"TRADER" SERVICE SHEET

1301

EMPLOYING press-button band switching, the Bush VHF61 is a 3-band A.M./F.M. table receiver designed for operation from A.C. mains of 100-120V, 200-250V, 40-100c/s. It employs seven Mullard valves (including a rectifier) and a Mullard cathode ray tuning indicator.

The bands covered are: A.M., 187-560m, 1,070-1,900m; F.M., 87.5-100Mc/s. Total mains consumption is 65 watts.

Release date and original price: August 1956, £20 8*s* 3*d*. *Purchase tax extra.*

CIRCUIT DESCRIPTION

Tuned internal A.M. aerial circuits **L9, C21** (M.W.) and **L10, C21** (L.W.) precede triode pentode valve **V2** which operates as A.M. frequency changer with external coupling. Provision is made for the connection of an external aerial and earth.

Oscillator grid coil **L11** is tuned by **C26** for both M.W. and L.W. operation. Parallel trimming by **C30** (M.W.) and **C28, C29** (L.W.); series tracking by **C27** (M.W. and L.W.). Reaction coupling from oscillator anode via **L12. S12** opens on M.W. to stabilize the oscillator circuit via **R9.**

V3 and **V4** are variable-mu R.F. pentodes operating as A.M. I.F. amplifiers with tuned transformer couplings **L15, L16; L19, L20** and **L24, L25.**

A.M. intermediate frequency 470kc/s

Diode section **c** of triple diode triode valve **V5** operates as A.M. signal detector. Audio frequency component in its rectified output is developed across **R21** and passed via **C59,** volume control **R26** and **C62** to **V5d,** which operates as A.F. amplifier. I.F. filtering by **C54, R24** and **C63.**

D.C. potential developed across **R21** is fed back as bias to **V2b, V3** and **V4,** giving automatic gain control.

Resistance-capacitance coupling by **R29, R31, C65, R33** between **V5d** and pentode output valve **V6.** Tone control by **C64, R32** in **V6** control grid circuit. Tone correction by **R34, C66** and **C67** in **V6** anode circuit.

Negative feed-back tone correction via **C68, R37, R38, S24** between **T1** secondary winding **b** and **V5d** grid circuit. Addition negative feed-back tone correction is introduced by **V6** cathode resistor **R36,** which is not decoupled. Provision is made for the connection of a low-impedance external speaker across winding **b** on **T1.**

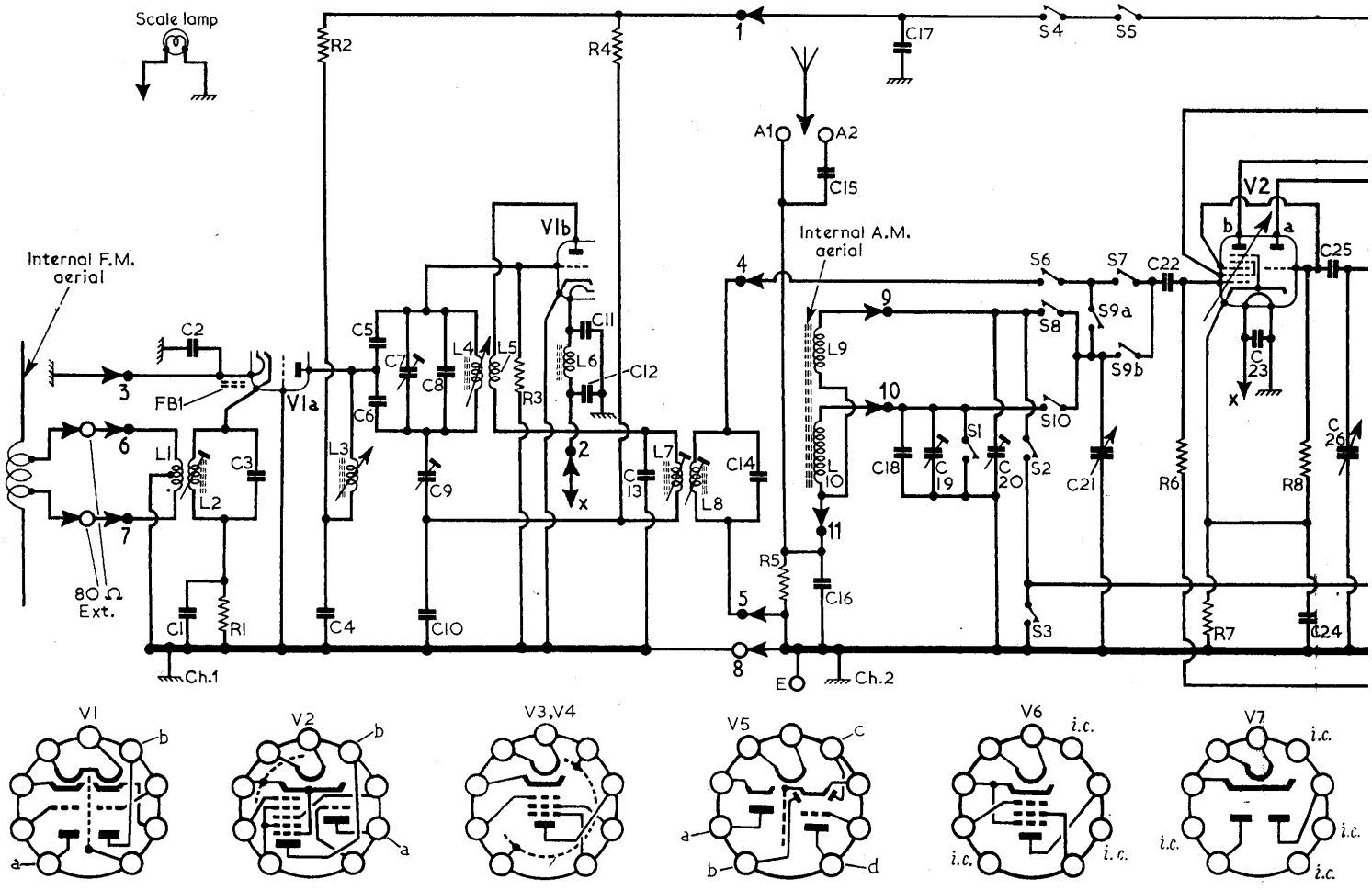
H.T. current is supplied by full-wave I.H.C. rectifying valve **V7.** H.T. smoothing by **R30, R40** and electrolytic capacitors **C61, C69, C70.**

Operation on F.M.

80Ω balanced F.M. aerial input is coupled via **L1** and pre-tuned aerial circuit **L2, C3** to earthed-grid R.F. amplifier **V1a.** Section **b** of **V1** operates as oscillator/mixer valve with tuned oscillator grid circuit **L4, C5, C6, C7, C8.**

Reaction coupling from oscillator anode via **L5.** Output of **V1a** is developed across R.F. tuning coil **L3** and is coupled via **C5, C6** to **V1b.**

To prevent oscillator voltages from passing into the R.F. and aerial circuits



Circuit diagram of the Bush VHF61. **C2** in the F.M. tuner unit in this receiver is short-circuited by connection 3. This is because the F.M. tun control grid circuit appears complicated due to inter-connections on the push-button unit, the switch operations are quite simple and are as follow

Supplement to Wireless & Electrical Trader, 18 May 1957

BUSH VHF61 A.M./F.M. RECEIVER

Fitted with Internal Aerials for M.W., L.W. and V.H.F. Reception and Designed to Operate from A.C. Mains

and radiating oscillator frequencies, a bridge neutralizing circuit is formed between **C5, C6, C9, C10** and the grid/cathode inter-electrode capacitance of **V1b. V1a** anode is thus at zero oscillator potential. F.M. tuning is by means of the cores of **L3** and **L4,** which are ganged to the main drive drum.

V2b, V3 and **V4** form the 3-valve F.M. I.F. amplifier with I.F. transformers **L7, L8; L13, L14; L17, L18** and **L21, L22, L23.**

F.M. intermediate frequency 10.7Mc/s

Diode sections **a** and **b** of **V5** operate in a ratio detector circuit whose A.F. output is developed across **C57** and passed via de-emphasis circuit **R23, C58** and **C59** to the volume control circuit. **R20** and **C55** improve the balancing of the detector circuit.

Limiting is performed by the flywheel action of D.C. reservoir circuit **R25, C56,** and by **R21, R22** in **V4** control grid circuit.

D.C. potential developed across **R25, C56** is fed back as bias to **V4** suppressor grid.

Tuning indicator **T.I.** is switched via **S18** to the A.M. A.G.C. line for M.W. and L.W. operation, and via **S19** to the D.C. reservoir circuit for F.M. operation.

With the receiver switched to F.M. operation, **S24** opens to insert **R39** in the negative feed-back network **C68, R37, R38** and thus increase the amount of feed-back between **T1** secondary winding and **V5d** grid circuit.

VALVE ANALYSIS

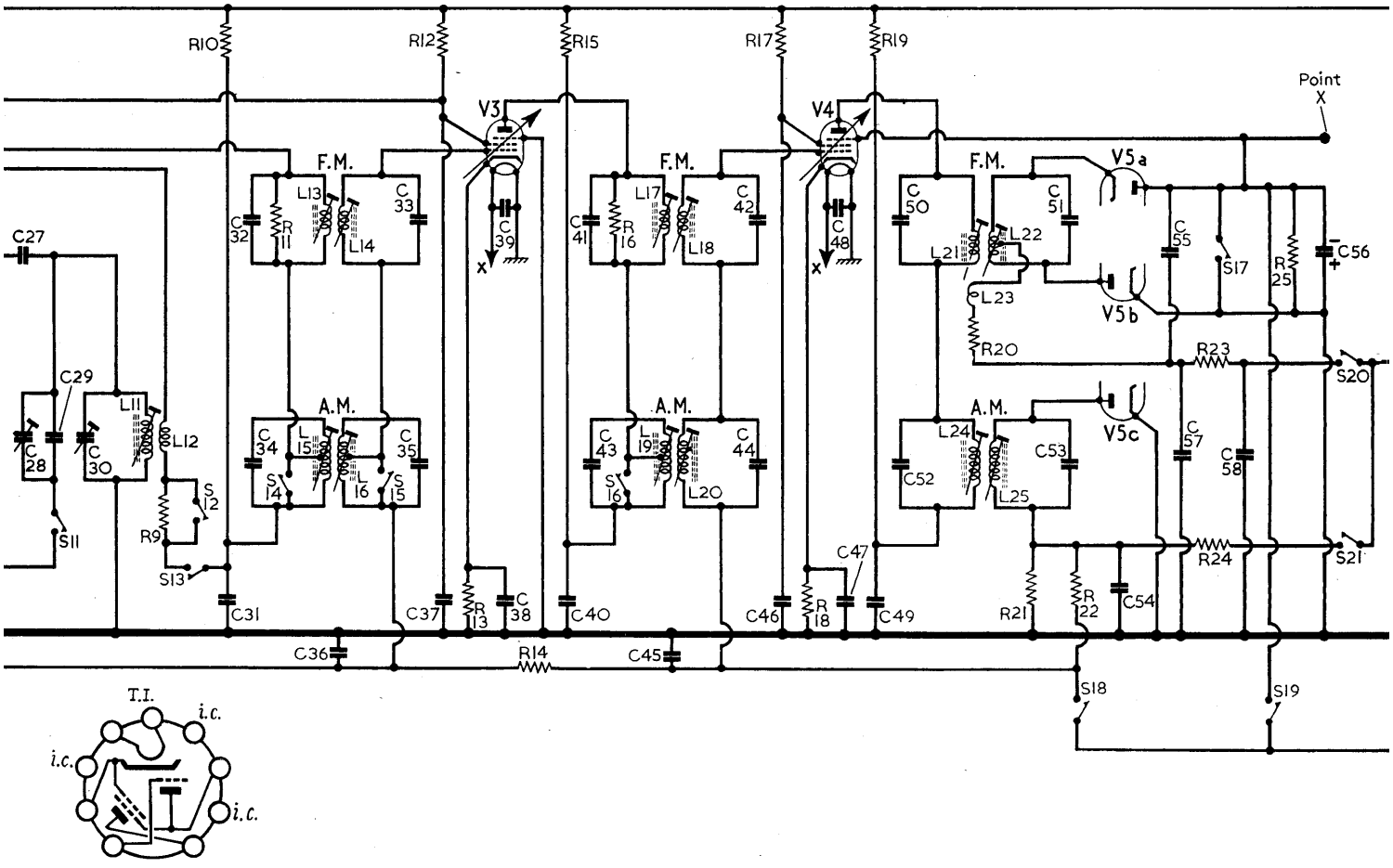
Valve voltages and currents given in the table below are those derived from the manufacturers' information. Except where otherwise indicated they were measured with the receiver switched to M.W. Voltages were measured on the 10V and 1,000V ranges of a Model 7 Avometer, chassis being the negative connection in every case, using the appropriate mains voltage tapping on the mains transformer **T2.**

Valve	Anode (V)	Screen (V)	Cath. V	Cath. mA
V1 ECC85 { a	150†	—	1·0†	6·7†
V1 ECC85 { b	127†	—	—	6·3†
V2 ECH81 { a	*	—	1·7	11·3
V2 ECH81 { b	105	85		
V3 EF89	168	85	1·3	8·7
V4 EF89	165	135	2·3	15·3
V5 EABC80 { a-c	—	—	—	—
V5 EABC80 { d	70	—	—	*
V6 EL84	245	210	6·5	36·0
V7 EZ80	240[1]	—	252	84·0
T.I. EM81	24[2]	—	—	—

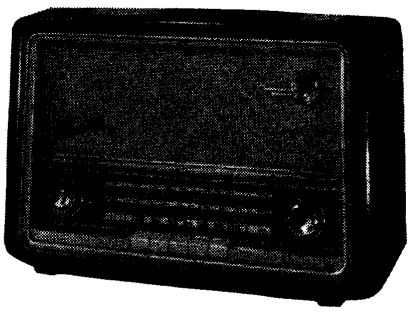
* *No reading quoted.*
† *Receiver switched to F.M.*
[1] *A.C. reading each anode.*
[2] *Target anode 170V.*

CIRCUIT ALIGNMENT

Equipment Required.—An accurately calibrated 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 (unmodulated); a Model 8 Avometer, or alternatively a D.C. valve voltmeter and a



ıer unit is also employed in Bush receivers having a series heater chain, and **C2** then functions as a heater by-pass capacitor. **FB1** is a ferrite bead which s
ws: F.M., **S6, S7** close; M.W., **S8, S9a, S7** close; L.W., **S10, S9b** close. Negative feed-back is effected by omitting **V6** cathode by-pass capacitor and



0-50μA D.C. microammeter; two matched 47kΩ resistors; a 1kΩ resistor for use as damping unit.

A.M. I.F. Stages

Remove chassis from cabinet. Check that with the gang at maximum capacitance the cursor coincides with the calibration dots at the high wavelength end of the tuning scale.

1.—Switch receiver to M.W. and tune it to 300m. Connect output of signal generator to control grid (pin 2) of **V4** and chassis.

2.—Feed in a 470kc/s modulated signal and adjust the cores of **L25** (location reference C2) and **L24** (F5) for maximum audio output.

3.—Transfer live signal generator lead to control grid (pin 2) of **V3.** Feeding in a 470kc/s signal, adjust the cores of **L20** (B2) and **L19** (G5) for maximum audio output.

4.—Transfer live signal generator lead to control grid (pin 2) of **V2b.** Feeding in a 470kc/s signal, adjust the cores of **L16** (B2) and **L15** (G5) for maximum audio output.

A.M. R.F. Stages

5.—With signal generator output connected to **V2b** control grid, tune receiver to 500m, feed in a 600kc/s modulated signal and adjust the core of **L11** (H4) for maximum audio output.

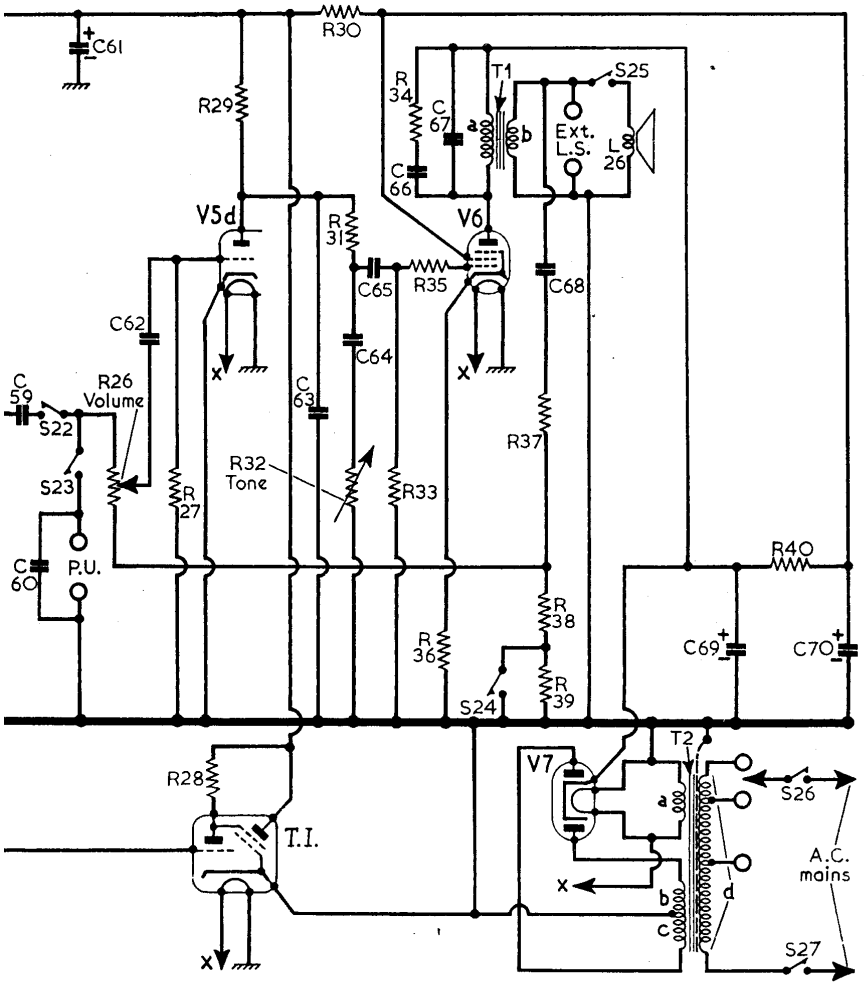
6.—Tune receiver to 200m, feed in a 1.5Mc/s modulated signal and adjust **C30** (G4) for maximum audio output.

7.—Repeat steps 5 and 6.

8.—Switch receiver to L.W., tune it to 1,400m, feed in a 214kc/s signal and adjust **C28** (G4) for maximum audio output.

9.—Disconnect signal generator leads, connect them to a single-turn loop of wire approximately 5in in diameter. Place this loop about 12-18 inches away from the internal A.M. aerial. Switch receiver to M.W., tune it to 200m, feed in a 1,500kc/s and adjust

(*Continued in col. 1 overleaf*)

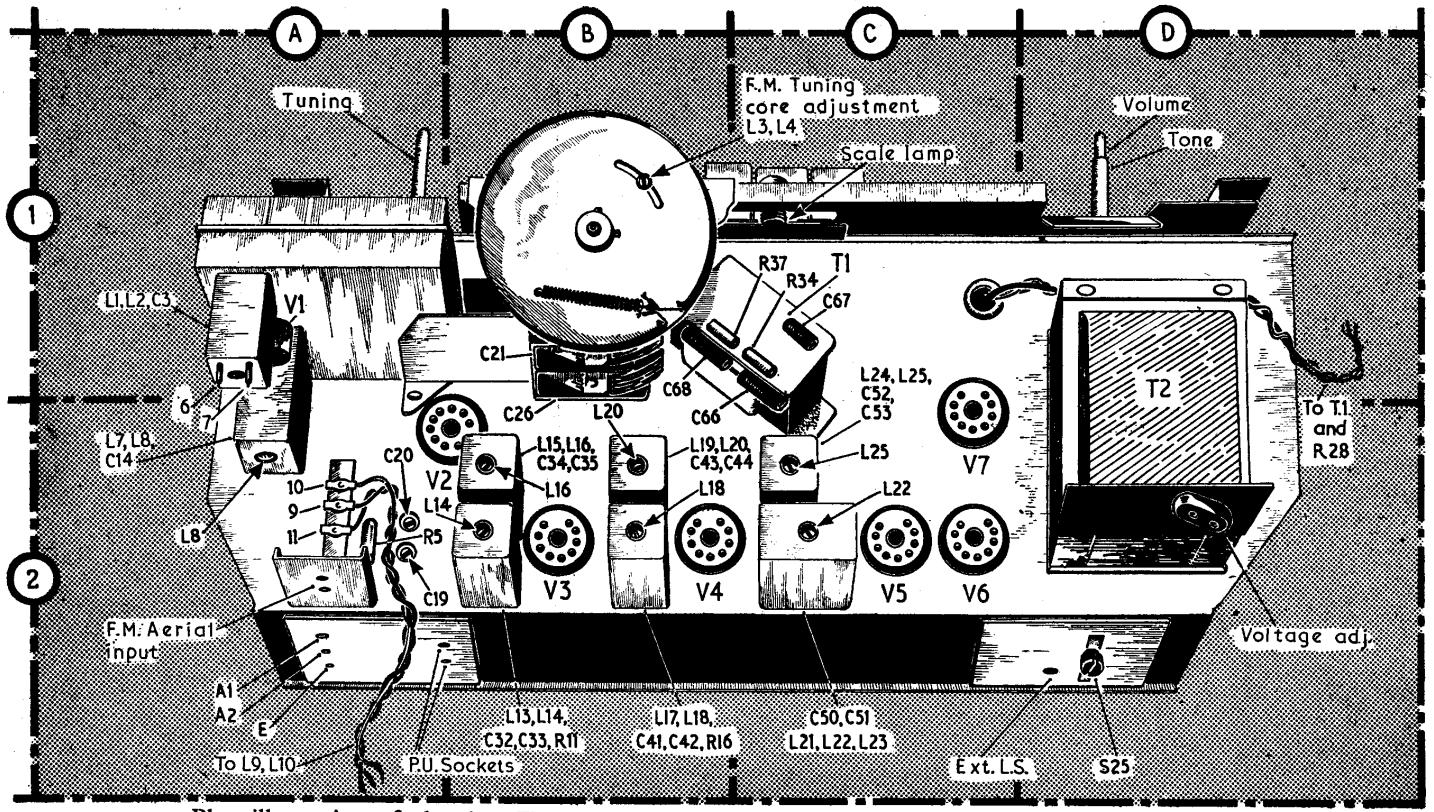


ı suppresses R.F. current in the heater lead. Although the band switching in **V2b** d by the potential divider **C68, R37, R38** and **R39.** **S24** closes for A.M. operation.

COMPONENT VALUES AND LOCATIONS

Capacitors		
C1	560pF	J6
C2	560pF	J6
C3	10pF	A1
C4	560pF	J6
C5	22pF	J6
C6	22pF	J6
C7	15pF	J6
C8	5·6pF	J6
C9	15pF	J6
C10	47pF	J6
C11	560pF	J6
C12	560pF	J6
C13	10pF	J6
C14	47pF	A2
C15	47pF	H5
C16	7,500pF	H5
C17	0·01μF	H4
C18	90pF	H5
C19	40pF	H5
C20	40pF	H5
C21	528pF	B1
C22	270pF	G4
C23	0·01μF	H5
C24	0·02μF	H5
C25	68pF	H4
C26	528pF	B1
C27	515pF	H4
C28	40pF	G4
C29	450pF	G4
C30	40pF	G4
C31	0·01μF	H5
C32	47pF	B2
C33	47pF	B2
C34	110pF	B2
C35	110pF	B2
C36	0·04μF	G5
C37	0·04μF	H5
C38	0·02μF	G5
C39	0·02μF	G5
C40	0·01μF	G5
C41	47pF	B2
C42	47pF	B2
C43	110pF	B2
C44	110pF	B2
C45	0·04μF	G5
C46	0·04μF	G5
C47	0·02μF	G5
C48	0·02μF	G5
C49	0·01μF	F5
C50	10pF	C2
C51	47pF	C2
C52	110pF	C2
C53	110pF	C2
C54	100pF	F5
C55	470pF	F4
C56	5μF	F5
C57	470pF	F5
C58	270pF	F4
C59	0·01μF	F4
C60	0·001μF	H5
C61	40μF	E4
C62	0·01μF	E3
C63	270pF	F5
C64	0·005μF	F5
C65	0·01μF	F5
C66	0·01μF	C1
C67	0·003μF	C1
C68	0·1μF	B1
C69	40μF	E4
C70	20μF	E4
Resistors		
R1	150Ω	J6
R2	2·2kΩ	J6
R3	100kΩ	J6
R4	6·8kΩ	J6
R5	10kΩ	A2
R6	680kΩ	G4
R7	150Ω	H4
R8	47kΩ	H4
R9	2·2kΩ	G4
R10	10kΩ	G5
R11	22kΩ	B2
R12	12kΩ	G5
R13	150Ω	G5
R14	1MΩ	G4
R15	1kΩ	G5
R16	22kΩ	B2
R17	10kΩ	G5
R18	150Ω	G5
R19	1kΩ	G5
R20	100Ω	F5
R21	330kΩ	F4
R22	1MΩ	F5
R23	100kΩ	F4
R24	47kΩ	F4
R25	22kΩ	F4
R26	1MΩ	E3
R27	15MΩ	F5
R28	470kΩ	D1
R29	180kΩ	F5
R30	1kΩ	F5
R31	120kΩ	F5
R32	1MΩ	E3
R33	470kΩ	F5
R34	10kΩ	C1
R35	47kΩ	F5
R36	180Ω	F5
R37	4·7kΩ	B1
R38	470Ω	F3
R39	1kΩ	E4
R40	1kΩ	E5
Other Components[1]		
L1	—	A1
L2	—	A1
L3	—	J6
L4	—	J6
L5	—	J6
L6	—	J6
L7	—	A2
L8	—	A2
L9	—	A2
L10	13·0	A2
L11	4·0	H4
L12	1·0	H4
L13	—	B2
L14	—	B2
L15	14·0	B2
L16	14·0	B2
L17	—	B2
L18	—	B2
L19	14·0	B2
L20	14·0	B2
L21	—	C2
L22	—	C2
L23	—	C2
L24	14·0	C2
L25	14·0	C2
L26	2·5	—
T1 a	380·0	C1
T1 b	—	C1
T2 a	—	D1
T2 b	130·0	D1
T2 c	138·0	D1
T2 d	25·0	D1
FB1	—	J6
S1-S24	—	F3
S25	—	D2
S26, S27	—	F4

[1]Approximate D.C. resistance in ohms.



Plan illustration of chassis. Test point X (not marked) is beside **L24, L25** can in location C2.

Circuit Alignment—*continued*

C20 (A2) for maximum audio output.

10.—Switch receiver to L.W., tune it to 1,400m, feed in a 214kc/s signal and adjust **C19** (A2) for maximum audio output.

F.M. I.F. Stages

11.—Switch receiver to F.M. Connect the 47kΩ resistors in series between chassis and point X (beside **L24, L25** can in C2). Connect Model 8 Avometer (switched to 10V D.C. range), or D.C. valve voltmeter, between chassis and point X.

12.—Connect output of signal generator between control grid (pin 2) of **V3** and chassis. Feed in a 10.7Mc/s unmodulated signal. During the following operations, adjust the output of the signal generator to maintain a 4V reading on the output meter, and when adjusting the cores choose the peak nearer the adjusting end of the coil former, excepting **L21** which is set to the second peak in.

13.—Adjust the core of **L21** (F5) for maximum reading on meter.

14.—Connect the 1kΩ resistor across **L18** and adjust the core of **L17** (G5) for maximum reading on meter.

15.—Connect the 1kΩ resistor across **L17** and adjust the core of **L18** (B2) for maximum reading on meter.

16.—Transfer live signal generator lead to control grid (pin 2) of **V2b.** Connect the 1kΩ resistor across **L14** and adjust the core of **L13** (H5) for maximum reading on meter.

17.—Connect the 1kΩ resistor across **L13** and adjust the core of **L14** (B2) for maximum reading on meter.

18.—Re-adjust the core of **L21** (F5) for maximum reading on meter. Disconnect meter from point X. Connect Avometer (switched to 50μA D.C. range), or D.C. microammeter, between junction of the 47kΩ resistors and the junction of **R23, C58** (F4).

19.—Adjust the core of **L22** (C2) for a zero reading on the microammeter. This will occur midway between a positive-going and a negative-going peak.

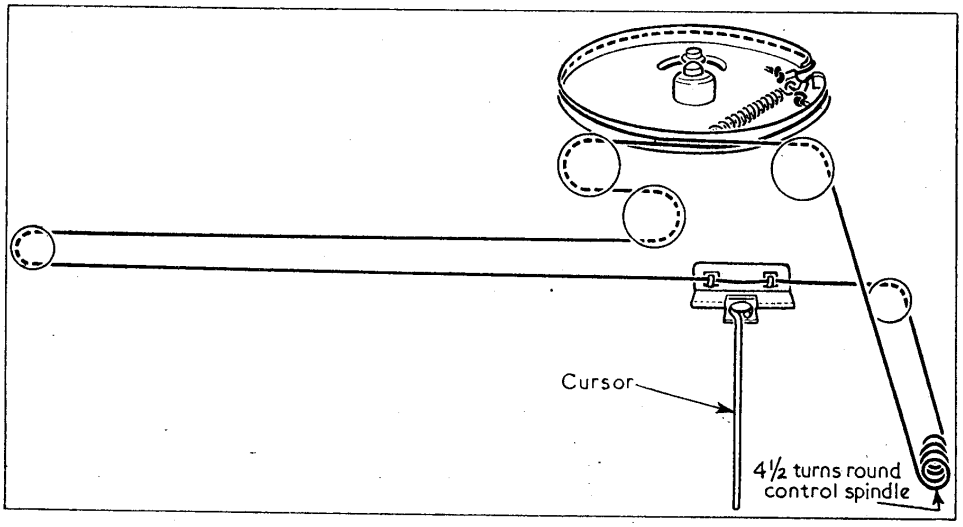
20.—Disconnect meter and 47kΩ resistors. Connect Avometer (switched to 10V D.C. range), or D.C. valve voltmeter, between chassis and point X.

21.—Transfer signal generator leads to F.M. aerial sockets. Adjust the cores of **L7** (J6) and **L8** (A2) for maximum output on meter.

F.M. R.F. Stages

22.—Tune receiver to 88Mc/s, feed in an 88Mc/s signal and adjust the cores of **L3, L4** by means of a screw in the gang drum (B1) which should be slackened off and moved along its radial slot until a position giving a maximum meter reading is found. Tighten up screw.

23.—Tune receiver to 94Mc/s, feed in a 94Mc/s signal and adjust the core of **L2** (J6) for maximum reading on meter. **C7** and **C9** are accurately aligned at the factory for minimum oscillator voltage at the F.M. aerial socket, and for optimum F.M. calibration respectively. As



Sketch of the A.M. tuning drive system as seen from the front of an upright chassis with the gang at maximum capacitance.

Switch Table

Switch	Gram	F.M.	M.W.	L.W.
S1 ..	C	C	C	—
S2 ..	C	C	C	—
S3 ..	C	C	—	C
S4 ..	—	C	—	—
S5 ..	—	C	C	C
S6 ..	C	C	—	C
S7 ..	C	C	C	—
S8 ..	C	C	C	—
S9a ..	—	—	C	—
S9b ..	—	—	—	C
S10 ..	—	—	—	C
S11 ..	—	—	—	C
S12 ..	C	C	—	C
S13 ..	C	—	C	C
S14 ..	—	C	—	—
S15 ..	C	C	—	—
S16 ..	—	C	—	—
S17 ..	—	—	C	—
S18 ..	C	—	C	C
S19 ..	—	C	—	—
S20 ..	—	C	—	—
S21 ..	C	—	C	C
S22 ..	—	C	C	C
S23 ..	C	—	C	—
S24 ..	C	—	C	C

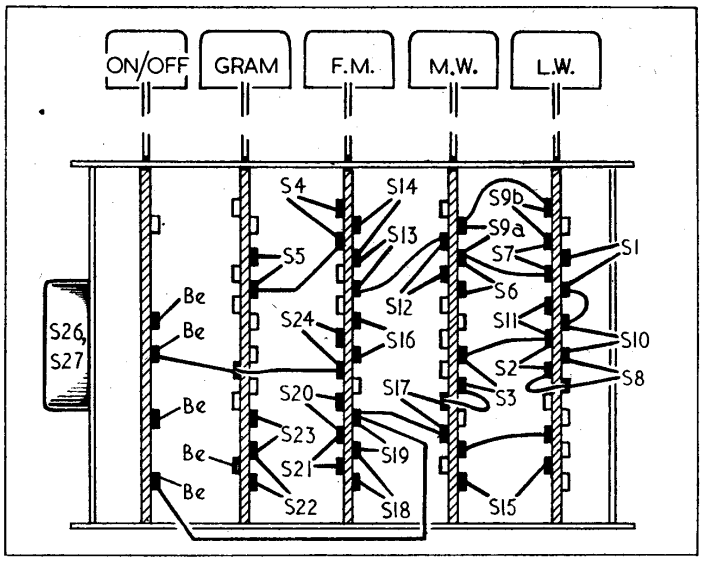


Diagram of the press-button switch connections, seen as viewed from the underside of the chassis.

these adjustments are made using special alignment equipment, and as the trimmers should not normally need re-adjustment, no alignment instructions are given for them.

GENERAL NOTES

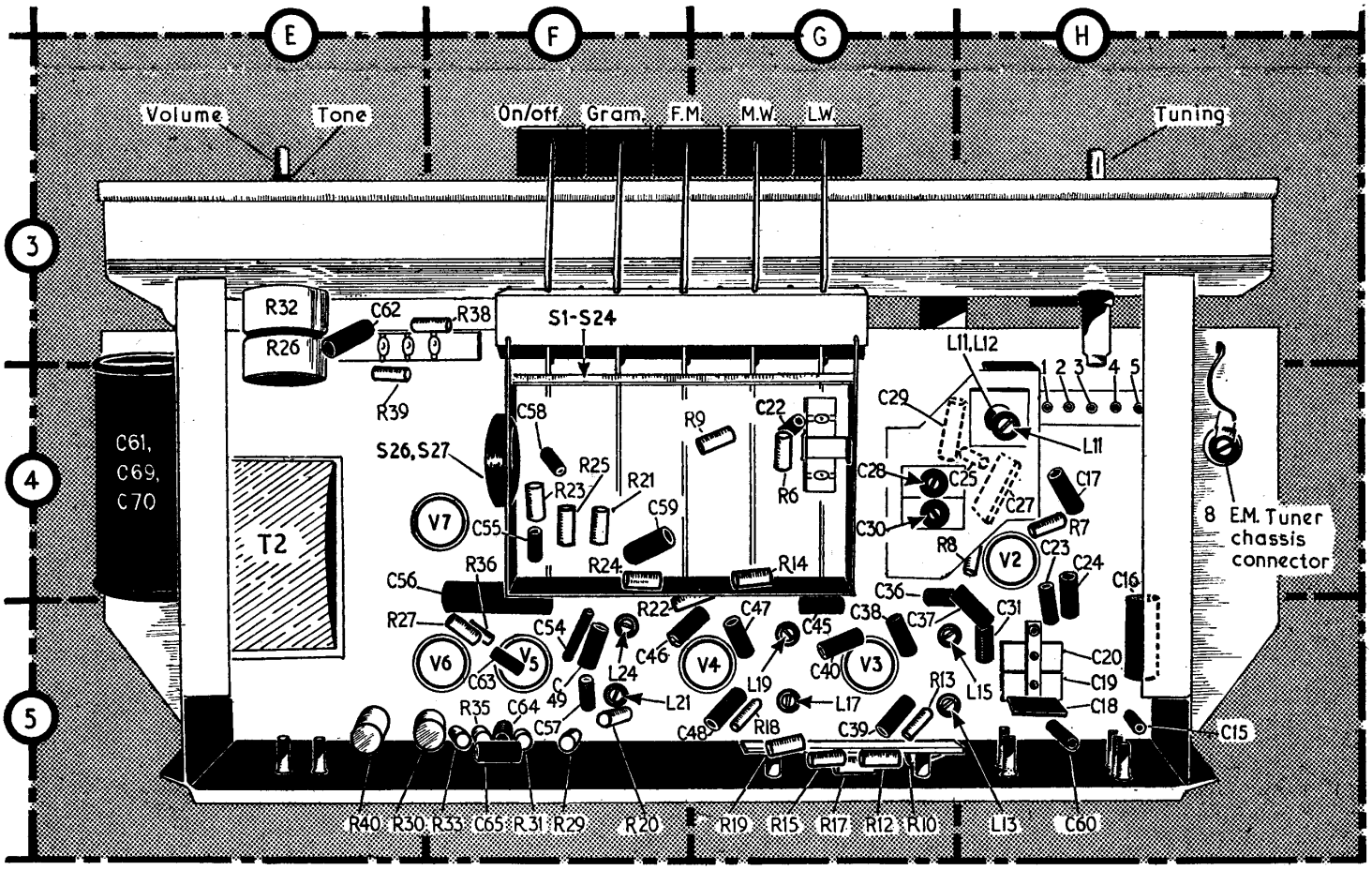
Switches.—S1-S24 are the band/gram switches ganged in a 5-way press-button unit beneath the chassis. This unit is indicated in the underside illustration of the chassis (location reference F3).

The individual switch contacts are identified in the diagram of the unit at the head of columns 5 and 6. The associated switch table in column 4 shows the switch operations when each button is depressed. A dash indicates open, and **C**, closed.

A.M. Drive Cord.—About 48in of nylon-braided glass yarn is required for a new drive cord. To replace the cord, first remove the tuning scale (secured by two screws and clips), and tie off one end of the cord to the anchoring clip.

Then attach the clip to the spring in the drive drum, and, setting the gang at maximum capacitance, pass the free end of the cord out through the opening in the drive drum and run it off clockwise round the drum.

Run the cord on as indicated in the sketch of the A.M. tuning drive system at the foot of columns 1 and 2, finally tying



Underside illustration of the chassis. F.M. tuner unit connections **1-5** and **8** are identified in location H4. Connections 6, 7 are identified in the plan illustration of the chassis (location A1).

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off the cord to the anchoring clip.

Check that with the gang at maximum capacitance, the cursor coincides with the calibration dots at the high wavelength end of the tuning scale.

F.M. Drive Cord.—Should a breakage occur in any section of the F.M. drive cord, or should one of the tuning cores break, the manufacturers recommend that the complete drive cord and core assembly (Part Number AP24888) be replaced.

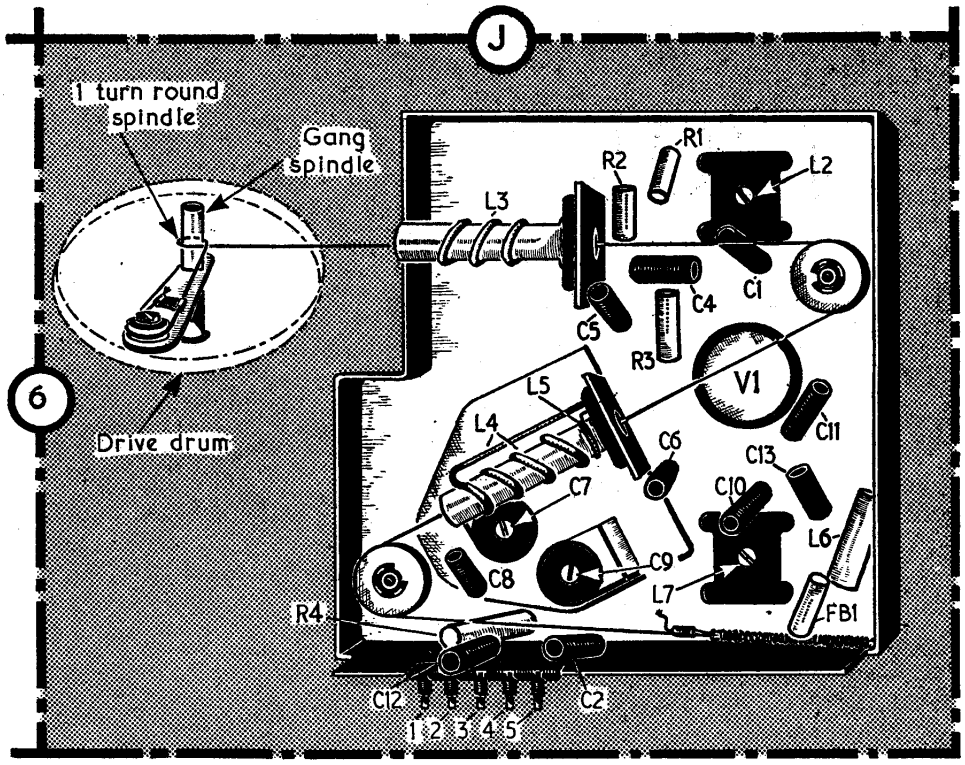
Access to the drive and tuning cores is obtained by removing the tuning scale and then removing the front cover of the F.M. tuner unit. (Seven 6BA $1\frac{3}{8}$in nuts and bolts.)

The screw on the drive drum which adjusts the position of the cores of **L3** and **L4** (location reference **B1**) should be removed. Next, the A.M. drive cord and the drive drum should be removed.

The new drive cord and core assembly should then be threaded through the formers of **L3** and **L4**, and with the A.M. tuning gang turned to minimum capacitance, the cord should be run as indicated in the front illustration of the tuner unit.

Replace the tuning drum and the A.M. drive cord (as instructed under "A.M. Drive Cord"). Re-set the drive drum adjusting screw for **L3, L4** by carrying out step 22 of the circuit alignment instructions.

Scale Lamp.—This is a 6.5V, 0.3A lamp with a small clear spherical bulb and an M.E.S. base.



Front view of the F.M. tuner unit with its screening cover removed. **C7, C9** and the cores of **L2** and **L7** are accessible through holes in the screening cover, but the capacitors should not be disturbed. The F.M. drive is also shown in this illustration.

DISMANTLING

Removing Chassis.—Remove four 2BA chassis bolts (with plain washers) from underside of chassis;

remove two 2BA bolts (with plain washers) securing brackets on chassis deck to side of cabinet;

slide chassis rearwards out of cabinet to extent of ferrite rod aerial and speaker leads;

release the two speaker connecting leads from their screw connections on the top of the output transformer;

remove ferrite rod from cabinet by gently dislodging the rubber grommets from the metal brackets;

loosen the nut holding the cleat on the top left-hand corner of the speaker, and slip the tuning indicator leads out from under it. These leads are long enough to enable the chassis to be withdrawn clear of the cabinet.

If it is required to separate the chassis from the cabinet completely, the tuning indicator should be eased away from the baffle (to release its base connector from a notch in the baffle) and withdrawn from the retaining spring.

ADDITIONAL NOTES AND MODIFICATIONS