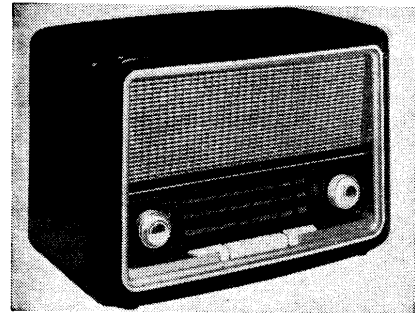


"TRADER" SERVICE SHEET  
**1439**



Appearance of the Bush VHF71.

# BUSH VHF71 & VHF72

3-Band A.M./F.M. Receiver for A.C. or D.C. Mains Supply

Release dates and original prices:  
VHF71, September, 1958, £18 4s 10d;  
VHF72, October, 1958, £22 4s 1d. Purchase tax extra.

### CIRCUIT DESCRIPTION

A.M. aerial tuning coils L8 (M.W.) and L9 (L.W.) are mounted on a ferrite rod to form an internal aerial. Tuning by C22, which is formed by the R.F. section of the tuning gang. C21 and C20 are trimmer capacitors for M.W. and L.W. respectively. Provision is made for the connection of an external aerial via aerial sockets A or A1.

Section b of triode-heptode valve V2 operates as mixer, and section a as oscillator. Oscillator grid coil L10 is tuned by C26 and parallel trimmer capacitors C30 (M.W.) and C28, C29 (L.W.). Reaction coupling from V2a anode via C31 and L11.

V3 is a variable-mu R.F. pentode operating as A.M. intermediate frequency amplifier with tuned transformer couplings C34, L14, L15, C35 and C42, L19, L20, C43.

#### A.M. Intermediate frequency 470kc/s.

Diode section c of triple-diode-triode valve V4 operates as A.M. detector. The audio frequency component in its rectified output is developed across diode load resistor R15 and passed via R16, switch S4y, C47, volume control R19, and coupling capacitor C48 to triode section V4d, which operates as a grid current biased A.F. amplifier.

The D.C. component of the rectified signal developed across R15 is fed back as A.G.C. bias to V2b and V3. The A.G.C.

voltage is also fed to tuning indicator T.I. via S4w.

The output of V4d is resistance-capacitance coupled via R23, C51 and R24 to pentode output valve V5. Tone correction by R29, C55, and the negative feedback network C56, R30, R31, connected between T1 secondary winding b and the input circuit of V4d. Tone control by R27 and C53.

In addition to the moving coil speaker L21, model VHF72 is fitted with an electrostatic tweeter. C52 is connected between V5 anode and the junction of R36, R37. The additional circuitry is shown dotted in our circuit diagram below.

H.T. current is supplied by half-wave rectifying valve V6. Smoothing by C57, R32 and C58.

### Operation on F.M.

80Ω balanced aerial input is coupled via L1 and L2 to the earthed-grid R.F. amplifier valve V1a, which together with self-oscillating frequency changer V1b operates in a conventional tuner circuit.

S4z is open circuit on F.M., thus muting the A.M. local oscillator V2a. Heptode section V2b now operates with V3 in a 2-stage F.M. I.F. amplifier circuit with tuned transformer couplings L6, L7; L12, L13; and discriminator transformer L16, L17 and L18.

#### F.M. Intermediate frequency 10.7Mc/s.

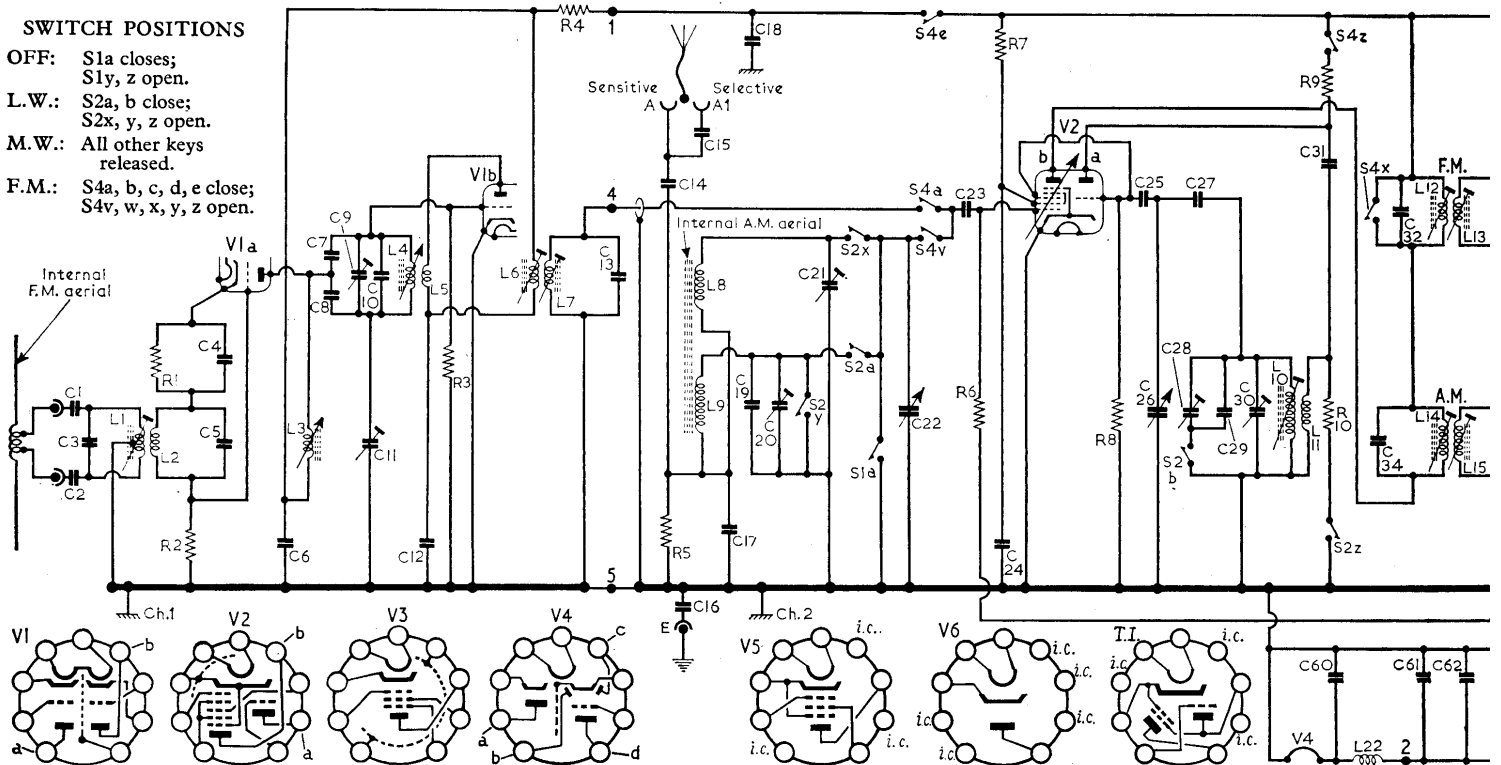
Diode sections a and b of V4 operate in a conventional ratio detector circuit. The A.F. output is developed across capacitive load C40 and passed via de-emphasis circuit

**H**OUSED in a plastics cabinet, the Bush VHF71 is a 3-band A.M./F.M. receiver designed to operate from A.C. or D.C. mains of 200-250V, 40-100c/s in the case of A.C. Total mains consumption is 40W. It is fitted with internal A.M. and F.M. aerials and provision is made for the connection of external aerials. The band ranges are 187-560m (M.W.); 1,050-1,935m (L.W.); and 87.5-100Mc/s (F.M.).

The VHF72 employs a similar chassis to the VHF71 but, in addition to the moving-coil speaker, it is fitted with an electrostatic tweeter.

### SWITCH POSITIONS

- OFF: S1a closes;  
S1y, z open.
- L.W.: S2a, b close;  
S2x, y, z open.
- M.W.: All other keys released.
- F.M.: S4a, b, c, d, e close;  
S4v, w, x, y, z open.



Circuit diagram of the Bush VHF71 and VHF72. The electrostatic speaker circuit, shown dotted in the diagram, applies to the VHF72 only. In the VHF72 the two models, together with certain modifications, are described in column 5 overleaf. The valve base data

R14, C41, and switch S4d to the volume control circuit.

### CIRCUIT ALIGNMENT

**Equipment Required.**—A signal generator covering the A.M. alignment frequencies of 200-1,500kc/s and the F.M. alignment frequencies of 10.7Mc/s and 87.5-100Mc/s; an A.C. voltmeter for use as an audio output meter; a Model 8 Avometer or a D.C. valve-voltmeter for use as a D.C. output meter; a 0-50μA microammeter; two 47kΩ, 5 per cent tolerance resistors; a 1kΩ resistor for use as a damping shunt; a 0.1μF capacitor; and a screwdriver-type trimming tool.

The chassis should be connected to the mains via an isolating transformer. Where this is not available, ensure that the chassis is connected to the neutral side of the mains. No earth connection, either direct or through earthed equipment, should be made to the receiver. Connect the signal generator to the appropriate points in the circuit via a 0.1μF isolating capacitor in its live output lead.

Allow the signal generator and receiver to warm up for at least 15 minutes before commencing the alignment procedure.

### A.M. Alignment

- 1.—Remove the chassis from the cabinet as described under "Dismantling" overleaf. Connect the audio output meter across T1 secondary winding. Connect the signal generator output between chassis and V3 control grid (pin 2).
- 2.—Switch the receiver to M.W. and tune it to 300m. Turn the volume control to maximum and the tone control to maximum top. Feed in a modulated 470kc/s signal and adjust the cores of L19 (B1) and L20 (J3) for maximum output.
- 3.—Transfer the signal generator to V2b control grid (pin 2). Feed in a modulated 470kc/s signal and adjust the cores of L14 (D1) and L15 (H3) for maximum output.
- 4.—Tune the receiver to 500m. Feed in a

600kc/s signal and adjust L10 (G4) for maximum output.

- 5.—Tune the receiver to 200m. Feed in a 1,500kc/s signal and adjust C30 (G4) for maximum output.
- 6.—Repeat operations 4 and 5.
- 7.—Switch the receiver to L.W. and tune it to 1,400m. Feed in a 214kc/s signal and adjust C28 (G4) for maximum output.
- 8.—Loosely couple the signal generator to the receiver via a loop of insulated wire placed about 3 feet from the receiver.
- 9.—Switch the receiver to M.W. and tune it to 200m. Feed in a 1,500kc/s signal and adjust C21 (H4) for maximum output.
- 10.—Switch the receiver to L.W. and tune it to 1,400m. Feed in a 214kc/s signal

and adjust C20 (H4) for maximum output. Disconnect the signal generator and audio output meter.

### F.M. Alignment

- 1.—Before commencing the alignment procedure position the I.F. coil cores as follows: L12 (C1) flush with the end of the coil former; L13 (H3) ¼in inside the former; L16 (J3) ¼in inside the former; and L17 (C1) ¼in inside the former.
- 2.—Switch the receiver to V.H.F. and set the volume control to minimum. Connect the two 47kΩ resistors in series across C46 (H3), then connect the Model 8 Avometer, switched to its 10V D.C. range, across

(Continued overleaf, col. 1)

### Resistors

R1	82Ω	L5	
R2	27Ω	L5	
R3	470kΩ	L5	
R4	3.3kΩ	L5	
R5	10kΩ	H4	
R6	680kΩ	D1	
R7	6.8kΩ	D1	
R8	47kΩ	D2	
R9	8.2kΩ	H4	
R10	2.2kΩ	H4	
R11	22kΩ	C1	
R12	1kΩ	B1	
R13	100Ω	C1	
R14	22kΩ	C1	
R15	330kΩ	B1	
R16	47kΩ	B1	
R17	2.2MΩ	C1	
R18	39kΩ	B1	
R19	2MΩ	K4	
R20	470kΩ	D1	
R21	68kΩ	J4	
R22	6.8MΩ	B1	
R23	180kΩ	B1	
R24	1MΩ	A1	
R25	47kΩ	A1	
R26	1kΩ	B2	
R27	50kΩ	K4	
R28	270Ω	A1	
R29	10kΩ	§	
R30	8.2kΩ	§	
R31	470Ω	§	
R32	400Ω	A2	
R33	400Ω	A2	
R34	2.7kΩ	A2	
R35	100Ω	K4	
R36	39kΩ	†	
R37	560kΩ	†	
R38	560kΩ	†	

### Capacitors

C1	470pF	G4
C2	470pF	G4
C3	15pF	L5
C4	560pF	L5
C5	10pF	G4
C6	125pF	L5
C7	22pF	L5
C8	22pF	L5
C9	15pF	L5
C10	5.6pF	L5
C11	15pF	L5
C12	8.2pF	L5
C13	47pF	F4
C14	1,800pF	G3
C15	47pF	G4
C16	1,800pF	F3
C17	7,500pF	J4
C18	0.01μF	F3
C19	120pF	H4
C20	30pF	H4
C21	30pF	H4

C22	528pF	G3
C23	270pF	H4
C24	0.01μF	D2
C25	100pF	D1
C26	528pF	G4
C27	515pF	D2
C28	40pF	G4
C29	450pF	D2
C30	40pF	G4
C31	0.001μF	H4
C32	47pF	H3
C33	47pF	H3
C34	150pF	H3
C35	150pF	H3
C36	4,700pF	C1
C37	0.01μF	B1
C38	10pF	J3
C39	47pF	J3
C40	560pF	C1
C41	2,200pF	C1
C42	150pF	J3
C43	150pF	J3
C44	0.04μF	C1
C45	100pF	B1
C46	5μF	H3
C47	0.01μF	J4
C48	0.01μF	K4
C49	270pF	B1
C50	40μF	J4
C51	0.01μF	B1
C52	0.003μF	A1
C53	0.05μF	K4
C54	50μF	B2
C55	0.01μF	§
C56	0.04μF	§
C57	40μF	§
C58	40μF	§
C59	0.05μF	J4
C60	0.01μF	B1
C61	560pF	L5
C62	560pF	L5
C63	560pF	L5
C64	0.001μF	C1
C65	0.01μF	†
C66	0.01μF	†

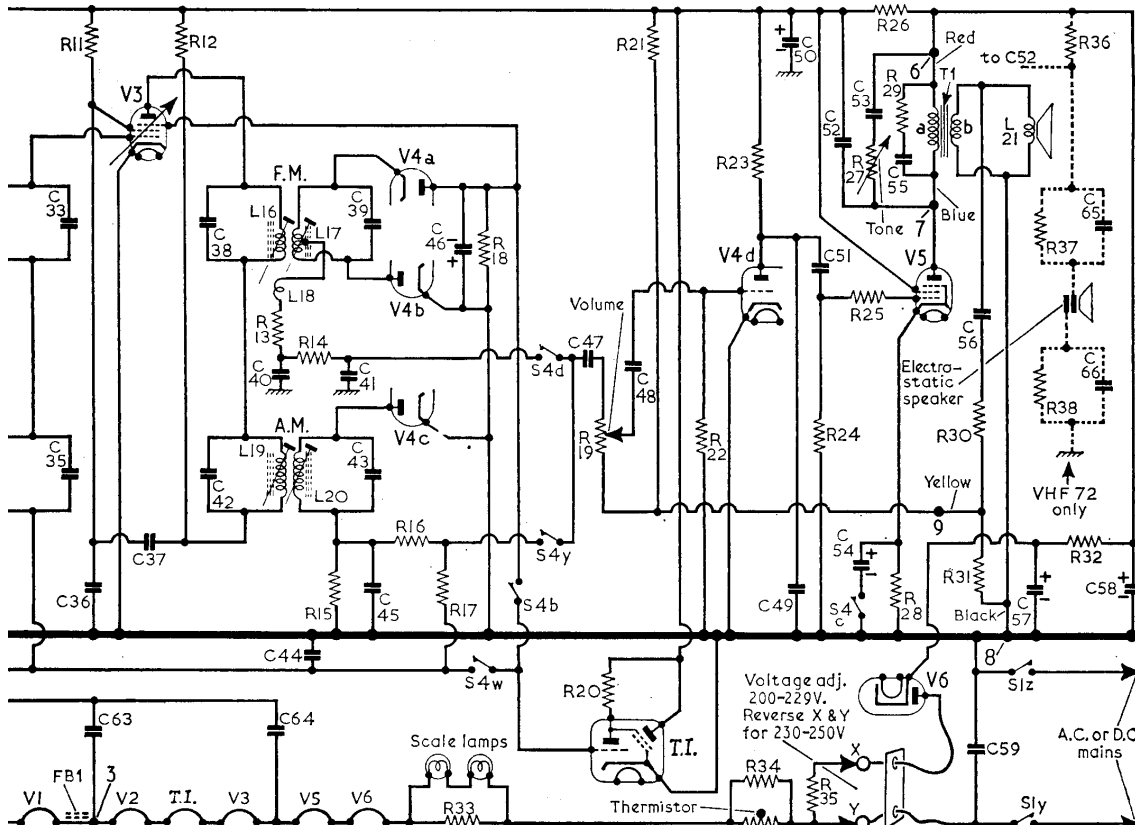
### Coils\*

L1	—	G4
L2	—	G4
L3	—	L5
L4	—	L5
L5	—	L5
L6	—	F4
L7	—	F4
L8	—	G3
L9	—	H3
L10	—	G4
L11	—	G4
L12	—	H3
L13	—	H3
L14	14.0	H3
L15	14.0	H3
L16	—	J3
L17	—	J3
L18	—	J3
L19	14.0	J3
L20	14.0	J3
L21	3.0	—
L22	—	E1

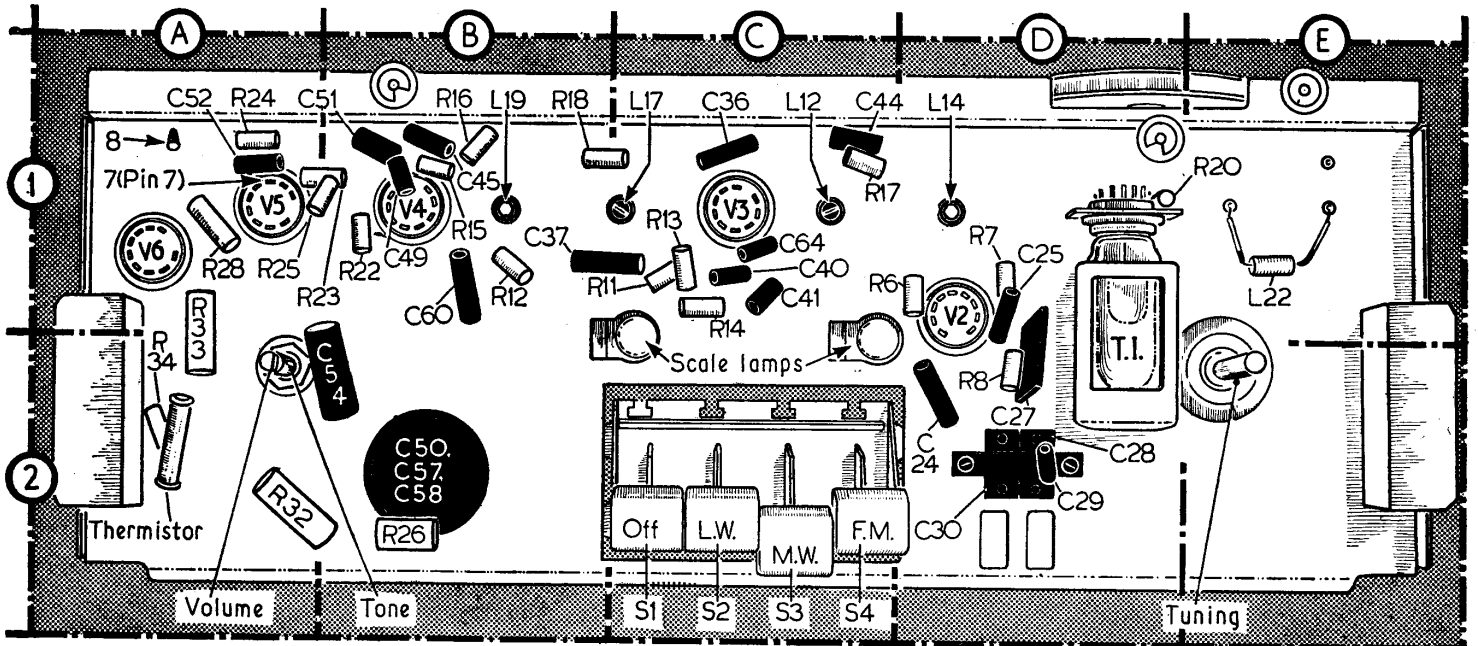
### Miscellaneous\*

T1	{ a	230-0	—
	{ b	—	—
Thermistor	CZ1	A2	
FB1	—	L5	
S1-S4	—	C2	

\* Approximate D.C. resistance in ohms.  
§ Mounted on output transformer.  
† VHF72 only.



72, C52 is connected between the anode of V5 and the junction of R36, R37. Other minor differences between diagrams are drawn as seen from the free ends of the pins.



Front view of the chassis with the tuning scale and reflector plate removed. The tuning drive system has been omitted in this illustration; this is shown in a detailed sketch at the foot of this page.

**Circuit Alignment—continued**

- C46, positive meter terminal to chassis. Connect the signal generator output, via the 0.1µF capacitor in its live lead, between chassis and V2b control grid (pin 2).
- 3.—For the following operations, feed in an unmodulated 10.7Mc/s signal and adjust the signal generator output to maintain a 4V reading on the D.C. output meter. The correct tuning peak for the iron-dust tuning cores is the first peak obtained from the adjusting end of the coil former, excepting L16 (J3) which is set to the second peak in.
- 4.—Adjust the core of L16 (J3) for maximum reading on the D.C. output meter.
- 5.—Connect the 0-50µA microammeter between the junction of R13, C40 (C1). Adjust L17 (C1) for a zero reading on the microammeter. This will occur mid-way between a positive and negative peak.
- 6.—Connect the 1kΩ damping resistor across L13 (H3) and adjust L12 (G1) for maximum D.C. output.
- 7.—Connect the damping resistor across L12

- and adjust L13 for maximum D.C. output. Then remove the damping resistor.
- 8.—Repeat operations 4 and 5.
- 9.—Transfer the signal generator to the V.H.F. aerial sockets. Adjust L7 (L5) and L6 (G4) for maximum D.C. output.
- 10.—Tune the receiver to 87.5Mc/s (this corresponds with the Third programme block on M.W.). Feed in an unmodulated 87.5Mc/s signal and adjust the cores of L4 and L6 by means of the screw on the gang drum, which should be slackedened off and moved along its curved slot until a position giving a maximum reading on the D.C. output meter is obtained. Retighten the locking screw.
- 11.—Tune the receiver to 94Mc/s. Feed in an unmodulated 94Mc/s signal; adjust core of L1 (G4) for maximum D.C. output. C9 and C11 are accurately aligned at the factory. No instructions are therefore given for adjusting these trimmers.

**GENERAL NOTES**

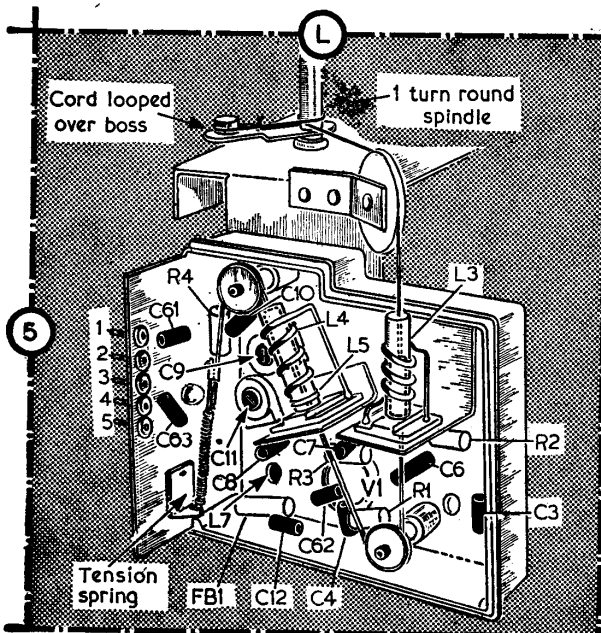
**A.M. Drive Cord.**—To replace the drive cord, first remove the control knobs and the

tuning scale. The right-hand and inner left-hand control knobs are held by grub screws, while the outer left-hand knob is a pull-off type. The tuning scale may be removed by releasing the retaining clamps at each end and tilting it forward to clear the control spindles and press-buttons.  
About 42½in of nylon-braided glass yarn is required for a new drive cord. This should be run as indicated in the sketch of the tuning drive system shown below. With the tuning gang at maximum capacitance the cursor should be adjusted to line up with the dots at the right-hand ends of the L.W., M.W. and V.H.F. tuning scales.

**F.M. Drive Cord.**—Should a breakage occur in any section of the F.M. drive cord, the manufacturers recommend that the complete drive cord and core assembly (Part No. CS61614) be replaced.

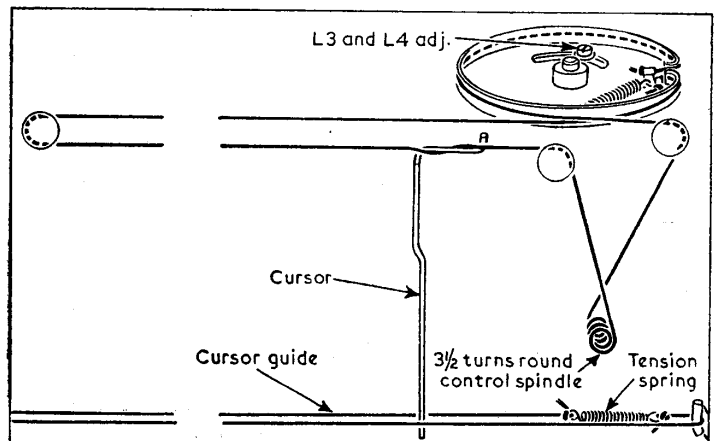
To replace the drive cord assembly, remove the front cover of the F.M. tuner unit (seven 6BA screws). Set the tuning gang to maximum capacitance. Unhook the tension spring from the drive drum and remove the screw and washer from the curved slot in the drum. Then remove the drive drum (loosen two grub screws). Thread the new drive cord and core assembly through the formers of L3 and L4 and run the cord as indicated in the front illustration of the tuner unit (col. 1).

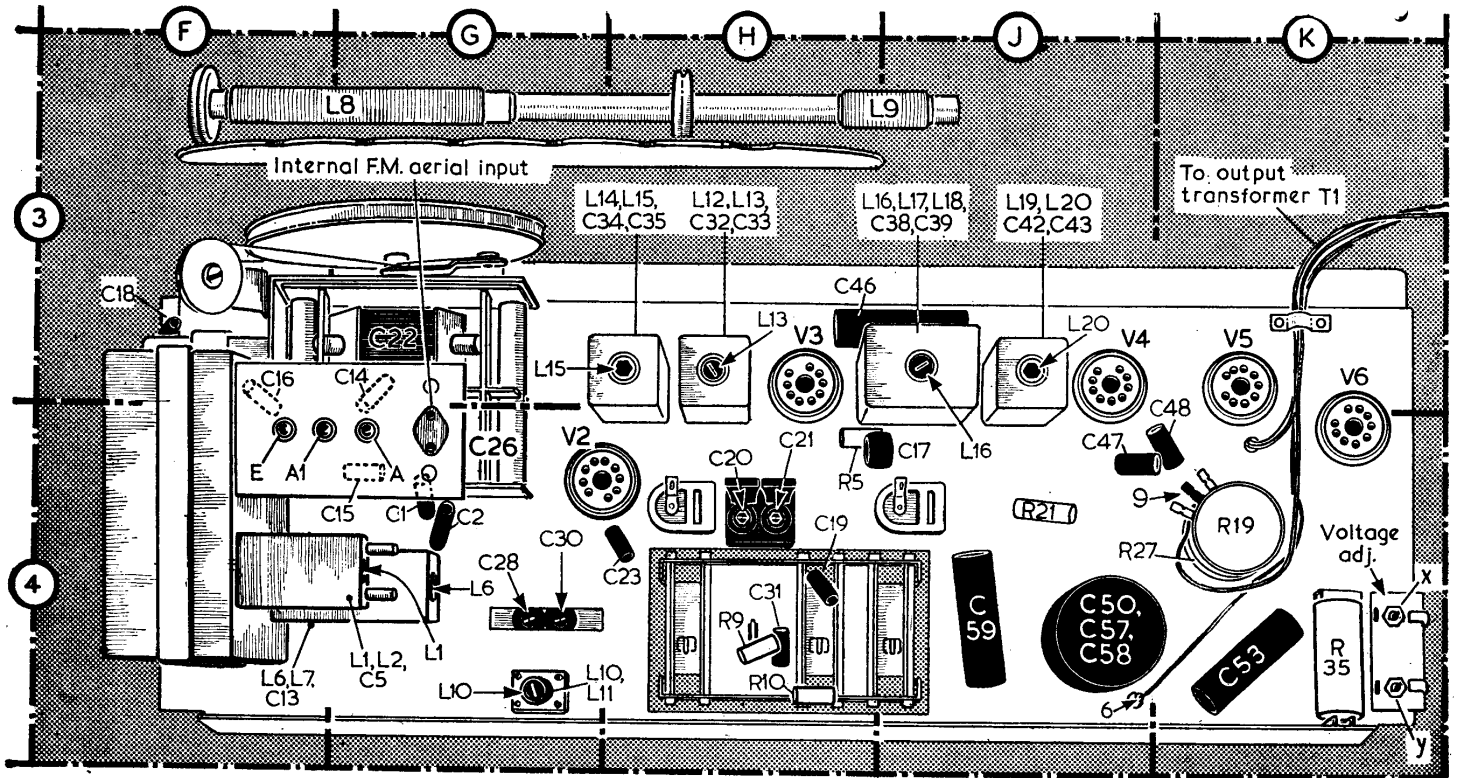
After reassembling, check that with the tuning gang set at maximum capacitance the cursor coincides with the dots at the right-hand ends of the L.W., M.W. and V.H.F.



Left: A view of the F.M. tuner unit with the screening cover removed.

Below: Sketch of the tuning drive system.





Rear view of the chassis. The ferrite rod aerial is mounted, together with output transformer T1, R29, R30, R31, C55 and C56, on the speaker baffle.

tuning scales. Then adjust the cores of L3 and L4 as described in operation 10 under "F.M. alignment" (col. 2).

**Switches.**—The A.M./F.M. switches are ganged in a press-button unit at the rear of the chassis (location reference H4). In this Service Sheet, a code has been used which allows the functions of the switches to be indicated in the circuit diagram. The switches are numbered S1-S4. Each press-button controls a group of individual switches which are lettered a, b, c, d, e, and v, w, x, y, z. By the use of both numbers and letters these individual switches are fully identified; for example, S3b, S4y.

In order to show which individual switches in a group close and which open when their press-button is depressed to "on" or released to "off," the letters have been applied in two selected series. One series is from the beginning of the alphabet, a, b, c, etc., the other is from the end of the alphabet, z, y, x, etc.

All switches in the a, b, c, d, e series will be closed when their press-button is "on" and open when their press-button is "off"; their action being the same as that of the press-button. On the other hand, all switches in the v, w, x, y, z series will be open when their press-button is "on" and closed when the button is "off," their action being the opposite to that of the press-button.

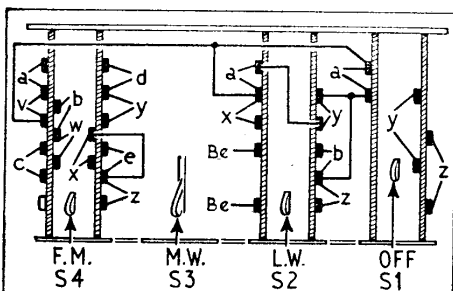


Diagram of the press-button switch unit as seen from the rear of the chassis.

**Model VHF72.**—The differences between this model and the VHF71, from which this Service Sheet was prepared, are in the audio stages. In addition to the moving coil speaker L21, the VHF72 is fitted with an electrostatic tweeter, this being connected as indicated by the circuitry shown dotted in our circuit diagram overleaf. It is important to note that C52 is then disconnected from the H.T. line and connected to the junction of R36 and R37. The additional components R36, R37, R38, C65 and C66 are mounted on output transformer T1. R31 is 1.2kΩ (820Ω in later receivers) and it is shunted by a 470Ω resistor and a 0.02μF capacitor connected in series, the capacitor being connected to chassis.

**Modifications.**—In early versions of the VHF71 and VHF72 receivers, R21 is omitted and R18 is 27kΩ. The scale lamps are connected between chassis and the receiver side of mains on/off switch S12; R33 is then 59Ω. A.M. I.F. transformers L14, L15 and L19, L20 are of different manufacture and their tuning capacitors C34, C35, C42 and C43 are 180pF.

In VHF71 receivers with serial numbers below 800, R2 is 150Ω and C4 and R1 are omitted.

In early versions of the VHF72, R31 was 1.2kΩ and was later reduced to 820Ω.

In later receivers than our sample model VHF71, R7 is 15kΩ and R9 is 8.2kΩ. This change also applies to model VHF72.

**Scale Lamps.**—These are two 6.3V, 0.115A lamps with clear spherical bulbs and M.E.S. bases.

### DISMANTLING

**Removing Chassis.**—Remove back cover (four 2BA screws and washers); remove four Phillips-head chassis retaining screws, two at the top corners of the chassis and two from underneath the cabinet; remove the ferrite rod aerial assembly (two 4BA nuts); remove the cleat clamping the output transformer leads to the chassis.

The chassis may now be removed to the extent of the output transformer leads.

**Tuner Unit.**—Access to the inside of the tuner unit may be gained by removing the screening cover (seven 6BA screws). To completely remove the unit from the chassis, proceed as follows:

- Unsolder five connections from the tuner.
- Set the tuning gang to minimum capacitance and unhook the tension spring from the drive drum;
- remove the cursor drive cord and the screw and washer from the curved slot on the drive drum;
- remove the drive drum (loosen two grub screws);
- remove the F.M. drive cord from the boss on the pivoted adjuster;
- remove the four screws holding the tuner unit retaining bracket to the tuning gang C22, C26;
- remove three Phillips-head screws and washers from the front of the chassis.

### VALVE ANALYSIS

Valve voltages given in the table below are those derived from the manufacturers' information. They were measured on the 10V and 1,000V ranges of a Model 8 Avometer, chassis being the negative connection in every case. Except where otherwise indicated, the receiver was switched to M.W.

Valve	Anode (V)	Screen (V)	Cath. (V)
V1 UCC85	a .. 112 <sup>1</sup>	—	0.7
	b .. 112 <sup>1</sup>	—	—
V2 UCH81	a .. 110	—	—
	b .. 158	100	—
V3 UF89	.. 150	85	—
V4 UABC80 d	.. 70	—	—
V5 UL84	.. 190	158	11.8
V6 UY85	.. *	—	230.0
T.I. UM80	.. *	—	—

<sup>1</sup> Receiver switched to F.M. Measured at the junction of L3 and L6.  
\* No reading quoted.