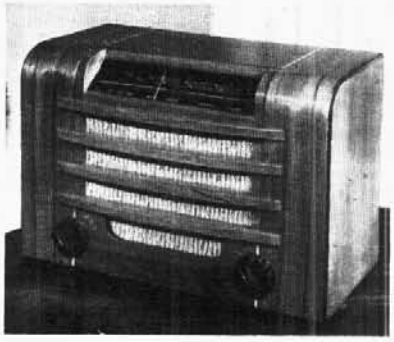
"TRADER" SERVICE SHEET

773

FERGUSON 450

S.W. and M.W. A.C. SUPERHET



A STURDY chassis of new design, with rails permitting it to be stood on any side, and quick removal facilities, are commendable servicing features in the Ferguson 450, a four-valve (plus rectifier) two-band superhet designed for A.C. mains of 200-250 V. The two wavebands are S.W. (13.5—50m) and M.W.

Release date and original price: 1946; £14 14*s*, *plus purchase tax* £3 3*s* 3*d*.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1, L2** to single-tuned circuits **L3** (S.W.), with **L4** (M.W.), and **C23,** the bottom of the appropriate coil being connected via **S3** or **S4** to **C4.**

First valve **(V1, Mullard metallised ECH35)** is a triode-hexode operating as frequency changer with internal coupling. Oscillator anode coils **L7** (S.W.) and **L8** (M.W.) are tuned by **C27.** Parallel trimming by **C26** (S.W.) and **C25** (M.W.); series tracking by **C7,** via **S7** (S.W.) and **C24** (M.W.). On M.W., **L7** and **L8** are connected in series via **S8.** Reaction via **L5, L6.**

Second valve **(V2, Mullard metallised EF39)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C28, L9, L10, C29** and **C30, L11, L12, C31.**

Intermediate frequency 470 kc/s.

Diode second detector is part of double diode triode valve **(V3, Mullard metallised EBC33).** Audio frequency component in rectified output is developed across **R10** and passed via **C15** and manual volume control **R11** to C.G. of triode section. I.F. filtering by **C11, R9, C12** and **C16.**

Second diode of **V3,** fed from **V2** anode via **C14,** provides D.C. potentials which are developed across **R14, R15** and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic volume control. Delay voltage, together with G.B. for triode section, is obtained from drop along **R13** in cathode lead to chassis.

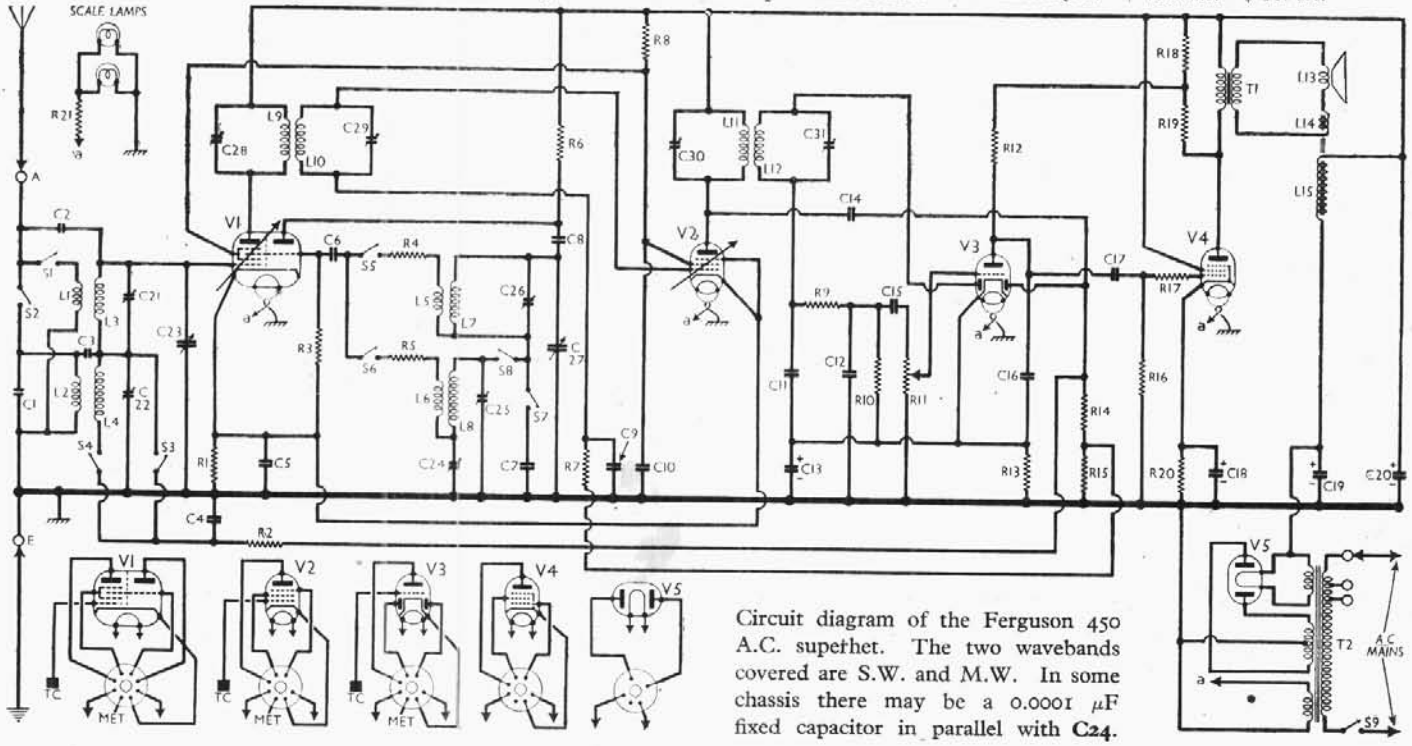
Resistance-capacitance coupling by **R12, C17** and **R16** between **V3** triode and pentode output valve **(V4, Mullard EL33).** Negative feed-back from potential divider **R18, R19** across **T1** primary to **V3** triode anode circuit, **R18** being common to both circuits.

H.T. current is supplied by full-wave rectifying valve **(V5, Mullard AZ31)** Smoothing by speaker field **L15** and dry electrolytic capacitors **C19, C20.**

COMPONENTS AND VALUES

	CAPACITORS	Values (μF)
C1	Aerial M.W. shunt ...	0·00002
C2	S.W. "top" coupling ...	0·000002
C3	M.W. "top" coupling ...	0·000005
C4	V1 hex. C.G. decoupling...	0·1
C5	V1 cathode by-pass ...	0·1
C6	V1 osc. C.G. capacitor ...	0·0001
C7	Osc. circ. S.W. tracker ...	0·005
C8	V1 osc. anode coupling ...	0·0001
C9	V2 C.G. decoupling ...	0·1
C10	V1, V2 S.G.'s decoupling ...	0·1
C11	I.F. by-pass capacitors ...	0·00015
C12	I.F. by-pass capacitors ...	0·0001
C13*	V3 cathode by-pass ...	25·0
C14	V3 A.V.C. diode coupling	0·0001
C15	A.F. coupling to V3 triode	0·02
C16	I.F. by-pass	0·0001
C17	A.F. coupling to V4 ...	0·02
C18*	V4 cathode by-pass ...	25·0
C19*	H.T. smoothing capacitors	16·0
C20*	H.T. smoothing capacitors	16·0
C21‡	Aerial S.W. trimmer ...	0·00003
C22‡	Aerial M.W. trimmer ...	0·00003
C23†	Aerial circuit tuning ...	—
C24‡	Osc. circ. M.W. tracker ...	0·00065
C25‡	Osc. circ. M.W. trimmer...	0·00003
C26‡	Osc. circ. S.W. trimmer...	0·00003
C27†	Oscillator circuit tuning...	—
C28‡	1st I.F. trans. pri. tuning	0·00018
C29‡	1st I.F. trans. sec. tuning	0·00018
C30‡	2nd I.F. trans. pri. tuning	0·00018
C31‡	2nd I.F. trans. sec. tuning	0·00018

* Electrolytic. † Variable. ‡ Pre-set.



Circuit diagram of the Ferguson 450 A.C. superhet. The two wavebands covered are S.W. and M.W. In some chassis there may be a 0.0001 μF fixed capacitor in parallel with **C24.**

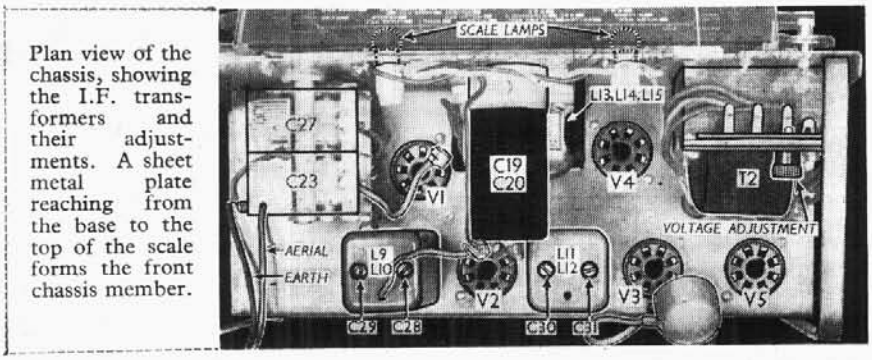
	RESISTORS	Values (ohms)
R1	V1, V2 fixed G.B. resistor	150
R2	V1 hex. C.G. decoupling	680,000
R3	V1 osc. C.G. resistor	56,000
R4	Osc. S.W. reaction damping	50
R5	Osc. M.W. reaction damping	2,700
R6	V1 osc. anode H.T. feed	22,000
R7	V2 C.G. decoupling	680,000
R8	V1, V2 S.G.'s H.T. feed	27,000
R9	I.F. stopper	56,000
R10	V3 signal diode load	680,000
R11	Manual volume control	2,000,000
R12	V3 triode anode load	56,000
R13	V3 G.B. resistor; A.V.C. delay	1,500
R14	V3 A.V.C. diode load resistors	680,000
R15	V3 A.V.C. diode load resistors	680,000
R16	V4 C.G. resistor	680,000
R17	V4 grid stopper	4,700
R18	Negative feed-back resistors	4,700
R19	Negative feed-back resistors	100,000
R20	V4 G.B. resistor	200
R21	Scale lamp ballast	2

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial S.W. coupling coil	1·4
L2	Aerial M.W. coupling coil	30·0
L3	Aerial S.W. tuning coil	Very low
L4	Aerial M.W. tuning coil	3·0
L5	Osc. S.W. reaction coil	0·15
L6	Osc. M.W. reaction coil	1·0
L7	Osc. S.W. tuning coil	Very low
L8	Osc. M.W. tuning coil	2·0
L9	1st I.F. trans. Pri.	8·5
L10	1st I.F. trans. Sec.	8·5
L11	2nd I.F. trans. Pri.	8·5
L12	2nd I.F. trans. Sec.	8·5
L13	Speaker speech coil	3·0
L14	Hum neutralising coil	0·1
L15	Speaker field coil	1,200·0
T1	Speaker input trans. Pri.	450·0
T1	Speaker input trans. Sec.	0·4
T2	Mains trans. Pri., total	31·0
T2	Mains trans. Heater sec.	0·2
T2	Mains trans. Rect. heat sec.	0·2
T2	Mains trans. H.T. sec., total	550·0
S1-S8	Waveband switches	—
S9	Mains switch, ganged R11	—

GENERAL NOTES

Switches.—S1-S8 are the waveband switches, ganged in a two-position rotary unit, indicated in our under-chassis view and shown in detail in the diagram in col. 2, where it is drawn as seen from the rear of an inverted chassis. All the odd-numbered switches **S1, S3, S5, S7** close on S.W. only, and all the even ones close on M.W. only.

S9 is the Q.M.B. mains switch, ganged with the volume control **R11.**



Plan view of the chassis, showing the I.F. transformers and their adjustments. A sheet metal plate reaching from the base to the top of the scale forms the front chassis member.

Scale Lamps.—These are two Osram M.E.S. types, with small spherical bulbs, rated at 6.5 V, 0.3 A. **R21** is in series with them.

External Speaker.—No provision is made for this, but one of low impedance (about 5 Ω) could be connected to the existing speech coil tags.

Capacitors C19, C20.—These are two 16 μF dry electrolytics in a single cardboard tubular container mounted horizontally through a hole in the vertical front chassis member. They are rated at 450 V D.C. working. The red and plain tags are the positive connections, and the black tag is the common negative connection.

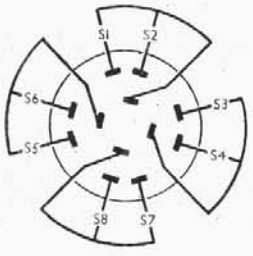
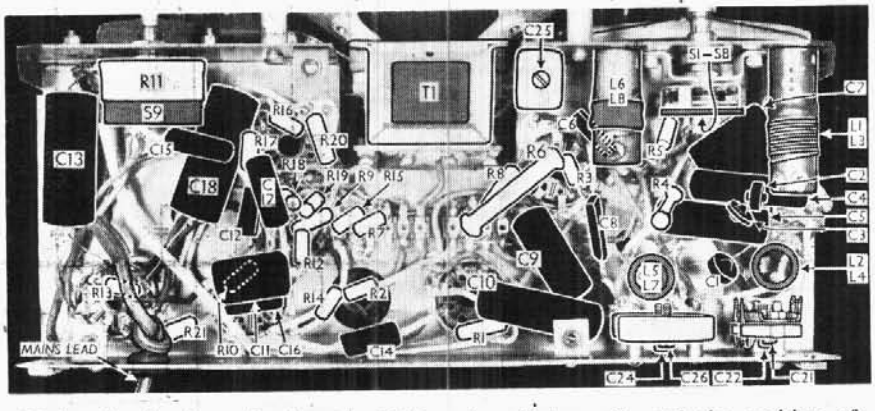


Diagram of the waveband switch unit, as seen from the rear of an inverted chassis.

Chassis Divergencies.—R21 was not shown on the makers' original diagram, but it should be present to reduce the strain on the scale lamps. A 0.0001 μF capacitor shown in the makers' diagram in parallel with **C24** was not present in our sample, but it is added in cases where the capacitance of **C24** is required to be increased beyond its maximum. In some cases, also, **R9** may be 50,000 Ω.



Under-chassis view, showing the R.F. and oscillator coils and the position of the waveband switch unit.

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set to M.W., and turn the gang and volume control to maximum. Connect signal generator to control grid (top cap) of **V1,** via a 0.1 μF capacitor, and chassis, removing normal cap connector and connecting a 500,000 Ω resistor between it and the valve cap. Feed in a 470 kc/s (638.3 m) signal, and adjust **C28, C29, C30** and **C31** for maximum output. Replace top cap connector.

R.F. and Oscillator Stages.—With the gang at maximum, pointer should be in line with the scale end markers. Transfer signal generator leads to **A** and **E** leads via a suitable dummy aerial. This may be a 0.0002 μF capacitor for M.W., but it is very important that it should be a 400 Ω resistor for S.W.

M.W.—Switch set to M.W., tune to 214 m on scale, feed in a 214 m (1,400 kc/s) signal, and adjust **C25,** then **C22** for maximum output. Feed in a 500 m (600 kc/s) signal, tune it in, and adjust **C24** for maximum output, while rocking the gang. Recheck at 214 m.

S.W.—Switch set to S.W., tune to 20 Mc/s on scale, feed in a 20 Mc/s (15 m) signal, and adjust **C26** for maximum output, taking care to select the peak involving the lesser trimmer capacity if two are found. Then adjust **C21** for maximum output, while rocking the gang for optimum results. Check at 6 Mc/s (50 m).

DISMANTLING THE SET

Pull off the three control knobs, taking care not to lose the springs, and remove the three screws (with washers) holding chassis to bottom of cabinet.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those quoted by the makers, who give the unsmoothed H.T. voltage as 320 V, smoothed H.T. as 250 V, total H.T. current as 53 mA, and total mains current as 200 mA, A.C.

Readings were taken when the receiver was working at its longest wavelength on the M.W. band, with volume control at maximum and no signal input. Voltages were measured on the 480 V range of a Model 40 Avometer, chassis being the negative connection.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 ECH35	250	2·1	145	1.6
	Oscillator			
	140	4·1		
V2 EF39	250	3·8	140	2·2
V3 EBC33	120	2·5	—	—
V4 EL33	240	31·0	250	2·4
V5 AZ31	315†	—	—	—

† Each anode, A.C.

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