis view.

Both sides of the press-button switch unit are shown in columns 4 and 5 overleaf. S25-S27 are scale lamp switches, associated with the press-button unit. Note the core adjustments of L14 and L17, and the speaker switches S23, S24.



connected in turn across the master oscillator tuning coil L10 according to which button is depressed. The modification is that, as the button controlling S12 switches is now in the "Out" position, the LW manual tracker C15 becomes connected in series with C14 across the master oscillator circuit, the

two together forming an additional trimmer.

Second valve (V2, Mullard metallised VP4B) is a variable- μ RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary iron-cored transformer couplings C8, C9, L14, L15, C10, C11 and C25, L16, L17, C26.

In the normal (1) position of the variable selectivity control, S22 is closed; when the control is turned to position 2, S22 opens and S21 closes, so that C9 is common to primary and secondary coils, and closer coupling is secured.

Provision is made for connection of a voltmeter across anode feed resistance R10 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), and is parallel-fed via C27 from tapping on L17. Audio frequency component in rectified output is developed across resistances R14, R15, and passed via AF coupling condenser C29, manual volume control R12 and grid stopper R13 to CG of triode section which operates as AF amplifier. IF filtering by R11, C28.

Provision for connection of gramophone pick-up, via S20a, between the junction of R14 and R15, and chassis. When the gram button is depressed, S19a and S20a close.

Second diode of V3, fed from tapping on L16 via C31, provides DC potential which is developed across load resistance R19 and fed back through decoupling circuits as GB to FC (except on SW) and IF valves, giving AVC. Delay voltage is obtained from R16.

Resistance-capacity coupling by R18,

C34 and R20 between V3 triode and triode AF amplifying valve (V4, Mullard metallised 354V). Bass-boosting is achieved in V3 triode anode circuit by suitable arrangement of values: C32 is 0.1, and its by-passing effect is progressively less noticeable as the frequency falls. Variable tone control by R24, C36 in V4 anode circuit.

Resistance-capacity coupling by R23, C37, R36 between V4 and triode output valve (V5, Mullard AC044 or Cossor 4XP). Provision for connection of low impedance external speaker across secondary of T1. Switches S23, S24, which are operated by the Ext. LS sockets, permit either or both of the speakers to be operated.

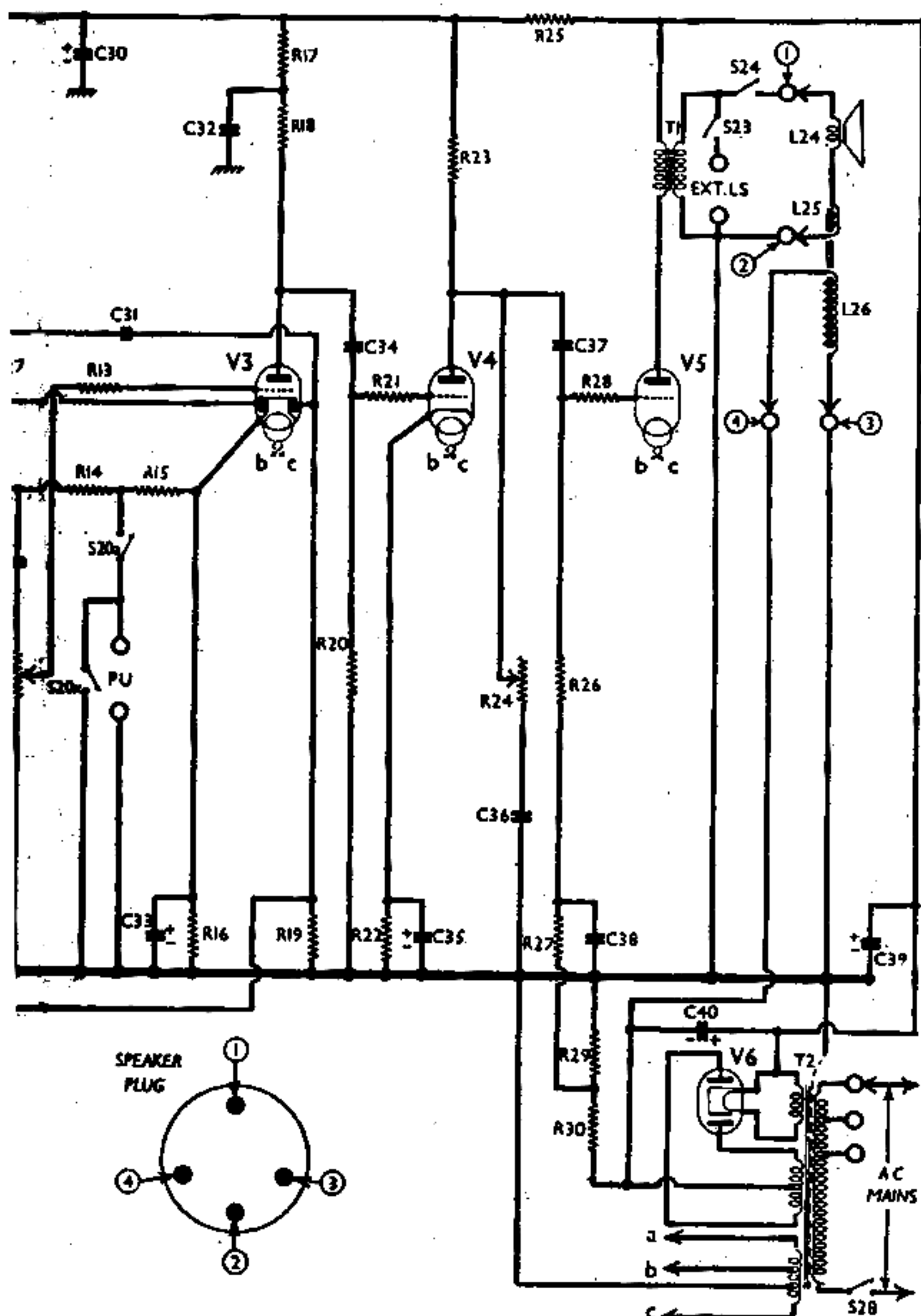
HT current is supplied by IHC full-wave rectifying valve (V6, Cossor 431U). Smoothing by speaker field L26 (in negative HT lead) and dry electrolytic condensers C39, C40. GB for V5 is obtained from potential divider R29, R30 across L26.

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (recessed grub screws), withdraw the speaker plug from its socket on the chassis deck, and remove the two round-head wood screws from the top of the scale assembly.

Now remove the four bolts (with claw washers) holding the chassis to the bottom of the cabinet, when the chassis can be withdrawn. When replacing, do not forget to replace the felt washers on the control spindles.

Removing Speaker.—Free the leads from the cleat on the side of the cabinet, withdraw the speaker connecting plug from its socket on the chassis deck, and remove the nuts and washers from



the four bolts holding it to the sub-baffle. When replacing, see that the connecting tags are at the top.

COMPONENTS AND VALUES

RESISTANCES		Values (ohms)
R1	V1 heptode CG decoupling...	1,000,000
R2	V1 heptode CG resistance ...	5,000,000
R3	Aerial-LW auto damping ...	50,000
R4	V1 fixed GB resistance ...	100
R5	V1 osc. CG resistance ...	30,000
R6	V1 osc. anode & SG HT feed	20,000
R7	V2 CG decoupling ...	2,000,000
R8	V2 CG stabiliser ...	50
R9	V2 SG HT feed resistance ...	100,000
R10	V2 anode HT feed resistance	10,000
R11	IF stopper ...	250,000
R12	Manual volume control ...	500,000
R13	V3 triode grid stopper ...	100,000
R14	V3 signal diode load resistances	250,000
R15	V3 triode GB; AVC delay...	1,000
R16	V3 triode anode decoupling...	50,000
R17	V3 triode anode load ...	5,000
R18	V3 AVC diode load ...	1,000,000
R19	V4 CG resistance ...	500,000
R20	V4 grid stopper ...	100,000
R21	V4 GB resistance ...	2,000
R22	V4 anode load resistance ...	50,000
R23	Variable tone control ...	250,000
R24	V1, V2, V3, V4 HT feed ...	4,000
R25	V5 CG resistance ...	250,000
R26	V5 CG decoupling ...	500,000
R27	V5 grid stopper ...	10,000
R28	V5 automatic GB potential divider	100,000
R29		100,000
R30		100,000

CONDENSERS		Values (μF)
C1	A2 filter tuning condensers...	0.00045
C2	A3 series condenser ...	0.001
C3	Aerial SW coupling ...	0.00005
C4	Aerial LW circuit shunt ...	0.0008
C5	V1 heptode CG decoupling...	0.5
C6	Aerial LW fixed trimmer ...	0.00003
C7	1st IF transformer fixed tuning condensers ...	0.00015
C8		0.003
C9		0.00015
C10		0.003
C11	V1 osc. CG condenser ...	0.00003
C12	V1 Cathode by-pass ...	0.05
C13	Part auto osc. trimmer ...	0.00034
C14	Osc. LW tracker (manual); part osc. trimmer (auto)...	0.000316
C15	Osc. circuit MW tracker ...	0.000556
C16	Osc. circ. SW fixed trimmer	0.000015
C17	Osc. circ. MW fixed trimmer	0.00001
C18	Osc. circ. LW fixed trimmer	0.00013
C19	V1 osc. anode SW coupling	0.00005
C20	V1 osc. anode and SG decoupling ...	0.05
C21	V2 CG decoupling ...	0.05
C22	V2 SG decoupling ...	0.05
C23	V2 anode decoupling ...	0.05
C24	2nd IF transformer fixed tuning condensers ...	0.00015
C25		0.00016
C26	Coupling to V3 signal diode	0.0001
C27	IF by-pass condenser ...	0.0001
C28	AF coupling to V3 triode ...	0.005
C29	V1, V2, V3, V4 HT decoupling	8.0
C30*	Coupling to V3 AVC diode...	0.00005
C31	V3 anode decoupling...	0.1
C32	V3 cathode by-pass ...	50.0
C33*	V3 triode to V4 AF coupling	0.01
C34	V4 cathode by-pass ...	50.0
C35*	Part of variable tone control	0.03
C36	V4 to V5 AF coupling ...	0.01
C37	V5 CG decoupling ...	0.5
C38	HT smoothing condensers ...	16.0
C39*		8.0
C40†	Aerial circuit SW trimmer...	0.00001
C41‡	Aerial circuit MW trimmer...	0.00001
C42‡	Aerial circuit LW trimmer...	0.00001
C43‡	Aerial circuit manual tuning	—
C44‡	Osc. circuit manual tuning...	—
C45‡	Osc. circuit SW trimmer ...	0.00001
C46‡	Osc. circuit MW trimmer ...	0.00001
C47‡	Osc. circuit LW trimmer ...	0.00001
C48‡	Aerial circuit LW automatic tuning trimmers ...	0.00045
C49‡		0.00045
C50‡		0.00045
C51‡		0.00045
C52‡	Aerial circuit MW automatic tuning trimmers ...	0.00015
C53‡		0.00015
C54‡		0.00015
C55‡	Oscillator circuit automatic tuning trimmers	0.000316
C56‡		0.000316

* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS		Approx. values (ohms)
L1	Aerial filter coil ...	2.9
L2	Aerial SW coupling coil	0.1
L3	Aerial MW coupling coil	0.6
L4	Aerial LW coupling coil	30.0
L5	Aerial SW tuning coil...	0.05
L6	Aerial MW tuning coil ...	1.3
L7	Aerial LW tuning coil...	14.0
L8	Osc. circuit SW tuning coil ...	0.1
L9	Osc. circuit MW tuning coil ...	1.6
L10	Osc. circuit LW tuning coil ...	3.0
L11	Oscillator SW reaction	0.2
L12	Oscillator MW reaction	1.1
L13	Oscillator LW reaction	2.2
L14	1st IF trans. { Pri. 4.0	
L15	{ Sec. 4.0	
L16	2nd IF trans. { Pri. 4.0	
L17	{ Sec. 4.0	
L18	Oscillator circuit LW automatic tuning coils	2.0
L19		2.0
L20		1.4
L21	Oscillator circuit MW automatic tuning coils	1.2
L22		1.0
L23		0.7
L24	Speaker speech coil ...	2.8
L25	Hum neutralising coil...	0.5
L26	Speaker field coil ...	600.0
T1	Speaker input trans. { Pri. 250.0	
	{ Sec. 0.8	
T2	Mains trans. { Heater sec., total 0.25	
	{ Rect. heat. sec. 0.1	
	{ HT sec., total ... 650.0	
S1a, b, x to S3a, b, x	Aerial circ. waveband and manual/auto switches	—
S10a, b, x to S12a, b, x	Osc. circuit waveband and manual/auto switches	—
S4a, b, x to S9a, b, x	Aerial circuit auto tuning trimmer selector switches	—
S13a, b, x to S18a, b, x	Oscillator circuit auto tuning coil selector switches	—
S19a	Radio/gram change switches	—
S20a, x	Variable selectivity switches	—
S21, S22	Ext. L.S. switch	—
S23	Internal LS switch	—
S24	Scale lamps switches	—
S25-S27	Mains switch, ganged	—
S28	R24	—

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 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	240	2.3	72	1.7
	{ Oscillator 75	{ 8.5		
V2 VP4B	180	4.7	82	1.6
V3 TDD4	100	2.3	—	—
V4 354V	135	1.7	—	—
V5 ACO44	312	4.6	—	—
V6 48IU	370†	—	—	—

† Each anode AC

GENERAL NOTES

Switches.—There are ten press-buttons, and each one controls three 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 six buttons control pre-set stations, the seventh is the LW button, the eighth the SW, the ninth the MW, and the tenth, on the right, gram.

In addition to the actual press-button switches, there are three scale lamp switches, \$25-\$27, controlled by the three wavechange buttons. They are shown in our under-chassis view.

\$21, \$22 are the variable selectivity switches, in a unit on the right at the front of the chassis.

\$23, \$24.—These are the speaker switches, mounted on the ext. LS panel at the rear of the chassis. A special extension speaker plug is provided which, when inserted in the sockets, operates as a switch control. Except when the internal speaker is switched on, the plug cannot be withdrawn.

\$28 is the QMB mains switch, ganged with the tone control R24.

Coils.—All the coils, with the exception of L1 and the IF transformers, are on un-screened tubular formers, built into a unit, together with the press-button switches and the various trimmers. L2, L5; L8, L11; L9, L12; L10, L13; L8, L11 and L9, L12 are air-cored. L3, L6 and L4, L7 have fixed iron-dust cores, while L18-L23 have adjustable iron-dust cores for permeability trimming of the oscillator circuits of the six pre-set station buttons.

The IF transformers L14, L15 and L16, L17 are in two screened units on the chassis deck. They have adjustable iron cores, and the adjustment screws protrude above and below the cans. The screws are indicated in our chassis illustrations.

L1, with its associated fixed condensers, forms a local station rejector. Its frequency is determined by the locality, and the iron core is adjusted by the dealer upon installation.

Scale and Indicator Lamps.—Two lamps are employed to illuminate the press-button labels. They are connected to tappings b and c on T2 heater secondary.

Three more lamps illuminate the waveband scales, and a further one the "Telefic" dial. These are connected to tapping a and chassis.

All the lamps have round bulbs, MES bases, and are rated at 6.2V, 0.3A.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2.5 Ω) external speaker. See also under "Switches."

Speaker Plug.—The speaker is connected to the chassis via leads which terminate at a 4-pin plug. A diagram of the plug, looking at the free ends of the pins, is shown beneath the circuit diagram, and the numbers in circles in the diagram correspond with those on the plug.

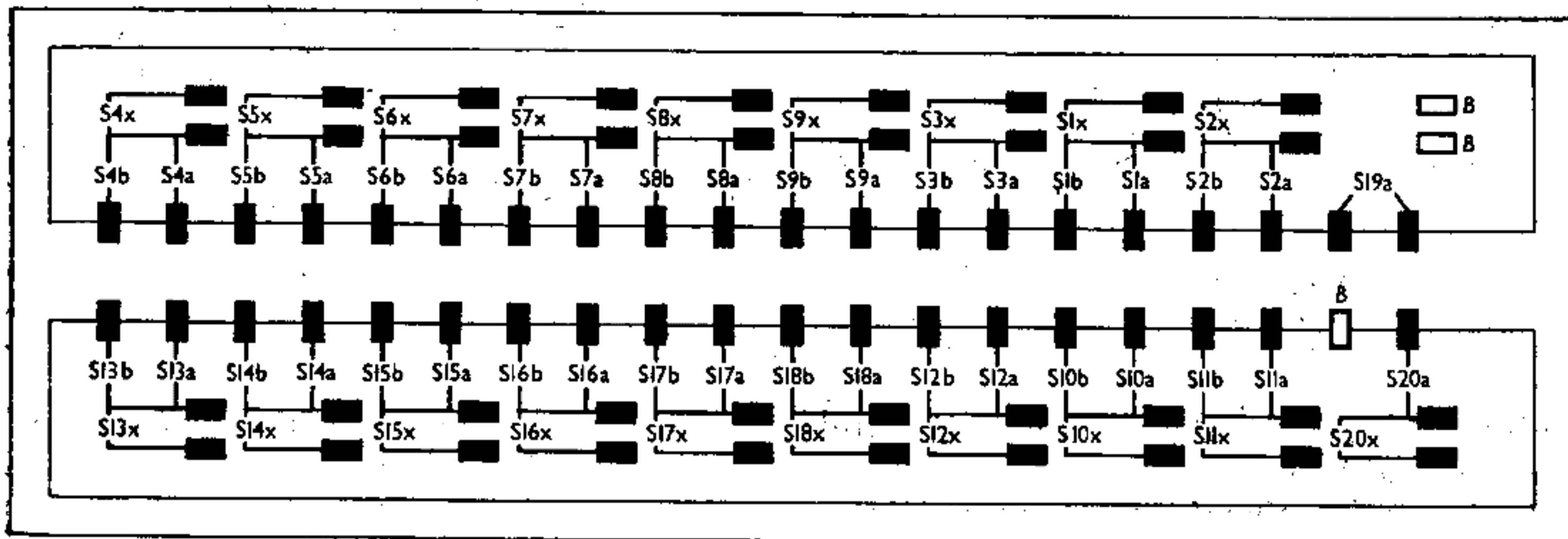
The colours of the four leads are as follows: 1, brown; 2, green; 3, black; 4, blue.

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 R10, which serves as an indicator when setting the station selector buttons.

Condensers C30, C39.—These are two dry electrolytics in a single carton on the chassis deck, having a common negative (black) lead. The red lead is the positive of C39 (16μF), and the yellow lead is the positive of C40 (8μF). The voltage rating is 550V (peak).

MODEL SUG64 MODIFICATIONS

The SUG64 console has a very nearly similar chassis, with the following differences: A 0.0003μF condenser is connected between the top and slider of R12; R18 becomes 10,000 Ω; the ext. LS sockets and S23, S24 are fitted to the back of the cabinet, instead of the rear of the chassis, via a plug and socket device; the "Telefic" dial is not fitted, but a filter circuit is connected across T1 primary winding.



Diagrams of the press-button switch unit. The upper one is as seen looking from the rear of the underside of the chassis, while the lower one shows the reverse side as seen looking from the front of the chassis after the tuning unit has been partially withdrawn.

MODELS RG64, RG64G AND RG64G AUTO

These are similar to the SUG64, except that RG64 is a radiogram; RG64G is the same, but the speaker is replaced by a Rola model G12; while RG64G Auto is the RG64G with automatic record-changer.

ALIGNMENT OF MANUAL CIRCUITS

IF Stages.—Press MW manual tuning button, tune to 300 m on the scale, turn volume control to maximum, variable selectivity to "Normal" (1), and tone control to "low." A damping circuit consisting of a 30,000 Ω resistor in series with a 0.05μF condenser 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 core of L17 for maximum output. Connect damping between V3 signal diode (pin 1) and chassis, and adjust core of L16 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 core of L15 for maximum output. Connect damping circuit between control grid (top cap) of V2 and chassis, and adjust core of L14 for maximum output.

RF and Oscillator Circuits.—With gang at maximum, indicator should be opposite wording "Vatican City" at top of SW scale. 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 A1 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 C46 (above SW button) and C41 (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 C47 (above MW button) and C42 (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 C48 (above LW button) and C43 (below LW button) for maximum output. Check calibration at 1,900 m.

PRE-SET STATION SELECTION

Stations can be selected by buttons 1 to 6, numbering from the left. The wavelength ranges covered by each button are: 1 and 2, 1,200-2,000 m; 3 and 4, 325-550 m; 5 and 6, 200-350 m.

To select a station accurately, it is advisable to use a DC voltmeter (0-60 V), connected across the two tags at the rear of the chassis 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 C48 will affect the tuning of the pre-selected stations. After manual circuit alignment, therefore, the cores of L18 to L23 must be re-adjusted.

Any adjustment of the MW manual tuning aerial trimmer C42 will necessitate readjustment of the MW pre-set station trimmers. Similarly any adjustment of the LW manual tuning aerial trimmer, C43 will affect the setting of C49 and C50.

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 C48 for correction purposes. Press the sixth button, which controls a station near the bottom of the MW band, and adjust C48 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 C48 which is necessary will not affect the LW manual alignment appreciably.

Plan view of the chassis. S21 and S22 are variable selectivity switches. All the core adjustments (except those for L1, L14 and L17 beneath the chassis) are indicated. Note that each IF coil contains certain additional components. R13 is inside the top cap connector of V3.

