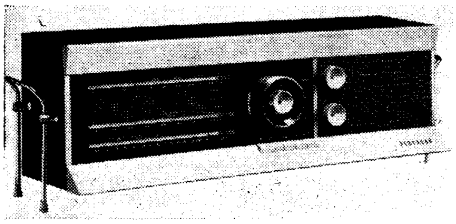
"TRADER" SERVICE SHEET

1388

FERGUSON 388A

"Futura" A.M./F.M. Table Receiver



Appearance of the Ferguson 388A.

EMPLOYING press-button band and gramophone switching, the Ferguson "Futura" model 388A is a 3-band A.M./F.M. table receiver, designed to operate from A.C. mains of 200-250V, 50-60c/s. It is fitted with an internal F.M. aerial and an internal ferrite rod A.M. aerial. Provision is made for the connection of external aerials, a gramophone pickup and an external speaker. The wavebands covered are 88-101Mc/s (F.M.), 188-545m (M.W.) and 1,160-1,940m (L.W.).

Release date and original price: July 1958, £21 4*s* 7*d. Purchase tax extra.*

CIRCUIT DESCRIPTION

A.M. aerial input, via bottom-coupling capacitor **C18,** to the single-tuned aerial circuits comprising **L9, C19** and **C20** (M.W.) and **L8, L9, C19, C20** and **C21** (L.W.). Coupling via **C17** and the low impedance of **L7** to the control grid of **V2,** which operates as frequency changer. **L9** is mounted on a ferrite rod to form an internal aerial.

Triode section **a** of **V2** operates as a tuned grid oscillator, with oscillator grid coil **L10** tuned by **C25, C26** (M.W.), and in addition by **C27** and **C29** (L.W.). Tracking is achieved by **C28** and the adjustable inductance of **L10.**

Variable-mu R.F. pentode **V3** is employed as intermediate frequency amplifier with tuned transformer couplings **C33, L14, L15, C34;** and **C40, L19, L20, C41.**

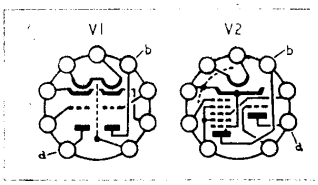
A.M. intermediate frequency 470kc/s.

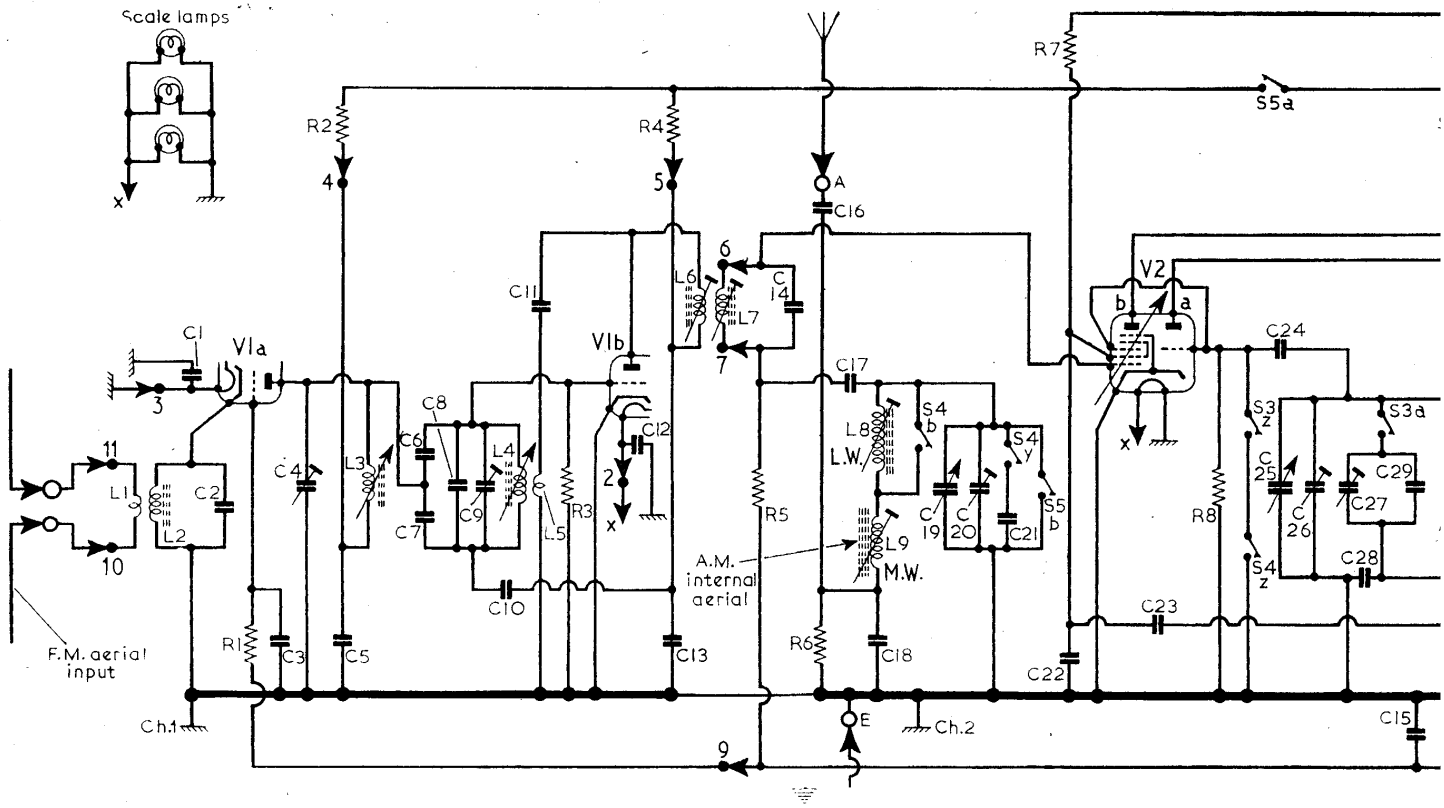
Diode A.M. detector is section **c** of triple-diode-triode valve **V4.** Audio frequency component in its rectified output is developed across load resistor **R16,** and is passed via R.F. filter **C42, R17,** switches **S5z, S2y,** volume control **R27** and A.F. coupling capacitor **C49** to the control grid of **V4d,** which operates as A.F. amplifier. Bias for **V4d** is obtained from the grid current flowing through **R28.** Provision is made for the connection of a gramophone pickup via **S2a** and **R25.**

The D.C. component of the rectified signal developed across **R16** is fed back via **R17** and decoupling circuit **R18, C15** to **V2b** and **V3,** giving automatic gain control. A.G.C. voltage is also fed via **R22** to the control electrode of tuning indicator **T.I.**

Resistance-capacitance coupling by **R29, C50** and **R30** between the anode of **V4d** and the control grid of pentode output valve **V5.** Tone correction by **C54** and by negative feedback from winding **c** on **T1,** via **R35, R36, R27** and **C49.**

Diagrams of the valve base connections as seen from the free ends of the pins.





Circuit diagram of the Ferguson 388A. To prevent oscillator radiation via the R.F. and aerial circuits, a bridge neutralizing circuit the input capacitance of **V1b;** *the R.F. output of* **V1a** *is connected to the point of zero oscillator potential at the junction of* **C6,** *on A.M.; on F.M., A.G.C. bias is derived from* **V3** *grid current flowing through the high resistance* **R18,** *which is connected to chassis circuit. The switch coding used is explained overleaf under "General Notes."*

Tone control by **C48, R26.** Provision is made for the connection of a low-impedance speaker across winding **c** on **T1.**

H.T. voltage is supplied by full-wave metal rectifier **MR1.** Smoothing by **C53, R34** and **C52.** Residual hum is neutralized by passing H.T. current through winding **a** on **T1.**

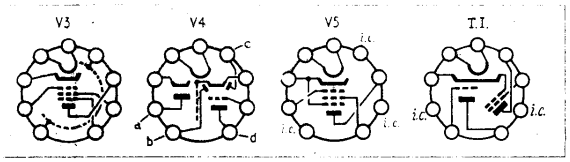
Operation on F.M.

75Ω balanced F.M. aerial input via coupling coils **L1, L2** to the earthed-grid **R.F. amplifier V1a.** Output of **V1a** is developed across permeability tuned circuit **L3, C4** and passed via **C6, C7** to **V1b.**

V1b operates as a self-oscillating mixer. Permeability tuned oscillator grid coil **L4** is tuned by **C6-C9.** Reaction coupling from oscillator anode via **C11, L5.** To prevent oscillator radiation via the R.F. and aerial circuits, a bridge neutralizing circuit is formed by **C6, C7, C10, C13** and the grid-cathode capacitance of **V1b,** and the output of **V1a** is connected to the point of minimum oscillator potential at the junction of **C6, C7.**

V2b and **V3** are employed as F.M.

(Continued overleaf col. 1)



COMPONENT VALUES AND LOCATIONS

Resistors

R1	680kΩ	J5
R2	10kΩ	H4
R3	680kΩ	J5
R4	15kΩ	H4
R5	1MΩ	H4
R6	3·3kΩ	D1
R7	47kΩ	G4
R8	47kΩ	H4
R9	27kΩ	H3
R10	1kΩ	G4
R11	3·3kΩ	G4
R12	47kΩ	F4
R13	33Ω	G4
R14	3·3kΩ	F4
R15	68Ω	F4
R16	330kΩ	F4
R17	220kΩ	F4
R18	2·2MΩ	H4
R19	330Ω	F4
R20	100kΩ	F4
R21	27kΩ	F4
R22	2·2MΩ	F4
R23	6·8MΩ	F4
R24	470kΩ	G3
R25	470kΩ	H4
R26	500kΩ	D2
R27	1MΩ	D2
R28	6·8MΩ	F4
R29	220kΩ	F4
R30	470kΩ	F4
R31	4·7kΩ	F4
R32	150Ω	B4
R33	680Ω	F3
R34	820Ω	B2
R35	3·9kΩ	A2
R36	82Ω	D2

Capacitors

C1	0·001μF	J6
C2	20pF	J5
C3	220pF	J5
C4	10pF	C2
C5	1,500pF	J6
C6	10pF	J5
C7	10pF	J6
C8	18·7pF†	J5
C9	10pF	D2
C10	10pF	J6
C11	25pF	J5
C12	0·001μF	J6
C13	85pF	J6
C14	33pF	H4
C15	0·1μF	G4
C16	500pF	D1
C17	220pF	H4
C18	0·003μF	D1
C19	528pF	G3
C20	40pF	C2
C21	165pF	H3
C22	0·005μF	H4
C23	0·005μF	G4
C24	220pF	G4
C25	528pF	G3
C26	40pF	B2
C27	40pF	C2
C28	390pF	G3
C29	375pF	C2
C30	220pF	G4
C31	0·005μF	G4
C32	15pF	C1
C33	220pF	C1
C34	220pF	C1
C35	0·005μF	G4
C36	0·005μF	G4
C37	12pF	B1
C38	47pF	B1
C39	400pF	F4
C40	220pF	B1
C41	220pF	B1
C42	100pF	F4
C43	400pF	F4
C44	500pF	F4
C45	4μF	F3
C46	0·01μF	F4
C47	0·02μF	F4
C48	3,900pF	D2
C49	0·02μF	F4
C50	0·005μF	F4
C51	32μF	B2
C52	40μF	B2
C53	40μF	B2
C54	0·004μF	B2
C55	2,500pF	F4
C56	50μF	F4
C57	0·02μF	G4

Coils*

L1	—	I5
L2	—	J5
L3	—	J6
R4	—	J5
L5	—	J5
L6	—	J6
L7	—	J6
L8	15·0	D1
L9	—	—
L10	2·0	G4
L11	—	G4
L12	—	C1
L13	—	C1
L14	5·5	C1
L15	5·5	C1
L16	—	B1
L17	—	B1
L18	—	B1
L19	5·5	B1
L20	5·5	B1
L21	3·0	—

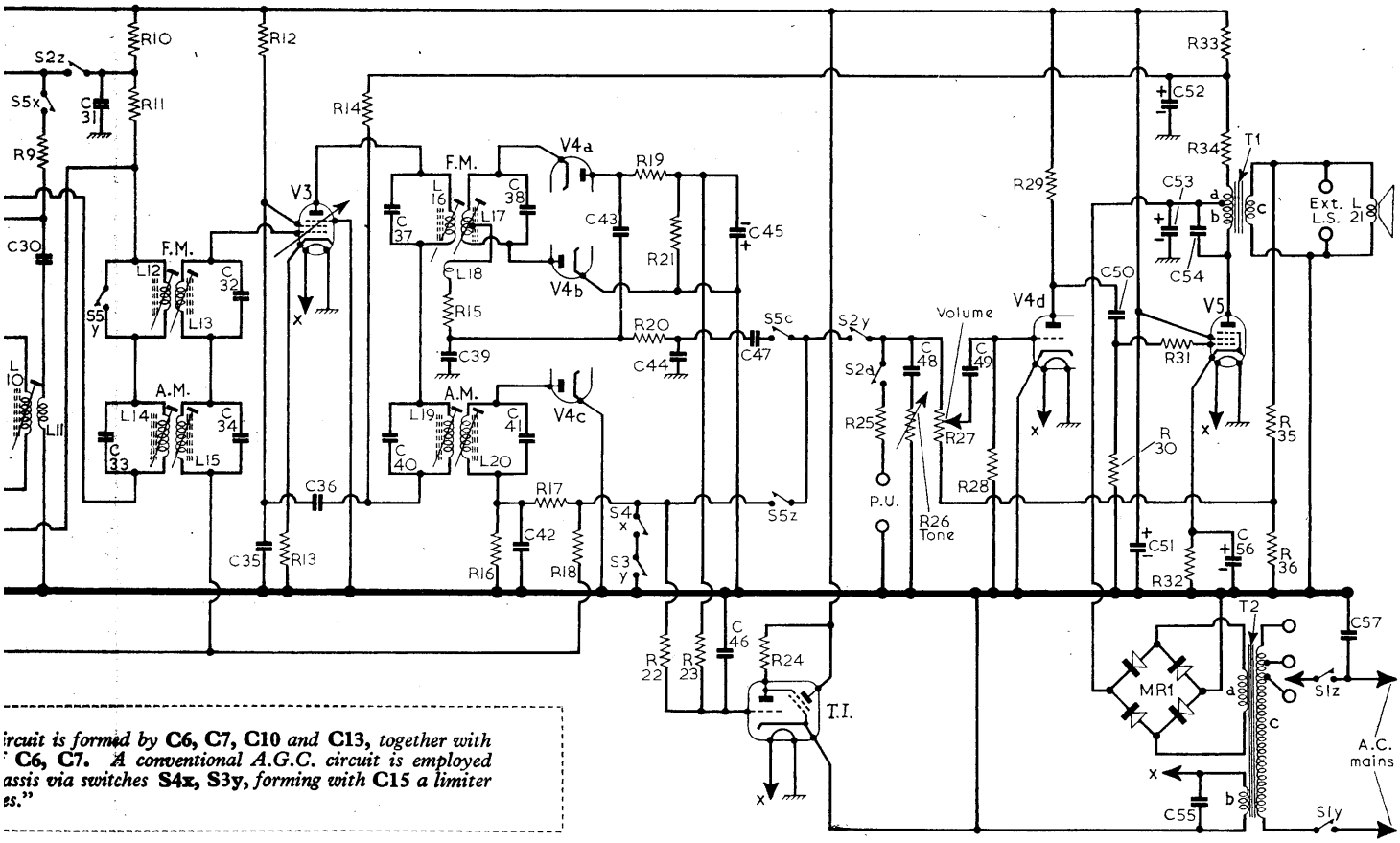
Miscellaneous*

T1	a	8·0	B2
	b	500·0	
	c	—	
T2	a	100·0	A1
	b	—	
	c	38·0	
MR1	B250 C75[1]		F3
S1-S5		—	H3

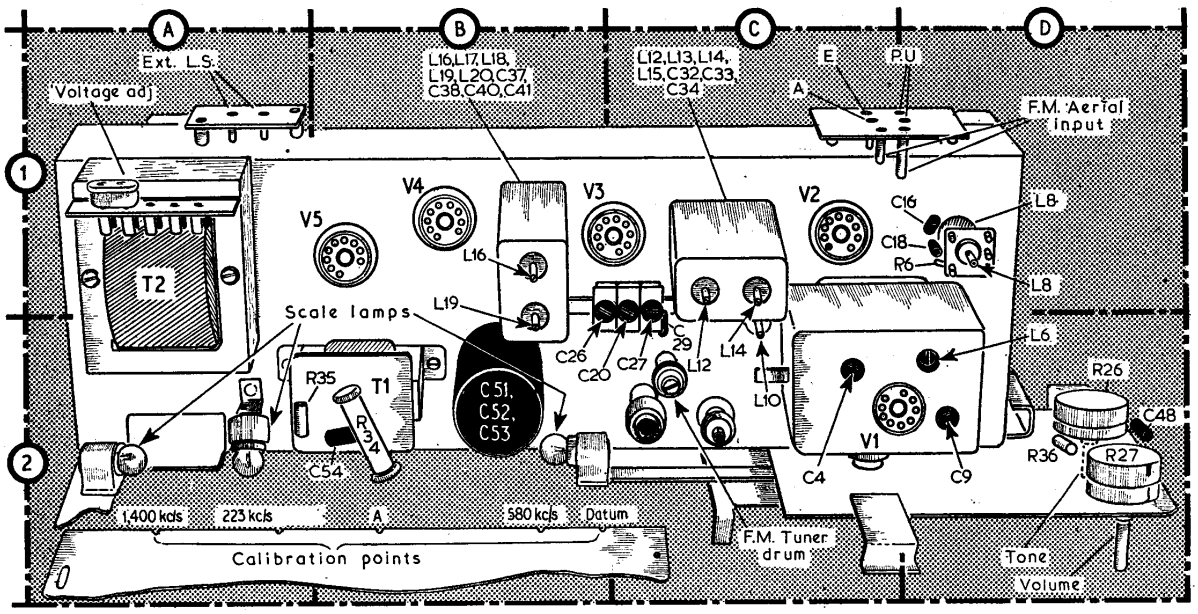
**Approximate D.C. resistance in ohms.*

†14pF and 4·7pF.

[1]Siemens.



ircuit is formed by **C6, C7, C10** *and* **C13,** *together with* **C6, C7.** *A conventional A.G.C. circuit is employed assis via switches* **S4x, S3y,** *forming with* **C15** *a limiter es."*



Plan view of the chassis, not including the tuning drive systems, which are shown at the foot of cols. 5, 6. The lower section of the tuning scale backing plate is shown removed from the chassis (location references A2, B2), in order to show the calibration points used in circuit alignment. Ferrite rod aerial coil **L9** *is fixed to the cabinet, above and to the right of the chassis.*

Circuit Description—*continued*

intermediate frequency amplifiers with transformer couplings **L6, L7; L12, L13** and discriminator transformer **L16, L17, L18.** Switch **S5x** is open circuit on F.M., muting A.M. oscillator valve **V2a.**

F.M. intermediate frequency 10.7Mc/s.

R18 is connected to chassis via **S4x, S3y,** and an increase in signal amplitude at **V3** control grid causes an increase in grid current, resulting in an increase in negative potential drop across **R18,** thus **V3** C.G. forms a limiting circuit, reducing the gain of **V1a** and **V2b.** The D.C. component of the rectified signal developed across **C45** is passed to the control electrode of tuning indicator **T.I.**

Diode sections **a** and **b** of **V4** are employed in a ratio-detector circuit. A.F. output is developed across capacitative load **C39,** and passed via de-emphasis circuit **R20, C44,** A.F. coupling capacitor **C47** and switches **S5c, S2y,** to volume control **R27.** From **R27** the audio signal route is the same as described for A.M. operation.

CIRCUIT ALIGNMENT

Equipment Required.—An accurately calibrated A.M./F.M. signal generator, modulated 30 per cent at 400 c/s for A.M., and deviated by ±25 kc/s for F.M.; an output meter; a non-metallic trimming tool.

As the tuning scale remains fixed to the cabinet when the chassis is removed for alignment purposes, calibration points are marked on the scale backing plate by means of a series of notches on the lower edge of the scale backing plate itself. These calibration notches are identified in the plan view of the chassis (location references A2, B2). Check that with the gang at maximum capacitance the cursor coincides with the datum point on the scale backing plate.

Allow the receiver and signal generator to warm up for at least 10 minutes before commencing the F.M. alignment procedure.

A.M. Alignment

1.—Switch receiver to M.W., turn gang to minimum capacitance and volume control to maximum. Connect output meter across external speaker sockets. Connect signal generator output, via a 0.01μF capacitor in the live lead, between the control grid of **V2b** (pin 2) and chassis.

2.—Feed in a 470 kc/s modulated signal and adjust the cores of **L20** (F4), **L19** (B2), **L15** (G4) and **L14** (C1) for maximum output, progressively reducing the signal generator output as the circuits come into line.

3.—With the receiver switched to M.W., loosely couple the signal generator output, via a loop of wire, to the ferrite rod aerial.

4.—Tune receiver to the 1,400 kc/s calibration point. Feed in a 1,400 kc/s signal and adjust **C26** (B2) and **C20** (C2) for maximum output.

5.—Tune receiver to the 580 kc/s calibration point. Feed in a 580 kc/s signal and adjust **L10** (C2) and the adjusting ring on the ferrite rod aerial for maximum output.

6.—Repeat operations 4 and 5 until no further improvement in sensitivity and calibration can be obtained.

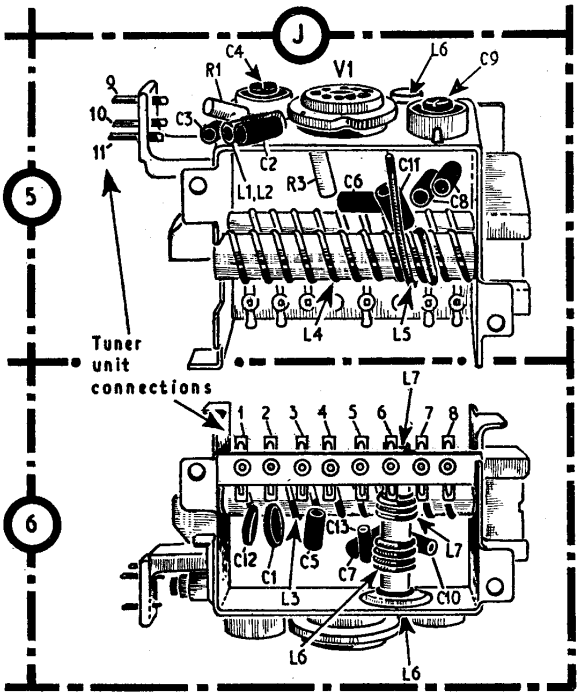
7.—Switch receiver to L.W. and tune it to the 223 kc/s calibration point. Feed in a 223 kc/s signal and adjust **C27** (C2) and **L8** (D1) for maximum output.

F.M. Alignment

1.—Switch receiver to F.M. Connect output of F.M. signal generator, via a 0.01μF capacitor in the live lead, between the control grid of **V3** (pin 2) and chassis. Throughout the following alignment procedure, adjust the output of signal generator to maintain a 100mW reading on the output meter.

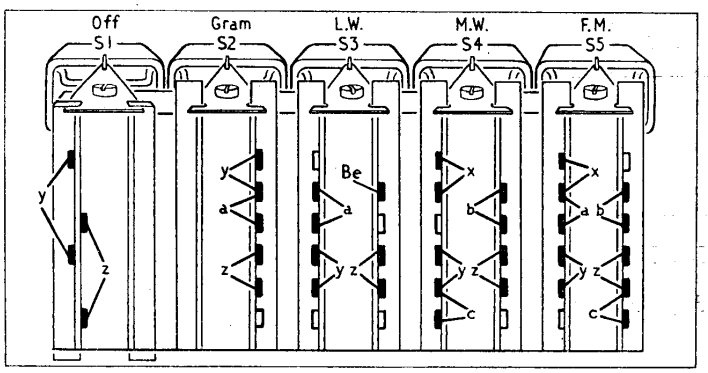
2.—Feed in a 10.7 Mc/s signal, deviated by ±25 kc/s, and adjust the cores of **L17** (F4) and **L16** (B1) for maximum output.

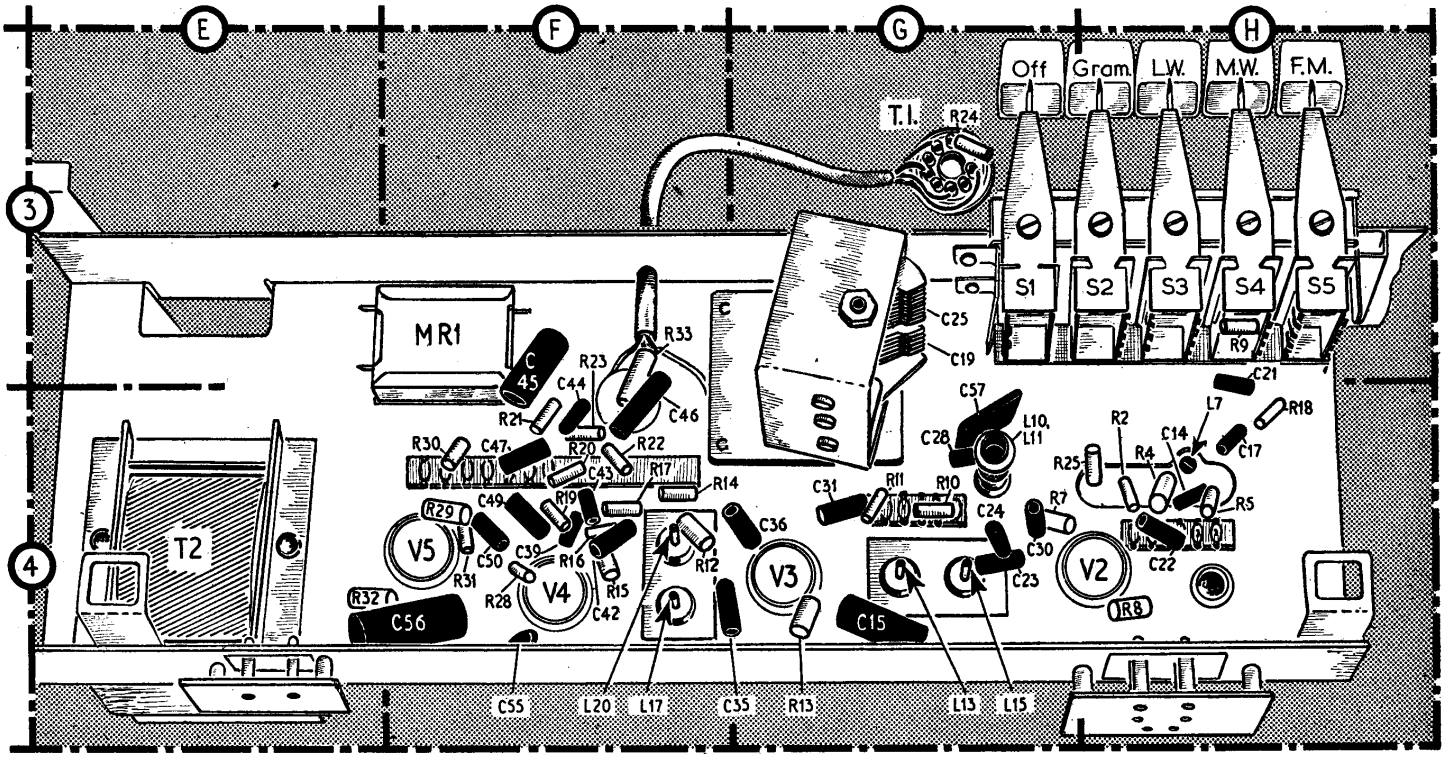
3.—Transfer signal generator output, via a 0.01μF capacitor in the live lead, to the



Left: *Two views of the F.M. tuner unit with the screening cover removed.*

Below: *Diagram of switches* **S1-S5.** *The coding and operation are described under "General Notes."*





Underside view of the chassis.

control grid of **V2b** (pin 2) and chassis. Feed in a 10.7 Mc/s signal, deviated by ±25 kc/s, and adjust the cores of **L13** (G4) and **L12** (C1) for maximum output. Transfer signal generator lead, via a 500pF capacitor in the live lead, to the junction of **R2** and **L3** (H4). Adjust **L7** (H4) and **L3** (D2) for maximum output.

4.—Transfer signal generator leads, discarding the 500pF capacitor, to the F.M. aerial sockets. Tune receiver to calibration point **A** (centre notch) on the scale backing plate, and holding the tuning drive in this position, slacken the securing screw on the F.M. tuning drive drum (C2), and then turn the drum fully anti-clockwise.

5.—Tighten F.M. tuning drum screw, making sure that the F.M. drive cord is still secured under the screw washer, and that the cord tension is still maintained.

6.—Turn the tuning control to its maximum clockwise position. Feed in a 91 Mc/s signal, deviated by 25 kc/s, and adjust **C9** (D2) for maximum output. No further adjustment of **C9** should be made.

7.—Slacken securing screw on the F.M. tuner drive drum and, without moving the drum, rotate tuning control until the cursor reaches the 223 kc/s calibration point on the scale backing plate.

8.—Feed in a 91 Mc/s signal, and, if necessary, readjust the F.M. tuning drum to receive the signal. Tighten drive drum securing screw. Finally, adjust **C4** (C2) for maximum output at 91 Mc/s.

GENERAL NOTES

Switches.—The mains "off" switches, gramophone and waveband switches are ganged in a five-way slide-type switch unit actuated by "piano-key" press-buttons designated **S1-S5.** Switches associated with each press-button bear a suffix letter to indicate its function when the appropriate button is pressed. When a given button is pressed, those with letters **a, b** and **c** close, and those with **x, y** and **z** open.

Individual switch groups are identified in the diagram of the unit shown in cols. 2 and 3.

A.M. Drive Cord.—About 86 inches of nylon-braided glass yarn is required for a new tuning drive cord. It should be run as indicated in the sketch (below) of the tuning drive systems, starting with the gang at maximum capacitance and securing one end of the cord in the lower notch in the gang drum.

F.M. Drive Cord.—Should a breakage occur in the F.M. drive cord, the manufacturers recommend that the complete drive cord assembly (Part Number Z17223) should be replaced.

To fit a new cord assembly, slacken off the screws securing the F.M. tuner unit to the main chassis and remove the end cover. The two small pulleys over which the cord runs are housed in a plastics moulding. When the pulleys are removed the tuning cores may be slipped out and the new assembly inserted. Ensure that the cores of the new assembly are inserted with their open and closed ends as indicated in the sketch below.

Tie a knot at the end of cord "A," and then anchor it in the lower slot of the F.M. drive drum. Then wind the cord on the F.M. drive drum as indicated in the sketch, finally securing the free end of cord "B" under the washer at the top of the drive drum. Re-align the F.M. unit as described in operations 4-8 under "F.M. Alignment."

Scale Lamps.—These are three 6.5 V, 0.3 A lamps with clear spherical bulbs and M.E.S. bases.

VALVE ANALYSIS

Valve voltages given in the table (col. 6) are those derived from the manufacturers' information. They were measured on a model 8 Avometer, chassis being the negative connection in every case. The receiver was operating from A.C. mains of 225 V, with the mains adjustment set at the 220-230 V tapping. There was no signal input.

Voltages measured across **C53** and **C52** were 275 V and 245 V respectively on A.M.

Valve		Anode (V)	Screen (V)	Cath. (V)
V1a ECC85	*	—	—	—
	†	140[1]	—	—
V1b ECC85	*	—	—	—
	†	150	—	—
V2a ECH81	*	90	—	—
	†	—	—	—
V2b ECH81	*	235	55	—
	†	190	75	—
V3 EF89	*	220	85	0·4
	†	215	80	0·38
V4d EABC80	*	75	—	—
	†	75	—	—
V5 EL84	*	255	240	6·5
	†	255	228	6·3
T.I. EM84	*	50	—	—
	†	50	—	—

**Measured with receiver switched to A.M.*
†Measured with receiver switched to F.M.
[1]Measured on 100V range with 2MΩ resistor in series with positive lead. Multiply scale reading by two.

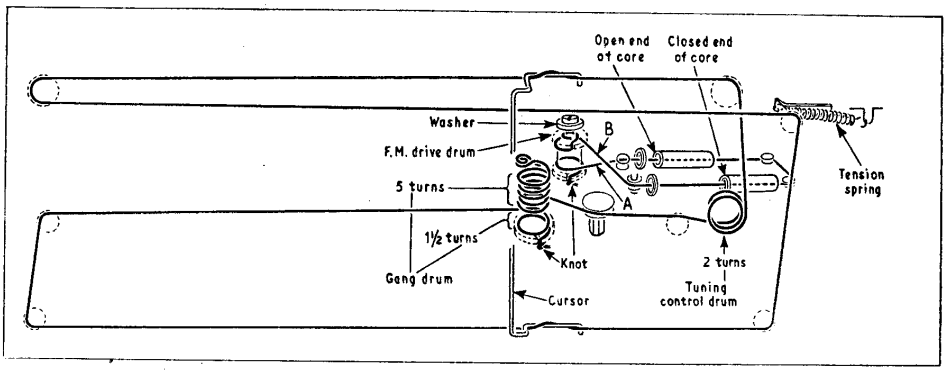


Diagram of the tuning drive systems, drawn as seen from the front of the chassis with the gang at maximum capacitance.

Printed in England by Cornwall Press Ltd., Paris Garden, London, S.E.1.