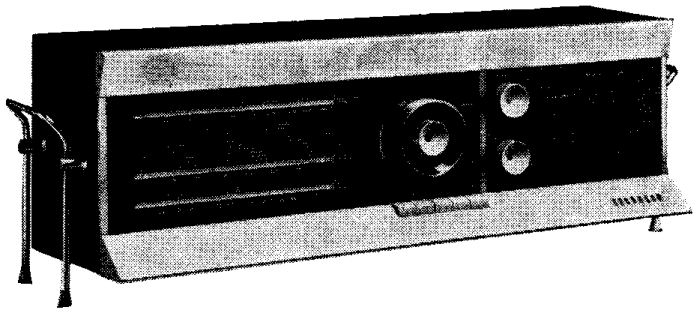
FERGUSON 'FUTURA' MODEL 388A

SERVICE MANUAL



SPECIFICATION

Description

Table model for AC mains operation, providing reception on MW, LW and VHF/FM bands. The 5-valve superheterodyne circuit incorporates a cathode ray tuning indicator and a contact cooled bridge type metal rectifier for HT supply. Internal aerials are included as well as sockets for external aerials, if required. Sockets are also provided for connecting an external loudspeaker and gramophone pick-up.

Mains Supply

AC mains 200-250V, 50-60 c/s.

Power consumption approximately 50 Watts.

Waveranges

Medium :	188—545 Metres.
Long :	1160—1940 Metres.
VHF :	88—101 Mc/s.

Valves

V1	ECC 85	VHF Amplifier and Mixer Oscillator.
V2	ECH 81	AM Frequency Changer and FM IF amplifier.
V3	EF 89	AM and FM IF Amplifier.
V4	EABC 80	AM and FM Detector and AF amplifier.
V5	EL 84	Audio output.
V6	EM 84	Tuning indicator.

Output Power

3 Watts.

Loudspeaker

Permanent magnet unit, 6½ in. diameter, 3Ω speech coil.

Sockets are provided for use with a 3-5Ω external loudspeaker.

Cabinet Dimensions

28 in. wide, 9½ in. high, 8¼ in. deep.

MECHANICAL DETAILS

Removal of Chassis

Disconnect the FM aerial and remove cabinet back. Withdraw all chassis retaining screws and free ferrite rod aerial. Remove the screws in the wood fillet securing the cabinet top rail and move the turnbuckles to complete the release of the rail. Pull off the three control knobs and slide out the tuning scale. Tilt the chassis forward slightly and remove from the back of the cabinet.

Drive Cord Replacement

Knot one end of the cord and secure it in the notch provided at the base of the drive drum. Wind the cord 5½ turns clockwise, round the gang spindle and continue as shown in the diagram (Fig. 1). When winding the final turns round the spindle make sure that the tension spring is exerting tension on the cord. To complete winding, tweezers may be used to loop the cord round the lug at the top of the drum and to thread the remaining cord into the slot. A little cellulose adhesive should be applied to the loops round the lug.

If a new tuner unit cord is required, fit service replacement Z17223 which comprises a length of cord with tuning slugs accurately fitted. The cores must be inserted in the tuner unit with the closed and open ends of the cores in their correct positions as indicated in the diagram. The diagram also shows the arrangement of the cord ends round the FM drive drum. When winding, ensure that the tension is sufficient to prevent tuning backlash.

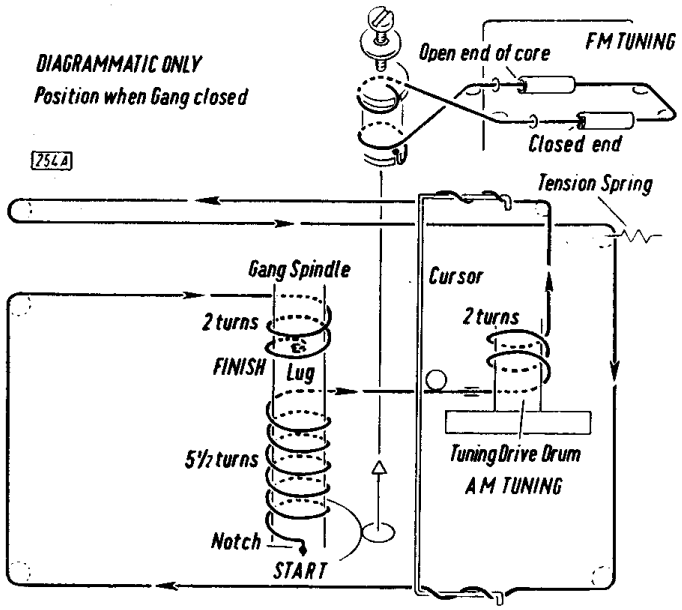


Fig. 1. Drive Cord. Use 4 ft. nylon braided cord.

VOLTAGE AND CURRENT MEASUREMENTS

Measurements were taken with a Model 8 Avometer on a number of receivers and the figures given are an average. The receivers were switched to MW with the gang fully open for the AM readings.

For an input of 225V AC the 220-230 tap was used, and the Avometer switched to 1,000V range wherever practicable.

GENERAL MEASUREMENTS

	AM	FM
Total HT Current	68mA	73mA
HT Voltage (Unsmoothed)	275V	275V
HT Voltage 1st section smoothing.....	255V	245V
HT Voltage 2nd section smoothing.....	240V	220V

VALVE MEASUREMENTS AM

		Anode Volts	Anode mA	Screen Volts	Screen mA	Cathode Volts
ECH 81	Heptode	230	1.5	55	4	—
	Triode	90	5.0	—	—	—
EF 89		220	9.0	60	4.2	0.4
EABC 80	Triode	70	0.8	—	—	—
EM 84		50	—	—	—	—
EL 84		255	40.0	240	4.5	6.5

VALVE MEASUREMENTS FM

		Anode Volts	Anode mA	Screen Volts	Screen mA	Cathode Volts
ECC 85	a	140	6	—	—	—
	b	150	4	—	—	—
ECH 81	(Hept.)	190	5	70	3.5	—
EF 89		215	8	80	3.0	0.38
EM 84		50	—	—	—	—
EL 84		255	37	228	4.0	6.3

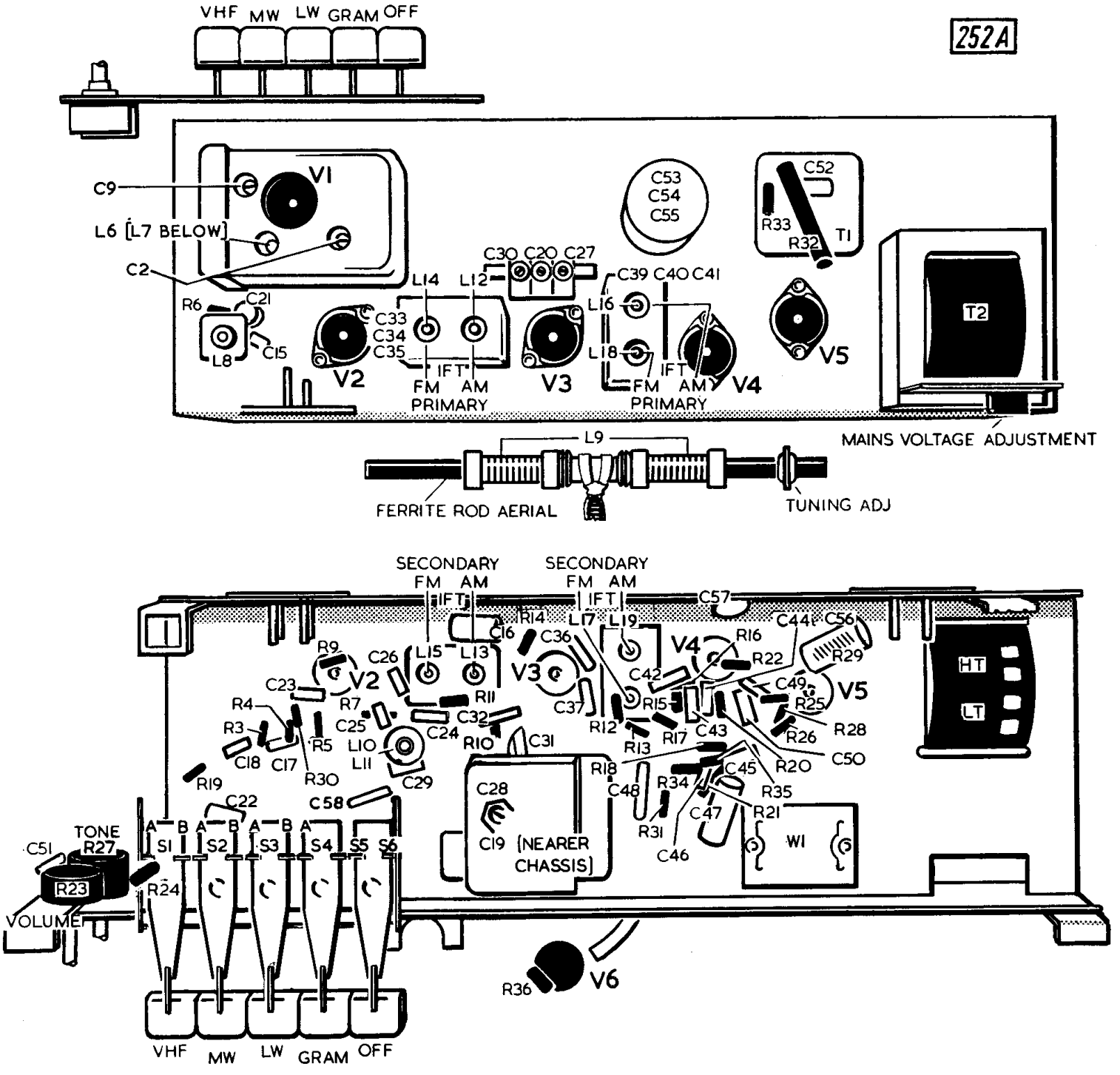


Fig. 2. Locations of trimmers, valves, etc., on chassis.

THE CIRCUIT

AM Reception

When switched to receive the Medium or Long waverange, HT is fed to the triode anode of the frequency changer **V2** by **S1B** (contacts 5 and 6) and the supply to the VHF tuner unit is disconnected (contacts 5 and 4).

On MW, **L8** is short circuited by **S2A** (contacts 4 and 5) and the ferrite-rod aerial **L9** is tuned by **C19** with trimmer **C20.** The signal is fed to the heptode control grid of **V2** via **C18** and **L7.**

On **LW** the inductance of the ferrite-rod aerial is supplemented by the loading coil **L8** and a fixed **LW** trimmer **C22** is switched in parallel with **C20** and the tuning capacitor **C19.**

When the external aerial is used the signal is developed across **C21** in the low potential end of the aerial tuned circuit. **R6,** in parallel with **C21,** prevents modulation hum by limiting the grid circuit impedance of **V2.** The AGC control voltage is applied through **R5.**

The triode section of **V2** functions as a tuned grid oscillator. **L10, L11** provide feedback coupling and on **MW L10** is tuned by **C28** (ganged with **C19**) and the **MW** oscillator trimmer **C27.** For LW reception, **C30** the **LW** trimmer and **C29** are connected in parallel with **L10** via **S3B** (contacts 4 and 5).

The first 470 Kc/s IF transformer **L14, C34** and **L15, C35** couples the signal to **V3** control grid. **V3** functions as the IF amplifier and the signal is coupled to the AM detector by the second IF transformer **L16, C38** and **L17, C39.** One of the diode sections of **V4** is used as a detector and **R17 C42** form the IF filter together with the capacitance of the screened lead to the volume control **R23.** The volume control is the diode load and is switched into circuit by **S1A** (contacts 3 and 2) and **S4A** (contacts 5 and 6). The audio signal developed across **R23** is coupled via **C50** to the grid of the triode section of **V4** the audio amplifier. The DC voltage developed across the diode load is fed through **R19** and decoupled by **C16** providing AGC bias to the grid circuits of **V2** and **V3** and the control voltage to the tuning indicator **V6.**

The triode section of **V4** is resistance capacitance coupled by **R25, C49** and **R26** to the output stage **V5.** The output transformer **T1** in the anode circuit has a hum neutralizing tapped primary. Negative feedback is taken from the secondary and injected across **R24** in the low potential end of the volume control circuit.

VHF/FM Reception

With the receiver switched to VHF/FM, the HT to **V2** triode section is broken by **S1B** (contacts 5 and 6) and the same switch (contacts 5 and 4) connects the supply to the VHF tuner unit.

The tuner unit utilises a double-triode valve **V1A** and **B. V1A** functions as an earthed-grid RF amplifier and the 75Ω aerial feeder is coupled into the cathode circuit by **L1, L2. L2** is broadly tuned by **C4** and the control grid is effectively earthed to RF by **C3. R1** is the grid leak and AGC feed resistor.

The anode load **L3** is capacitively tuned by trimmer **C2** and is tuneable over the band by means of an adjustable aluminium slug core.

V1B functions as a self-oscillating mixer with inductive coupling between anode and grid circuits provided by **L4, L5.** The grid winding **L4** is fitted with an aluminium slug core mechanically ganged with the core of **L3** to provide variable tuning. The tuning capacitance is made up by a pre-set capacitor **C9** plus **C8** and **C7,** which have compensating temperature co-efficients to reduce oscillator drift, and **C5, C6** in series. The junction of **C5, C6** provides a point of injection for the signal voltage developed across **L3.**

Additive mixing takes place and the resulting 10.7 Mc/s IF is developed across **L6** in **V1B** anode circuit. **L6** is tuned by **C12** which also serves as the anode coupling capacitor for the oscillator feedback coil.

A small proportion of the IF output is also developed across **C11** and provides IF feedback to **V1B** grid which increases the impedance of the oscillator circuits which shunt **L6.**

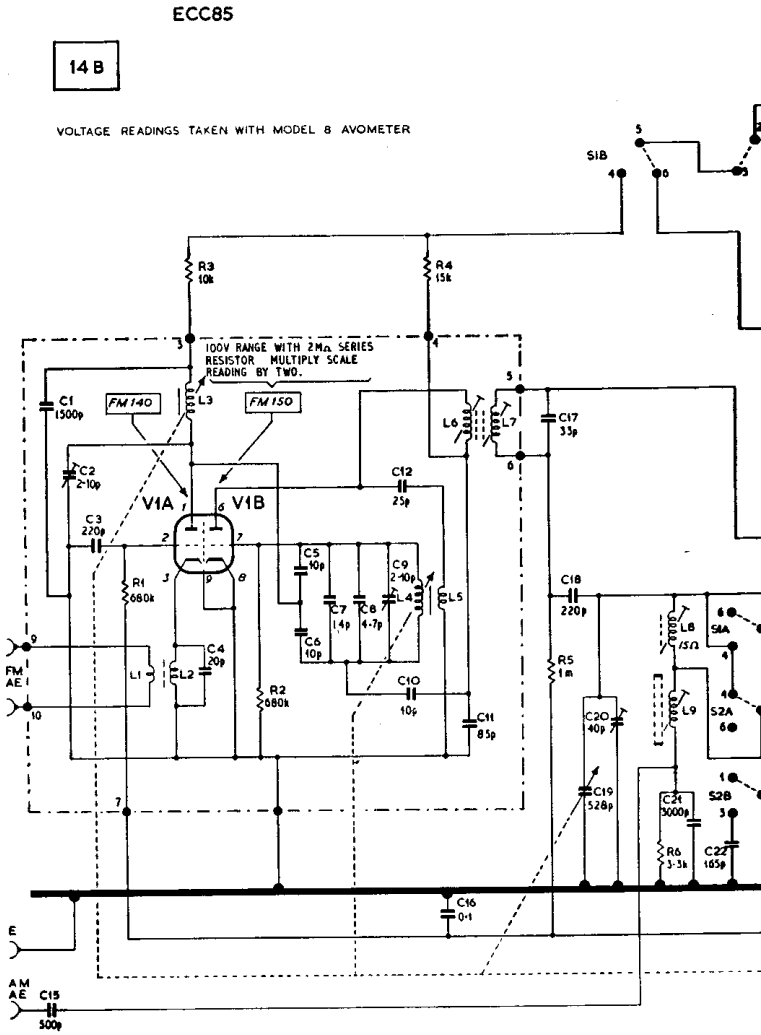


Fig. 3. Figures adjacent to the valve electrodes denote pin indicate voltages measured with a 20,000Ω/Voltmet shown against inductances where these are 1Ω or gre

L6 and **L7** tuned by **C17,** form the first 10.7 Mc/s IF transformer which couples the output of the tuner to the heptode control grid of **V2** operating as an IF amplifier. The second 10.7 Mc/s IF transformer **L12, L13,** is included in **V2** anode circuit and couples the signal to **V3** control grid which provides a further stage of IF amplification. The grid is returned to the AGC line via the secondary of the 470 Kc/s IF transformer. The AGC line is common to both AM and FM circuits, but with the receiver switched to VHF/FM, one side of **R19** is connected directly to chassis through **S2B** (contacts 5 and 6) and **S3B** (contacts 3 and 2). Therefore, the grid circuit of **V3** is returned to chassis through **R19** in parallel with **C16.** The charge developed on **C16** provides a negative bias which reduces the gain of the valve. This voltage is also applied to **V2** and **V1A** via the AGC line.

The signal developed in the anode circuit of **V3** is coupled to the ratio detector by a tuned transformer **L18, C40** and **L19, C41** with a tertiary winding **L20.** Two of the diode sections of **V4** are connected in a ratio-detector circuit with **C47** as the stabilising reservoir capacitor and **R21** the detector load. The control voltage for the tuning indicator **V6** is taken from **R21.**

C43 and **C44** are the IF filtering capacitors and **R18, C46** the FM de-emphasis network. **C45** couples the signal to the volume control and audio amplifier via **S1A** (contacts 1 and 2) and **S4A** (contacts 6 and 5).

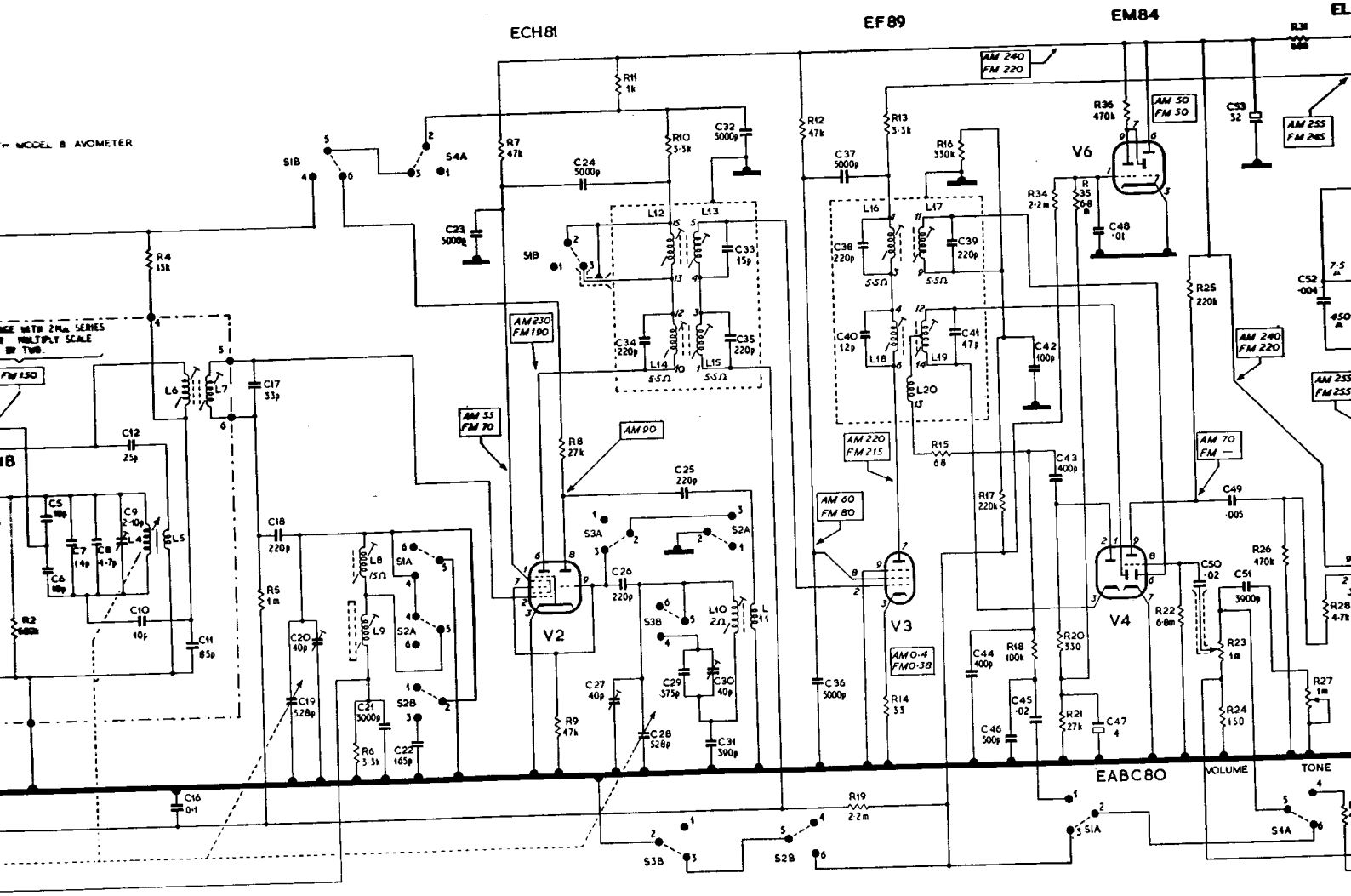


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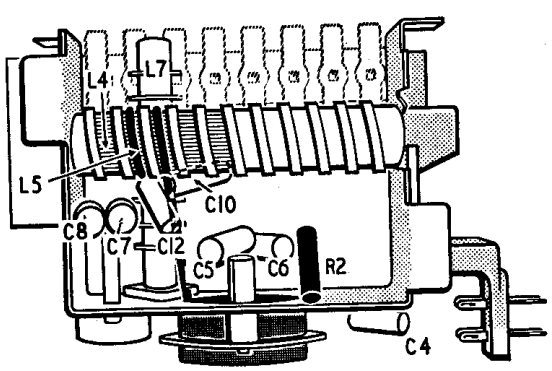
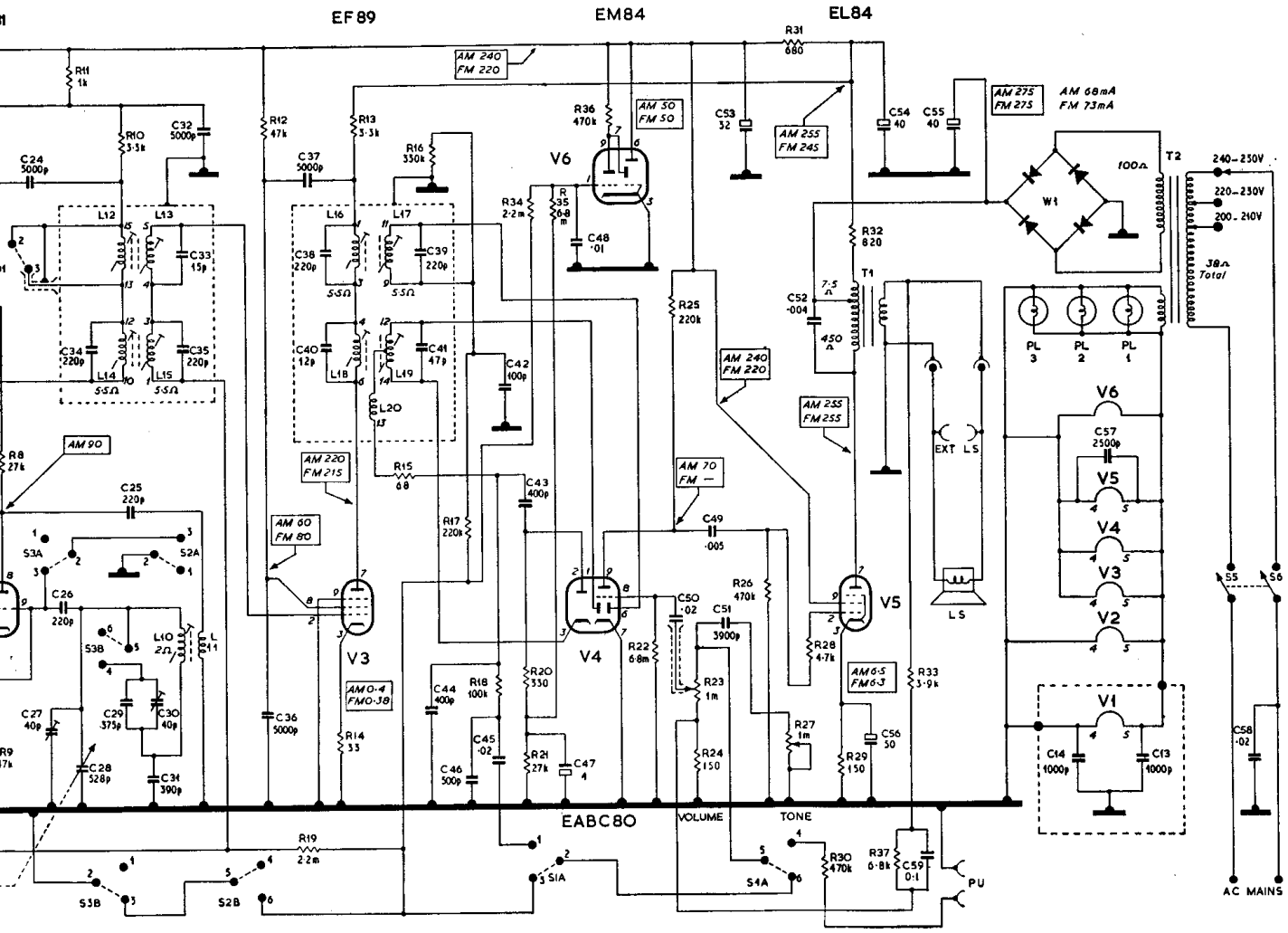
Fig. 4. VHF/FM tuner unit showing component locations.





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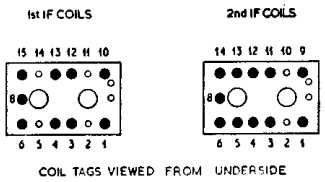

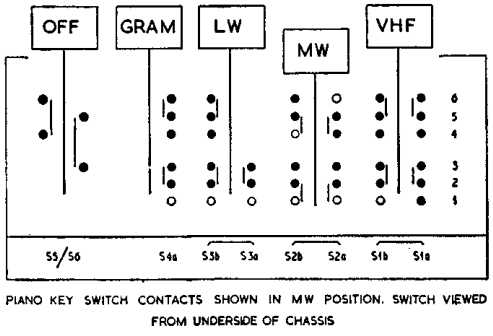

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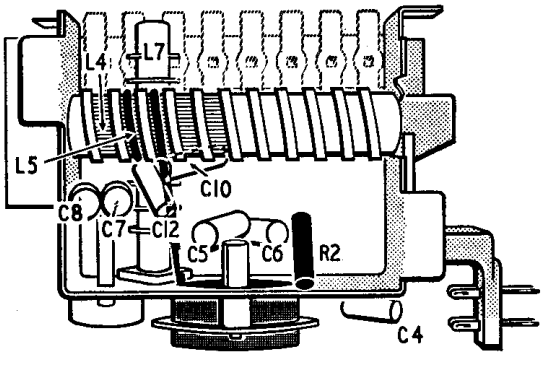

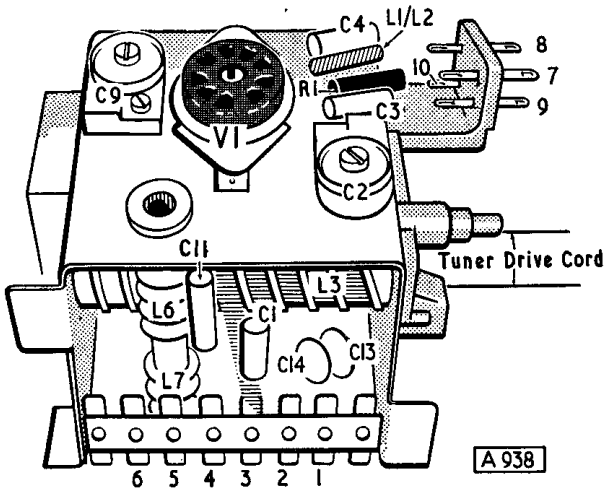

ALIGNMENT DATA

AM CIRCUITS

IF Alignment

Switch receiver to MW, turn gang to minimum capacitance position and volume control to maximum. Inject a 470 Kc/s modulated signal through a 0.1 uF capacitor at the grid of **V2** (pin 2).

Adjust **L17, L16, L15** and **L14** for maximum output, adjusting input signal level to maintain peak output at approximately 50 mW.

RF Alignment

MW must be aligned first. Signals to be injected via a loop, loosely coupled inductively to the ferrite-rod aerial. Input level to be adjusted to maintain output at 50 mW.

1. With gang at maximum capacitance, set cursor to marker **E** (see Fig. 5).
2. Switch to MW, inject 1400 Kc/s signal, set cursor to marker **A** and adjust **C27** and **C20** for maximum output.
3. Set cursor to marker **D**, inject 580 Kc/s signal and adjust **L10** and the adjusting ring on the ferrite-rod aerial for maximum output.
4. Repeat 2 and 3 until no further improvement results.
5. Switch to LW, inject 223 Kc/s signal, set cursor to marker **B** and adjust **C30** and **L8** until no further improvement results.

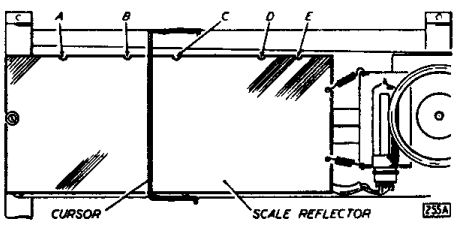

Fig. 5. Positions of alignment markers.

FM CIRCUITS

The various trimming adjustments associated with the VHF/FM band must not be disturbed unless suitable equipment is available to re-align the tuned circuits. Disturbance of the wiring or components in the VHF tuner may impair its performance. In the event of component replacement in this unit, care must be taken to restore the wiring to its original position and to ensure that the lead lengths of the replacement parts are the same as in that originally fitted.

The following alignment procedure is based on the use of an FM signal generator with IF and band II coverage and of 75Ω output impedance. Carrier deviation should be set at 25 Kc/s and throughout alignment, the signal input to the receiver should be adjusted to maintain an audio output of 100 mW. The stage by stage sequence given must be strictly observed.

IF Alignment

Allow the receiver to warm up for at least 10 minutes, switch to VHF/FM position and set volume control to maximum.

Adjustment	Signal Frequency	Point of Injection
L19, L18	10.7 Mc/s	**V3** control grid (pin 2 via 0.01 uF)

With signal generator output of 20 mV, adjust core of **L19**, followed by **L18**, for maximum audio output. This should be approximately 100 mW.

Adjustment	Signal Frequency	Point of Injection
L13, L12	10.7 Mc/s	**V2** control grid (pin 2 via 0.01 uF)

Adjust **L13** and **L12** for maximum audio output reducing input signal level as required so that the audio output does not exceed 100 mW.

Adjustment	Signal Frequency	Point of Injection
L7, L6	10.7 Mc/s	Junction **R3** and **L3** (Tag 3 VHF tuner via 500 pF)

Using non-metallic trimming tool, adjust **L7** and **L6** for maximum audio output reducing input level as necessary.

RF Alignment

1. Rotate control until cursor located at marker **C.**
2. With main drive held in this position, slacken VHF tuner drive bush fixing screw and rotate bush fully anti-clockwise. Check that free end of cord is under washer and that cord tension is maintained, then tighten fixing screws.
3. Rotate tuning control clockwise until cursor reaches marker **E** (end stop).
4. Inject 91 Mc/s signal into aerial and, using a non-metallic trimming tool, adjust **C9** for maximum audio output. **No further adjustment of C9 should be made.**
5. Slacken VHF tuner drive bush and rotate tuning control until cursor reaches marker **B.** Re-adjust VHF drive bush to bring in 91 Mc/s signal (during this operation, cord tension must be maintained) and tighten fixing screw.
6. Adjust **C2** for maximum audio output, reducing input signal level as required.

CAPACITORS

All 350 Volt working, 20% tolerance unless otherwise stated.

Ref.	Value	Rating		Function
C 1	1500pF			V1A HT decoupling.
C 2	2-10pF	Pre-set		L3 tuning.
C 3	220pF			V1A grid coupling.
C 4	20pF	5%		L2 tuning.
C 5, C 6	10pF	±½pF	P100	Oscillator/mixer signal injection.
C 7	14pF	10%	P100	Part L4 tuning and temp.
C 8	4.7pF	±½pF	N750	compensating.
C 9	2-10pF	Pre-set		Oscillator trimmer (FM).
C10	10pF			Oscillator balancing.
C11	85pF	2½%		Mixer IF feedback.
C12	25pF	5%		V1B anode coupling and L6 tuning.
C13	1000pF	—20+80%		V1 heater RF bypass.
C14	1000pF	—20+80%		
C15	500pF			AM aerial isolating.
C16	0.1uF			AGC decoupling.
C17	33pF	5%		L7 tuning.
C18	220pF			V2 signal coupling (AM).
C19	528pF	Variable		Aerial tuning.
C20	40pF	Pre-set		MW aerial trimmer.
C21	3000pF	5%		AM aerial coupling.
C22	165pF	5%		LW aerial trimmer.
C23	5000pF			V2 HT decoupling
C24	5000pF			and neutralizing.
C25	220pF			V2 osc. anode coupling.
C26	220pF			V2 osc. grid coupling.
C27	40pF	Pre-set		MW oscillator trimmer.
C28	528pF	Variable		Oscillator tuning (AM).
C29	375pF	2%		LW oscillator trimmers.
C30	40pF	Pre-set		
C31	390pF	2%		Oscillator padder (AM).
C32	5000pF			V1 and V2 HT decoupling.
C33	15pF	5%		L13 tuning.
C34	220pF	2%		L14 tuning.
C35	220pF	2%		L15 tuning.
C36	5000pF			V3 HT decoupling
C37	5000pF			and neutralizing.
C38	220pF	2%		L16 tuning.
C39	220pF	2%		L17 tuning.
C40	12pF	5%		L18 tuning.
C41	47pF	5%		L19 tuning.
C42	100pF		750V	IF bypass (AM).
C43	400pF	10%		IF filter (FM).
C44	400pF	10%		
C45	.02uF			Audio coupling (FM).
C46	500pF			FM de-emphasis.
C47	4uF	Elec.	100V	Ratio det. stabiliser.
C48	.01uF		150V	V6 grid decoupling.
C49	.005uF			V5 CG coupling.
C50	.02uF			V4 grid coupling.
C51	3900pF	10%		Part tone control.
C52	.004uF		350V AC	Tone correction.
C53	32uF	Elec.	275V	HT smoothing and reservoir.
C54	40uF	Elec.	275V	
C55	40uF	Elec.	275V	
C56	50uF	Elec.	25V	V5 cathode bypass.
C57	2500pF	—20+80%		V5 heater bypass.
C58	.02uF		350V AC	Mains RF bypass.
C59	0.1uF		150V	Neg. feedback tone correction.

MISCELLANEOUS

Ref.	Description	Part No.
S 1	VHF/FM	X17030/1
S 2	MW	
S 3	LW	
S 4	Gram	
S 5, S 6	Mains on off	
W 1	HT rectifier.	Z10508
PL1, PL2, PL3	6.5V 0.3A Pilot lamps.	33755
LS	Loudspeaker 6", 3Ω, P.M. type.	Y16002/16

FERGUSON RADIO CORPORATION LTD.

Great Cambridge Road, Enfield, Middx.

LONDON : Eley's Estate, Angel Road, N.18 - Edmonton 3060
BIRMINGHAM : 24 Sheepcote Street, 15 - Midland 5291
MANCHESTER : Derby Street, Cheetham 8 - Deansgate 8484
GLASGOW : 160/162 Battlefield Road, S.2 - Langside 9251/2/3/4

RESISTORS

All 20%, ¼ watt carbon unless otherwise stated.

Ref.	Value	Rating		Function
R 1	680KΩ			V1A grid leak.
R 2	680KΩ			V1B grid leak.
R 3	10KΩ	10%		V1A anode feed.
R 4	15KΩ	10%		V1B anode feed.
R 5	1MΩ			V2 hep. grid leak.
R 6	3.3KΩ			AM aerial shunt.
R 7	47KΩ	10%		V2 SG HT feed.
R 8	27KΩ	10%		V2 osc. anode load.
R 9	47KΩ	10%		V2 osc. grid leak.
R10	3.3KΩ			V2 hep. anode feed.
R11	1KΩ			V1 and V2 HT decoupling.
R12	47KΩ	10%		V3 SG HT feed.
R13	3.3KΩ			V3 anode HT feed.
R14	33Ω			V3 minimum bias.
R15	68Ω	10%		L20 series.
R16	330KΩ			AM detector load.
R17	220KΩ			IF filter (AM).
R18	100KΩ			FM de-emphasis and IF filter.
R19	2.2MΩ			AGC decoupling.
R20	330Ω			Ratio detector load.
R21	27KΩ	10%		
R22	6.8MΩ			V4 grid leak.
R23	1MΩ	Log. Pot.		Volume control.
R24	150Ω	10%		Neg. feed back injection.
R25	220KΩ			V4 triode anode load.
R26	470KΩ			V5 grid leak.
R27	1MΩ	Log. Pot.		Tone control.
R28	4.7KΩ	10%		V5 grid stopper.
R29	150Ω	10%	½W	V5 cathode bias.
R30	470KΩ			Pick-up series.
R31	680Ω	10%	½W	HT smoothing.
R32	820Ω	10%	1W	
R33	3.9KΩ	10%		Neg. feedback series.
R34	2.2MΩ			Tuning indicator feed (AM).
R35	6.8MΩ			Tuning indicator feed (FM).
R36	470KΩ			V6 anode load.
R37	6.8KΩ	10%		N.F.B. tone correction.

INDUCTORS AND TRANSFORMERS

Ref.	Function	Part No.
L 1, L 2	VHF Aerial Input Transformer.	Z10475
L 3	VHF Amplifier Tuning.	
L 4	VHF Oscillator Tuning.	
L 5	VHF Oscillator Feedback.	
L 6, L 7	1st FM IFT.	Y10474
L 8	LW Loading Coil.	Y10570
L 9	MW Ferrite-rod Aerial.	Y10567/1
L10	MW/LW Oscillator Tuning.	Y10489
L11	MW/LW Oscillator Feedback	
L12, L13	2nd FM IFT.	X25698
L14, L15	1st AM IFT.	
L16, L17	2nd AM IFT.	X17017
L18, L19, L20	Ratio Det. Transformer.	
T 1	Audio Output Transformer.	Z14586
T 2	Mains Transformer.	Y17020

SPARE PARTS LIST (MECHANICAL)

Part Description	Part No.
Cabinet	V25892
Cabinet Back	N24667
Control Knobs :—	
Tuning	Z25875
Volume and Tone	Y25874
Control Knob Clip	37309
Cursor	Y25688
Drive Drum (AM)	Z10483
Drive Drum (FM)	Z10491
Ferrite Aerial Mounting	Y10453
Handle (foot Z25871)	Y25867
Pilot Lamp Holder	Z13305/2
Scale	X25893