

# FERGUSON 501

## 3-BAND A.C. SUPERHET

**T**HE Ferguson 501 is a 4-valve (plus rectifier) A.C. superhet, suitable for mains of 200-250 V, 50-100 C/S. It employs three wavebands, the S.W. range being 16-50 m. There is provision for a pick-up and extension speaker. Short leads and clips are used for the aerial and earth connections in place of sockets.

**CIRCUIT DESCRIPTION**

Aerial input via series condenser **C1** and coupling condenser **C2** to coupling coil **L2** (S.W.) and bottom coupling condenser **C3** (M.W. and L.W.).

The choke **L1** across input circuit is claimed to prevent mains hum modulating the carrier and the resistance **R1** damps the rejector circuit, to prevent a resonance peak.

Single-tuned circuits **L3, C27** (S.W.), **L4, C27** (M.W.) and **L5, C27** (L.W.) precede first valve (**V1, Mullard metallised FC4**), an octode operating as frequency changer with electron coupling. Oscillator grid coils **L6** (S.W.), **L7** (M.W.) and **L8** (L.W.) are tuned by **C28**; parallel trimming by **C29** (S.W.), **C30** (M.W.) and **C7, C31** (L.W.); series tracking by **C32** (S.W.), **C33** (M.W.) and **C34** (L.W.). Anode reaction by coils **L9** (S.W.) and **L10** (M.W.); on L.W. anode is coupled back via resistance **R6** to low potential end of **L8**.

Second valve, a variable-mu R.F. pentode (**V2, Mullard metallised VP4B**), operates as intermediate frequency

amplifier with tuned-primary tuned-secondary transformer couplings **C35, L11, L12, C36** and **C37, L13, L14, C38**.

Intermediate frequency **465 KC/S**.

Diode second detector is part of double diode triode valve (**V3, Mullard metallised TDD4**), the two diodes being strapped together. Audio frequency component in rectified output is developed across load resistance **R13** and passed via A.F. coupling condenser **C12** and manual volume control **R11** to C.G. of triode section, which operates as A.F. amplifier. Bass compensation by condenser **C13**; variable tone control by R.C. filter **R12, C14**; fixed tone correction and I.F. filtering by **C15**. Provision for connection of gramophone pick-up via switch **S13** and **C12**, across **R11**.

The D.C. potential developed across **R13** is fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic volume control.

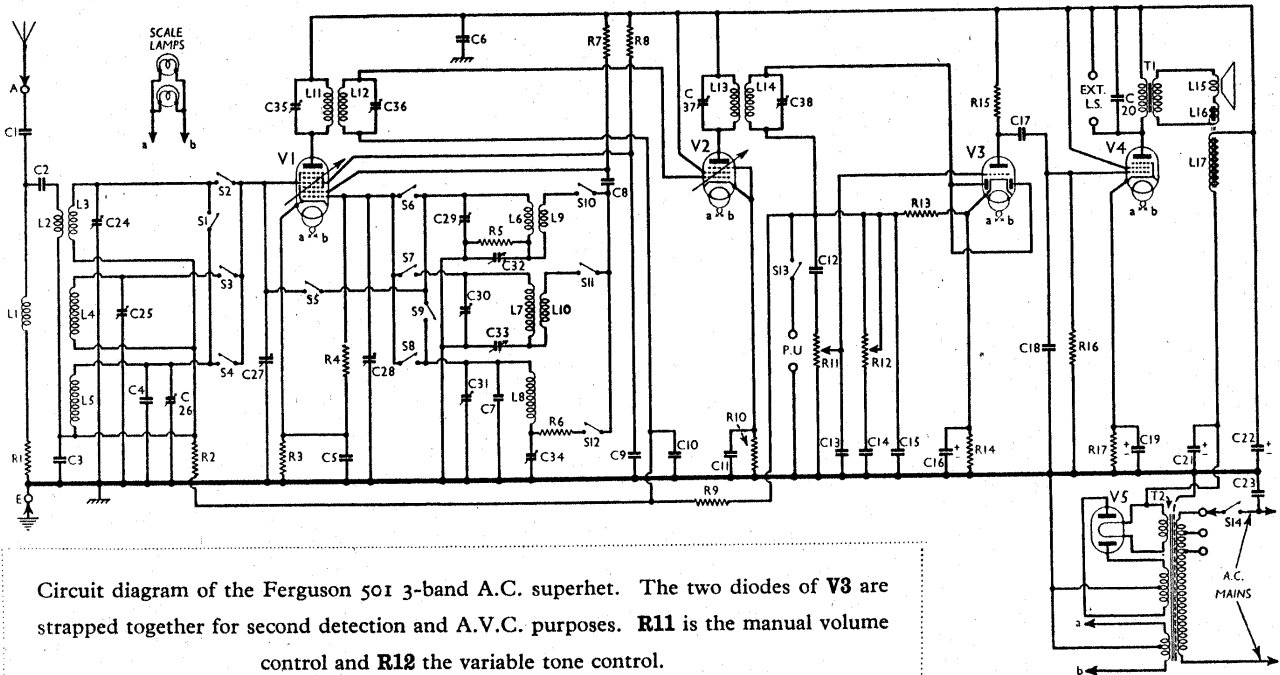
Resistance-capacity coupling by **R15, C17** and **R16** between **V3** triode and pentode output valve (**V4, Mullard Pen 4VA**). Fixed tone correction in anode circuit by condenser **C20**. Provision for connection of high impedance external speaker across primary of internal speaker input transformer **T1**.

H.T. current is supplied by full-wave rectifying valve (**V5, Mullard DW4/350**). Smoothing by speaker field **L17** and dry electrolytic condensers **C21, C22**. Mains R.F. filtering by condenser **C23**.

**COMPONENTS AND VALUES**

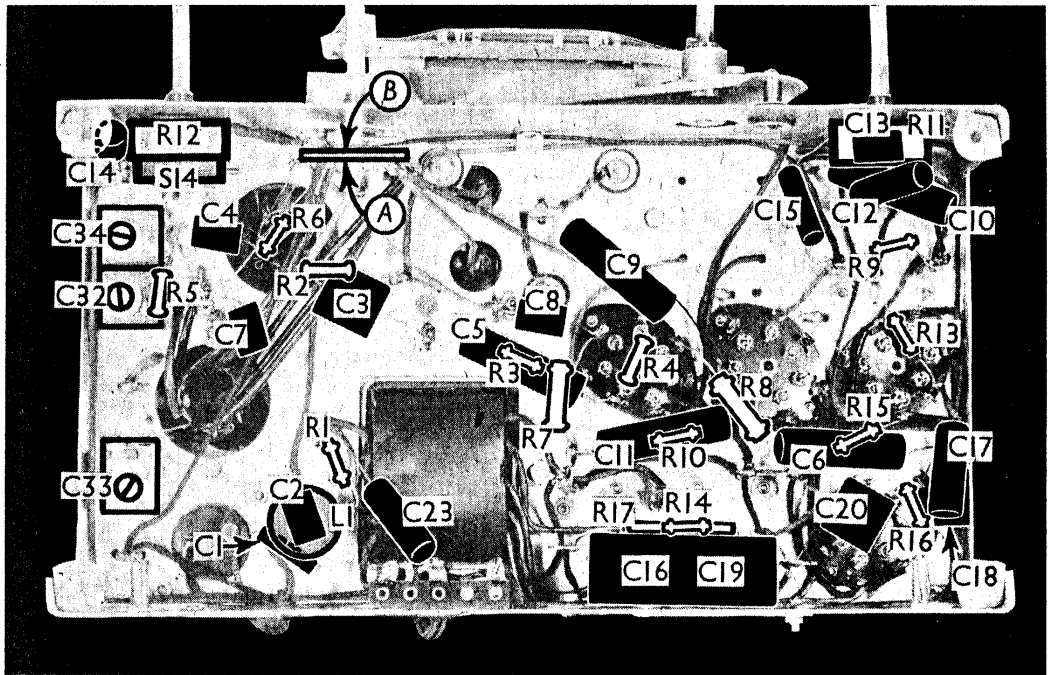
RESISTANCES		Values (ohms)
R1	A.F. rejector damping ..	2,500
R2	V1 pentode C.G. decoupling ..	500,000
R3	V1 fixed G.B. resistance ..	300
R4	V1 osc. C.G. resistance ..	25,000
R5	Osc. S.W. circuit stabiliser ..	500,000
R6	Osc. L.W. circuit stabiliser ..	2,500
R7	V1 osc. anode H.T. feed ..	50,000
R8	V1 S.G. H.T. feed ..	50,000
R9	A.V.C. line decoupling ..	500,000
R10	V2 fixed G.B. resistance ..	300
R11	Manual volume control ..	500,000
R12	Variable tone control ..	500,000
R13	V3 diodes load ..	500,000
R14	V3 G.B. resistance ..	10,000
R15	V3 triode anode load ..	500,000
R16	V4 C.G. resistance ..	500,000
R17	V4 G.B. resistance ..	600

CONDENSERS		Values (μF)
C1	Aerial series condenser ..	0.00025
C2	Aerial coupling condenser ..	0.00025
C3	M.W. and L.W. aerial coupling	0.002
C4	Aerial circuit L.W. fixed trimmer ..	0.000025
C5	V1 cathode by-pass ..	0.1



Circuit diagram of the Ferguson 501 3-band A.C. superhet. The two diodes of **V3** are strapped together for second detection and A.V.C. purposes. **R11** is the manual volume control and **R12** the variable tone control.

Under-chassis view. The two sides of the single switch unit are marked A and B, and diagrams looking in the directions of the arrows are on page VIII. The trackers C32, C33 and C34 are adjusted from the chassis deck. R17 is rather similar in appearance to a moulded condenser.



CONDENSERS (Continued)		Values ( $\mu$ F)
C6	H.T. circuit R.F. by-pass ..	0.1
C7	Osc. circuit L.W. fixed trimmer ..	0.00011
C8	V1 osc. anode coupling condenser ..	0.00025
C9	V1 S.G. decoupling condenser ..	0.1
C10	V2 C.G. decoupling condenser ..	0.1
C11	V2 cathode by-pass ..	0.1
C12	A.F. coupling to V3 triode ..	0.01
C13	Bass compensator ..	0.00025
C14	Part of tone control filter ..	0.01
C15	Fixed tone corrector and I.F. by-pass ..	0.002
C16*	V3 cathode by-pass ..	25.0
C17	V3 triode to V4 A.F. coupling ..	0.01
C18	I.F. by-pass ..	0.00025
C19*	V4 cathode by-pass ..	5.0
C20	V4 anode fixed tone corrector ..	0.002
C21*	H.T. smoothing ..	8.0
C22*		8.0
C23	Mains R.F. by-pass ..	0.01
C24‡	Aerial circuit S.W. trimmer ..	—
C25‡	Aerial circuit M.W. trimmer ..	—
C26‡	Aerial circuit L.W. trimmer ..	—
C27‡	Aerial circuit tuning ..	—
C28†	Oscillator circuit tuning ..	—
C29‡	Osc. circuit S.W. trimmer ..	—
C30‡	Osc. circuit M.W. trimmer ..	—
C31‡	Osc. circuit L.W. trimmer ..	—
C32‡	Osc. circuit S.W. tracker ..	—
C33‡	Osc. circuit M.W. tracker ..	—
C34‡	Osc. circuit L.W. tracker ..	—
C35‡	1st I.F. trans. pri. tuning ..	—
C36‡	1st I.F. trans. sec. tuning ..	—
C37‡	2nd I.F. trans. pri. tuning ..	—
C38‡	2nd I.F. trans. sec. tuning ..	—

\* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS		Approx. Values (ohms)	
L1	Aerial A.F. modulation rejector ..	19.0	
L2	Aerial S.W. coupling coil ..	Very low	
L3	Aerial S.W. tuning coil ..	Very low	
L4	Aerial M.W. tuning coil ..	3.0	
L5	Aerial L.W. tuning coil ..	16.5	
L6	Oscillator S.W. tuning coil ..	Very low	
L7	Oscillator M.W. tuning coil ..	2.0	
L8	Oscillator L.W. tuning and reaction coil ..	4.9	
L9	Oscillator S.W. reaction coil ..	0.1	
L10	Oscillator M.W. reaction coil ..	0.6	
L11	1st I.F. trans. { Pri. ..	9.5	
L12		{ Sec. ..	12.0
L13	2nd I.F. trans. { Pri. ..	12.0	
L14		{ Sec. ..	9.5
L15	Speaker speech coil ..	1.5	
L16	Hum neutralising coil ..	0.15	
L17	Speaker field coil ..	1800.0	
T1	Speaker input trans. { Pri. ..	650.0	
		{ Sec. ..	0.25
	Mains trans. { Pri. total ..	26.0	
		{ Heat. sec. total ..	Very low
		{ Rect. heat. sec. ..	0.75
	{ H.T. sec., total ..	380.0	
S1-S12	Waveband switches ..	—	
S13	Gram. pick-up switch ..	—	
S14	Mains switch, ganged R12 ..	—	

**DISMANTLING THE SET**

**Removing Chassis.**—If it is desired to remove the chassis from the cabinet, remove the four control knobs (pull off) and the felt washers behind them. Then remove the four round-head screws (with small spring washers and large flat washers) holding the chassis to the bottom of the cabinet. Chassis can now be withdrawn to the extent of the speaker leads, which should be just sufficient for normal purposes.

When replacing chassis, do not forget the felt washers between the control knobs and the cabinet.

To free chassis entirely, unsolder the three speaker leads from the speaker transformer terminal panel, and when replacing, connect them as follows, numbering the tags from top to bottom: 1, red/white; 2, blue; 3 and 4 connected together, red.

**Removing Speaker.**—To remove the speaker from the cabinet, remove the four square nuts (with spring washers) from the bolts holding speaker to the sub-baffle board. When replacing, see that the transformer is to the left.

**VALVE ANALYSIS**

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on A.C. mains of 227 V, using the 220-230 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. There was no signal input, the aerial and earth leads being connected together.

Voltages were measured on the 400 V scale of a Model 7 Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 FC4*	247	1.2	71	4.0
V2 VP4B ..	247	13.0	248	4.6
V3 TDD4 ..	51	0.35	—	—
V4 Pen4VA	227	28.5	248	2.6
V5 DW4/350	330†	—	—	—

\* Oscillator anode (G2) 78V, 3.7 mA.  
† Each anode, A.C.

**GENERAL NOTES**

**Switches.**—S1-S12 are the waveband switches and S13 the pick-up switch, all ganged in a double-sided rotary unit

Continued overleaf

**FERGUSON 501—Continued**

beneath the chassis. The two sides are marked with the letters A and B in circles in our under-chassis view, and are shown in detail in the diagrams on the right. Note that in many cases tags opposite each other on either side of the paxolin support are common.

The table below gives the switch positions for the four control settings, starting from fully anti-clockwise. A dash indicates open, and C closed.

Switch	S.W.	M.W.	L.W.	Gram.
S1	—	C	—	—
S2	C	—	—	—
S3	—	C	—	—
S4	—	—	C	—
S5	—	—	—	C
S6	C	—	—	—
S7	—	C	—	—
S8	—	—	C	—
S9	—	C	—	—
S10	C	—	—	—
S11	—	C	—	—
S12	—	—	C	—
S13	—	—	—	C

S14 is the Q.M.B. mains switch, ganged with the tone control, R12.

**Coils.**—L1 is unscreened, and is mounted beneath the chassis. L2-L5; L6-L10; L11, L12 and L13, L14 are in five screened units on the chassis deck, with their associated trimmers.

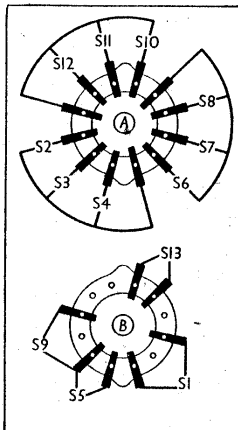
**Scale Lamps.**—These are two miniature bayonet cap types, rated at 4.5 V, 0.3 A.

**External Speaker.**—Two sockets are provided at the rear of the chassis for a high impedance (6,000 O) external speaker.

**Condensers C21, C22.**—These are two 8  $\mu$ F dry electrolytics in a single metal can on the chassis deck. The can is the

common negative connection, and the two tags projecting beneath the chassis deck are the two positives. One is coded with a blue dot, and this is the positive of C21. The plain tag is the positive of C22.

**Condensers C16, C19.**—These are two dry electrolytics in a single carton beneath the chassis, fixed to the rear member. The tag on the left (looking from the rear of the chassis) is the common negative, and the two on the right are the positives. The upper one is the



Views of the single switch unit from the two directions indicated by the arrows in the under-chassis view.

positive of C16 (25  $\mu$ F) and the lower the positive of C19 (5  $\mu$ F).

**Resistance R17.**—This is a moulded type, in shape not unlike a moulded condenser.

**Trimmers and Trackers.**—All the trimmers are housed inside the cans of the coil units with which they are associated. The three trackers, C32-C34, are adjusted by means of screws above the chassis

deck, on the right-hand side as seen in our plan chassis view.

**A-E Leads.**—These are short lengths of insulated wire, terminating in fahn-stock clips. The aerial wire has a green covering, and the earth, black.

**CIRCUIT ALIGNMENT**

The scale pointer should be vertical when the gang is fully meshed, marks being provided for accurate setting.

**I.F. Stages.**—Connect signal generator to grid (top cap) of V2 and earth lead, feed in a 405 KC/S signal and adjust C37 and C38 for maximum output. Transfer signal generator to grid (top cap) of V1, switch set to L.W., see that gang is fully meshed, and adjust C36 and C35 for maximum output. Keep input low.

If necessary, re-adjust C37 and C38.

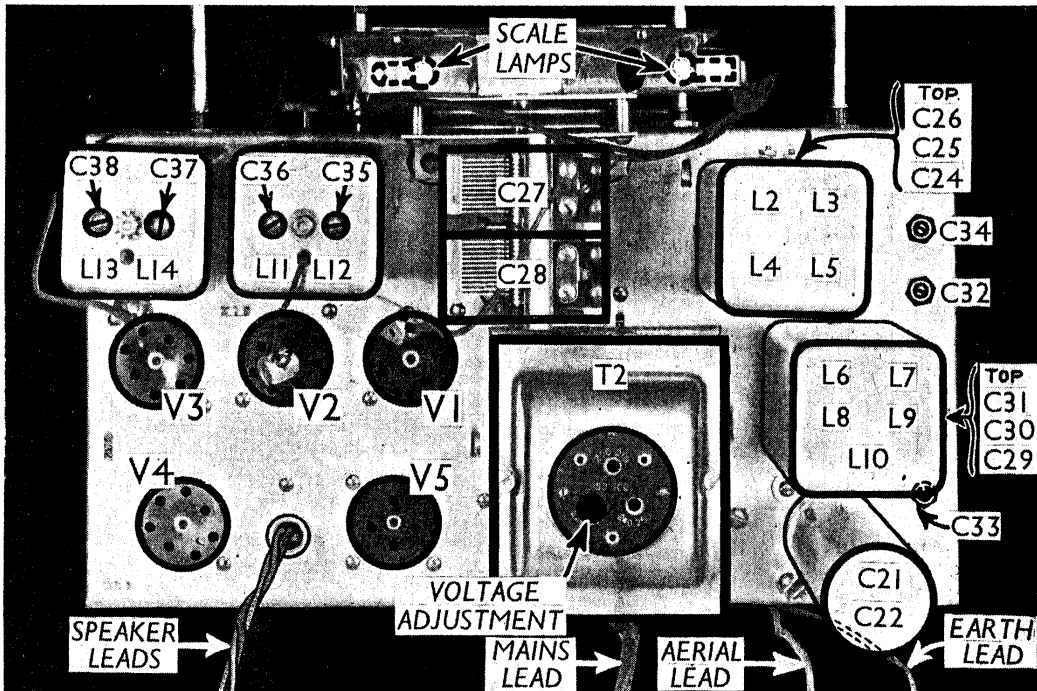
**R.F. and Oscillator Stages.**—First adjust trackers for maximum output at the top of each band, with the gang fully meshed. To do this, connect a high frequency buzzer via a 50  $\mu$ F condenser to the aerial lead of the set, and adjust C32 on the S.W. band, C33 on the M.W. band and C34 on the L.W. band for maximum output.

Switch set to S.W., connect signal generator to A and E leads and feed in a 21 m. signal. Tune to 21 m. on scale (about 235 m. on M.W. calibrated scale). Adjust C29 and C24 for maximum output. Fully mesh the gang again and re-track C32 as above. Return to 21 m., and re-adjust C29 and C24. Re-track C32 again.

On the M.W. band, repeat above procedure, trimming C30 and C25 at 250 m. and tracking C33 at the top of the scale.

On L.W., trim C31 and C26 at 1,200 m., and track C34 at top of scale.

On the S.W. band, if C29 peaks at two places, that with the least trimmer capacity is correct.



Plan view of the chassis. The trimmers for the R.F. and oscillator coil units are reached through holes in the sides of the cans. They are numbered from top to bottom. The trackers C32-C34 are adjusted by the screws on the right of the chassis deck.