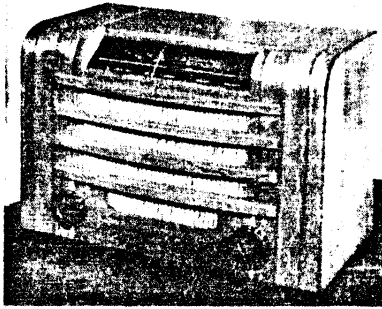


"TRADER" SERVICE SHEET

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 14s. plus purchase tax £3 3s 3d.

### 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 EGH35) 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

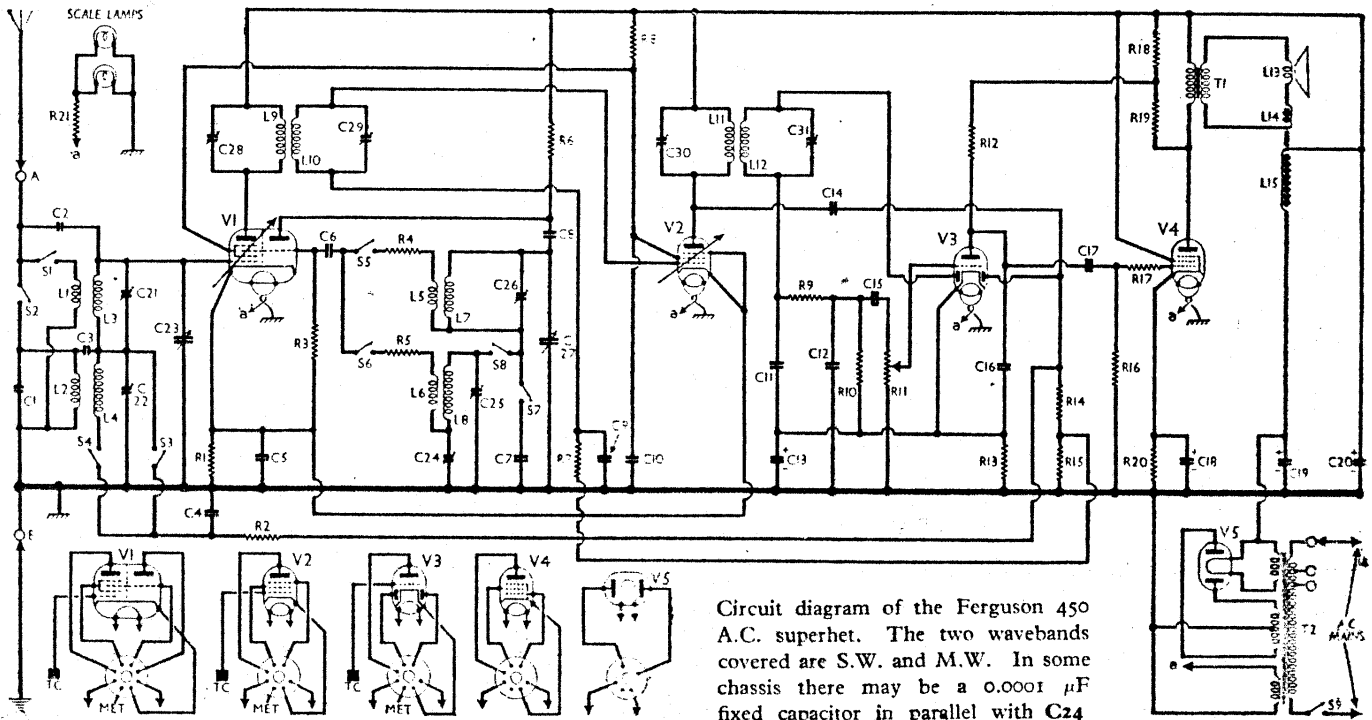
R18, R19 across T1 primary to V3 triode anode circuit, R18 being common to both circuits.

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 ( $\mu$ F) |
|------------|-----------------------------|-------------------|
| C1         | Aerial M.W. shunt           | 0.00002           |
| C2         | S.W. "top" coupling         | 0.00002           |
| C3         | M.W. "top" coupling         | 0.00005           |
| C4         | V1 hex. C.G. decoupling     | 0.1               |
| C5         | V1 cathode by-pass          | 0.1               |
| C6         | V1 osc. C.G. capacitor      | 0.001             |
| C7         | Osc. circ. S.W. tracker     | 0.005             |
| C8         | V1 osc. anode coupling      | 0.001             |
| 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        |                             | 0.0001            |
| C13*       | V3 cathode by-pass          | 25.0              |
| C14        | V3 A.V.C. diode coupling    | 0.001             |
| 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*       |                             | 16.0              |
| C21†       | Aerial S.W. trimmer         | 0.00003           |
| C22†       | Aerial M.W. trimmer         | 0.00002           |
| C23†       | Aerial circuit tuning       | —                 |
| C24†       | Osc. circ. M.W. tracker     | 0.00005           |
| C25†       | Osc. circ. M.W. trimmer     | 0.00002           |
| C26†       | Osc. circ. S.W. trimmer     | 0.00003           |
| C27†       | Oscillator circuit tuning   | —                 |
| C28†       | 1st I.F. trans. pri. tuning | 0.0001            |
| C29†       | 1st I.F. trans. sec. tuning | 0.0018            |
| C30†       | 2nd I.F. trans. pri. tuning | 0.0018            |
| C31†       | 2nd I.F. trans. sec. tuning | 0.0018            |

\* 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  $\mu$ F fixed capacitor in parallel with C24

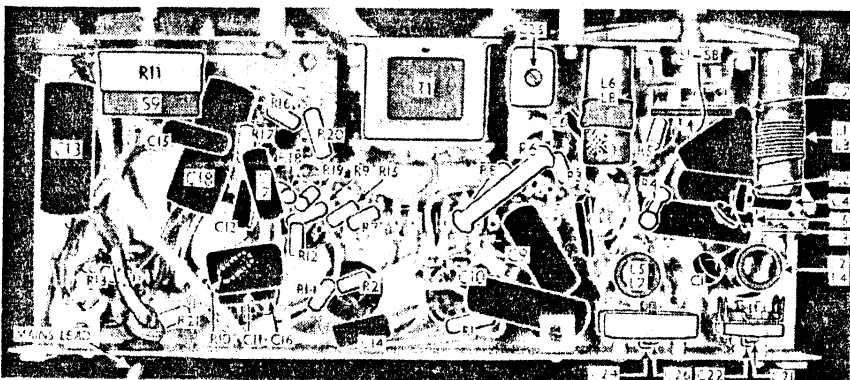
| RESISTORS |                                | Values (ohms) |
|-----------|--------------------------------|---------------|
| R1        | V1, V2 fixed G.B. resistor     | 150           |
| R2        | V1 hex. C.G. decoupling        | 680,000       |
| R3        | V1 osc. C.G. resistor          | 56,000        |
| 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       | V4 G.B. resistor               | 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 | 30.4                    |
| 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              |                           | Sec. ... 8.5            |
| L11              | 2nd I.F. trans.           | Pri. ... 8.5            |
| L12              |                           | 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          |
|                  |                           | Sec. ... 0.4            |
| T2               | Mains                     | Pri., total ... 31.0    |
|                  |                           | Heater sec. ... 0.2     |
|                  |                           | Rect. heat sec. ... 0.2 |
| S1-S8            | Waveband switches         | —                       |
| S9               | Mains switch, ganged R11  | —                       |

**GENERAL NOTES**

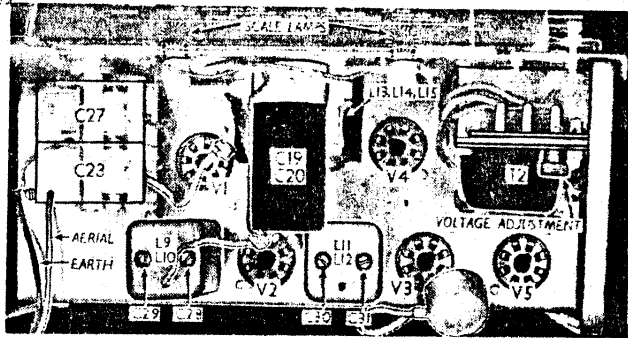
**Switches.**—S1-S8 are the waveband switches, ganged in a two-position rotary unit, indicated in our under-chassis view and shown in detail in the diagram in col. 2, where it is drawn as seen from the rear of an inverted chassis. All the odd-numbered switches S1, S3, S5, S7 close on S.W. only, and all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

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



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

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 horizon-

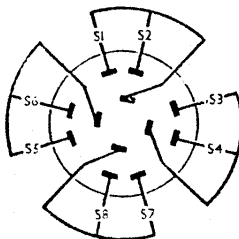


Diagram of the waveband switch unit, as seen from the rear of an inverted chassis.

tally 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.

**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.

**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 58 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 450 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        | —                  |                    |                     |
| V2 EF39  | 140               | 4.1                | 145                | 2.2                 |
| V3 EBC33 | 250               | 3.8                | —                  | —                   |
| V4 EL33  | 120               | 2.5                | —                  | —                   |
| V5 AZ31  | 240               | 31.0               | 250                | 2.4                 |
|          | 315†              | —                  | —                  | —                   |

† Each anode, A.C.