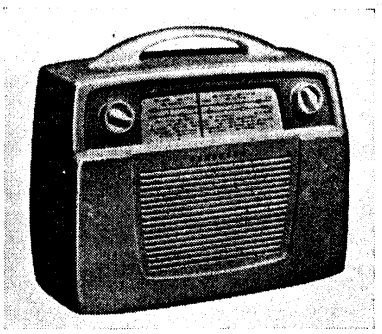
"TRADER" SERVICE SHEET

1076

# FERGUSON 351U



USING a chassis construction which takes the form virtually of a vertical plate, the Ferguson 351U affords convenient accessibility for service work. The receiver is a 3-valve (plus rectifier) 2-band superhet portable in which the I.F. amplifier is used as a reflex A.F. amplifier. It also uses its two diodes for detection and A.G.C. rectification.

It is designed to operate from A.C. or D.C. mains of 200-250 V, 40-100 c/s in the case of A.C. The waveband coverage is unusually wide, 185-575 m and 750-2,000 m. Provision is made for the connection of an external aerial and earth system.

*Release date and original price: October 1952; £12 2s 4d, plus purchase tax.*

## CIRCUIT DESCRIPTION

Tuned frame aerial input by **L1, C29** (M.W.) via **S1**; or **L1**, loading coil **L2, C29** (L.W.). Provision is made for the connection of an external aerial and earth via **C1** and **C2**. First valve **(V1, Mullard UCH42)** is a triode hexode operating as frequency changer with internal coupling.

Oscillator grid coils **L4** (M.W.) and **L3** (L.W.) are tuned by **C30**. Parallel trimming by **C31** (M.W.) and **C32** (L.W.); series tracking by **C10** (M.W.) and **C10, C33** (L.W.). Reaction coupling is across the common impedance of M.W. tracker **C10**, and is limited by shunt resistor **R5**.

Second valve **(V2, Mullard UBF80)** is a double diode R.F. pentode, its pentode section operating as I.F./A.F. reflex amplifier with tuned transformer couplings **C7, L5, L6, C8** and **C17, L7, L8, C18.**

**Intermediate frequency 470 kc/s.**

One diode of **V2** is used as signal detector, the A.F. component in its rectified output being developed across volume control **R12**, which operates as diode load, and passed via **C15** back to **V2** grid circuit. I.F. filtering by **R11, C19, C13** and **C20.**

The amplified A.F. signal in **V2** pentode output is developed across **R10** and passed via **C21** to control grid of pentode output valve **(V3, Mullard UL41)**. Tone correction by **C23.**

Second diode of **V2** is fed via **C16** from **V2** pentode anode and a proportion of the resulting potential, that developed across **R8** in diode load **R7, R8,** is fed back as bias to R.F. and I.F. stages, giving automatic gain control.

G.B. for **V3** is obtained from the potential drop across **R14, R15** in the negative H.T. lead to chassis. A proportion of this potential, that across **R14,** is used as G.B. for **V1** and **V2** pentode sections and as an A.G.C. delay.

H.T. current is supplied by I.H.C. half-wave rectifying valve **(V4, Mullard UY41).** Smoothing by **R18, R19,** and electrolytic capacitors **C24, C25, C26.** Valve heaters, together with ballast resistor **R21,** scale lamps with shunt **R23** and thermistor **R22 (Brimistor CZ2),** and mains R.F. filter chokes **L10, L11,** are connected in series across the mains input. **R20** protects **V4,** and **R23** the scale lamps, from current surges. In the event of scale lamp failure, thermistor **R22** carries the heater current and prevents **R23** from being overloaded.

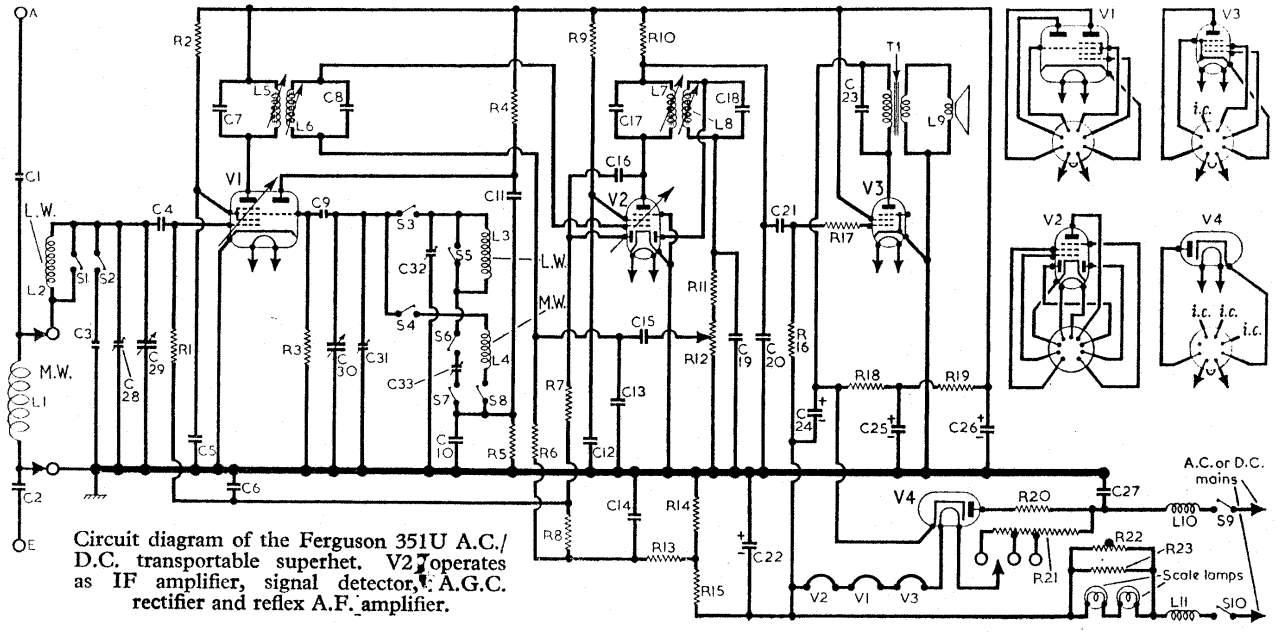
## COMPONENTS AND VALUES

| | RESISTORS | Values | Locations |
|---|---|---|---|
| R1 | V1 C.G. ... ... | 1MΩ | F3 |
| R2 | V1 S.G. feed ... | 33kΩ | D3 |
| R3 | V1 osc. C.G. ... | 47kΩ | F3 |
| R4 | Osc. anode feed ... | 22kΩ | F4 |
| R5 | Osc. reaction limiter | 3·9kΩ | F3 |
| R6 | V2 C.G. ... ... | 1MΩ | E3 |
| R7 | A.G.C. diode load | 330kΩ | D3 |
| R8 | | 680kΩ | D4 |
| R9 | V2 S.G. feed ... | 27kΩ | D3 |
| R10 | V2 A.F. load ... | 10kΩ | D3 |
| R11 | I.F. stopper ... | 100kΩ | D3 |
| R12 | Volume control ... | 500kΩ | C1 |
| R13 | A.G.C. delay decoup. | 150kΩ | D4 |
| R14 | G.B. resistors ... | 33Ω | D4 |
| R15 | | 150Ω | D4 |
| R16 | V3 C.G. ... ... | 470kΩ | D4 |
| R17 | V3 C.G. stopper ... | 100kΩ | D4 |
| R18 | H.T. smoothing ... | 470Ω | F4 |
| R19 | | 820Ω | F4 |
| R20 | V4 surge limiter ... | 140Ω | B2 |
| R21* | Heater ballast ... | 1·22kΩ | B2 |
| R22 | Brimistor CZ2 ... | — | C1 |
| R23 | Scale lamp shunt... | 1·2kΩ | C1 |

* Tapped at 820Ω + 200Ω + 200Ω from L10.

| | CAPACITORS | Values | Locations |
|---|---|---|---|
| C1 | Aerial coupling ... | 15pF | — |
| C2 | Earth isolator ... | 0·005μF | — |
| C3 | L.W. aerial trim. | 35pF | A1 |
| C4 | V1 C.G. ... ... | 200pF | A2 |
| C5 | V1 S.G. decoup. ... | 0·05μF | F3 |
| C6 | A.G.C. decoupling | 0·02μF | F3 |
| C7 | 1st I.F. trans. tuning | 100pF | B1 |
| C8 | | 100pF | B1 |
| C9 | V1 osc. C.G. ... | 50pF | F3 |
| C10 | M.W. osc. tracker | 600pF | F4 |
| C11 | Osc. anode coup. | 100pF | F3 |
| C12 | V2 S.G. decoup. | 0·1μF | E4 |
| C13 | I.F. by-pass ... | 500pF | E3 |
| C14 | G.B. decoupling ... | 0·05μF | D4 |
| C15 | A.F. coupling ... | 0·01μF | D3 |
| C16 | A.G.C. coupling ... | 100pF | D3 |
| C17 | 2nd I.F. trans. tuning | 100pF | C1 |
| C18 | | 180pF | C1 |
| C19 | I.F. by-passes ... | 200pF | D3 |
| C20 | | 0·001μF | D3 |
| C21 | A.F. coupling ... | 0·01μF | D4 |
| C22* | G.B. decoupling ... | 100μF | D4 |
| C23 | Tone corrector ... | 0·005μF | C2 |
| C24* | H.T. smoothing ... | 32μF | F4 |
| C25* | | 32μF | F4 |
| C26* | | 16μF | F4 |
| C27 | Mains R.F. by-pass | 0·01μF | B2 |
| C28‡ | M.W. aerial trim. | 40pF | A2 |
| C29† | Aerial tuning .. | §528pF | B2 |
| C30† | Oscillator tuning | §528pF | B1 |
| C31‡ | M.W. osc. trim. ... | 65pF | A1 |
| C32‡ | L.W. osc. trim. .. | 65pF | A2 |
| C33‡ | L.W. osc. tracker | 400pF | A1 |

* Electrolytic. † Variable. ‡ Pre-set. § "Swing" value, min. to max.




Circuit diagram of the Ferguson 351U A.C./D.C. transportable superhet. V2 operates as IF amplifier, signal detector, A.G.C. rectifier and reflex A.F. amplifier.

| | OTHER COMPONENTS | Approx. Values (ohms) | Locations |
|---|---|---|---|
| L1 | M.W. frame aerial | 1·5 | — |
| L2 | L.W. loading coil... | 15·0 | F3 |
| L3 | Oscillator tuning coils ... ... | 12·0 | A1 |
| L4 | | 2·7 | A1 |
| L5 | 1st I.F. trans. Pri. | 8·0 | B1 |
| L6 | 1st I.F. trans. Sec. | 8·0 | B1 |
| L7 | 2nd I.F. trans. Pri. | 8·0 | C1 |
| L8 | 2nd I.F. trans. Sec. | 6·0 | C1 |
| L9 | Speech coil ... | 2·6 | E4 |
| L10 | Mains R.F. filter coils ... ... | 3·5 | C2 |
| L11 | | 3·5 | C2 |
| T1 | O.P. trans. Pri. ... | 350·0 | C2 |
| | O.P. trans. Sec. ... | 0·4 | — |
| S1-S8 | Waveband switches | — | A1 |
| S9,S10 | Mains sw., g'd R12 | — | C1 |

## GENERAL NOTES

**Switches.**—**S1-S8** are the waveband switches, ganged in a single 2-position rotary unit on the rear of the chassis pressing. It is operated by a spindle that runs concentrically through the tuning control shaft, and in the anti-clockwise position of the control knob, the receiver is switched to M.W.

The position of the switch unit is indicated in our rear view of the chassis, but it is shown in detail in the diagram below. The table below it gives the switch positions for the two control settings, starting from the anti-clockwise position of the control knob. A dash indicates open, and **C**, closed.

**Scale Lamps.**—There are two scale lamps, with medium clear spherical bulbs and M.E.S. bases, rated at 8 V, 0.15 A. They project below the scale assembly, and are screened to prevent direct light from them falling upon it, the clear plastic scale carrying the light from the bulbs, which illuminate its edge.

**Tracker C33.**—This is a special type of capacitor, with a fixed and a variable section.

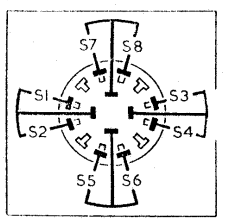
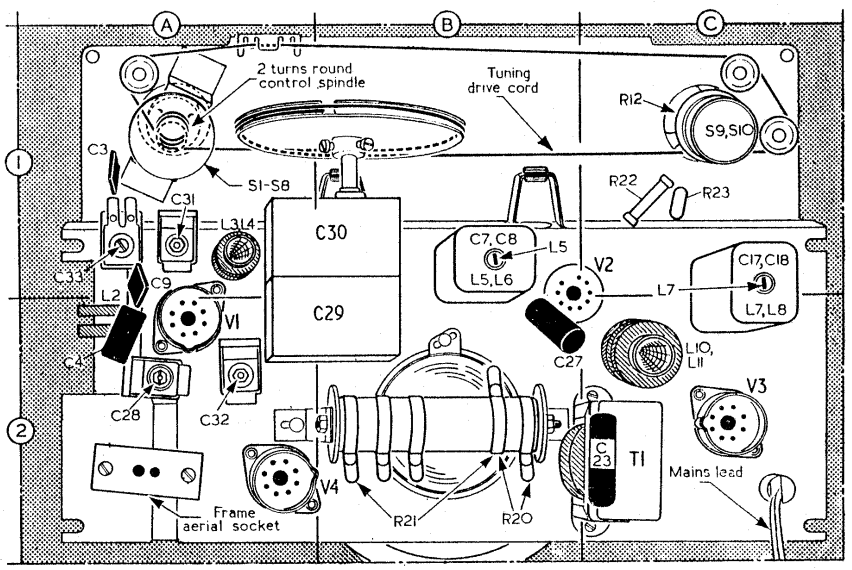



Diagram of the waveband switch unit, as seen in our rear chassis illustration. Below is the associated table.

| Switch | M.W. | L.W. |
|---|---|---|
| S1 | C | — |
| S2 | — | C |
| S3 | — | C |
| S4 | C | — |
| S5 | C | — |
| S6 | — | C |
| S7 | — | C |
| S8 | C | — |




Rear view of chassis, which stands vertically. The drive cord is indicated.

Its combined value is 250 pF minimum and 400 pF maximum.

**Modifications.**—Owing to hum that was experienced on some mains the circuit was altered to its present form as shown in our circuit diagram, but originally **C22** was 50 μF and **V3** screen grid was fed from the higher voltage point at the junction of **R18** and **R19.**

**Close-tolerance Components.**—The I.F. tuning capacitors **C7, C8, C17** and **C18** are rated at ±2% tolerance, as also are **C3** and **C10. R2, R9, R10** are rated at 10%, as also are **R8, R13, R14** and **R15.**

## CIRCUIT ALIGNMENT

**I.F. Stages.**—Unplug frame aerial lead and remove chassis from cabinet. Connect signal generator output, via an 0.1 μF capacitor in each lead, to junction of **C29** and **C4** and to chassis. Switch receiver to L.W. and turn volume control to maximum. Feed in a 470 kc/s (638.3 m) signal and adjust the cores of **L8** (location reference D3), **L7** (C1), **L6** (E3) and **L5** (B1) for maximum output, reducing the input as the circuits come into line to avoid A.G.C. action.

**R.F. and Oscillator Stages.**—The chassis should be replaced in its carrying case for the following adjustments and the frame aerial lead plugged in. When adjusting the M.W. aerial trimmer, the back cover must be in position. Connect the signal generator leads to a loop of wire placed parallel and fairly close to the back cover, or lay the generator leads close to the back cover.

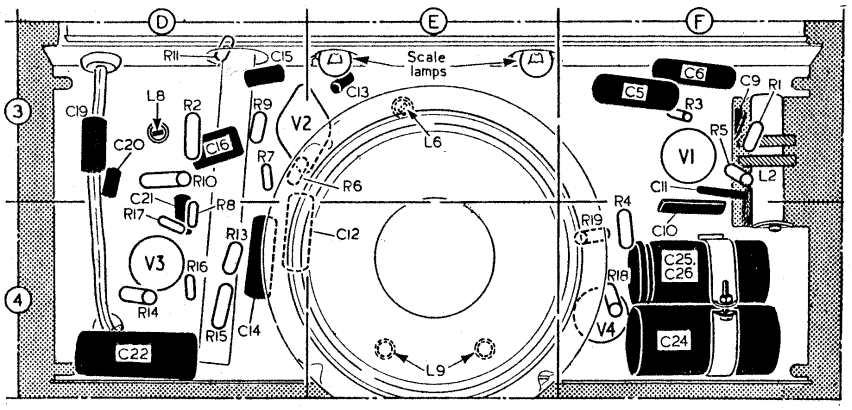
As the trimming and tracking points are not marked on the tuning scale it is necessary to make up a substitute paper scale as follows. Using the right-hand edge of the paper strip to represent the highest wavelength pointer setting, measure off and label the following points, the measurements being made each time to the right-hand edge: 160 kc/s, 0.7in; 580 kc/s, 0.86in; 220 kc/s, 2.52in; 950 kc/s, 3.32in; 350 kc/s, 4.58in; 1,500 kc/s, 4.95in. When in use the substitute paper scale is held against the tuning scale and its right-hand edge is lined up with the high wavelength ends of the tuning scales. Check that with the gang at maximum capacitance, the cursor coincides with the high wavelength ends of the tuning scales.

**M.W.**—Switch receiver to M.W., tune to 1,500 kc/s, feed in a 1,500 kc/s (200 m) signal and adjust **C31** (A1) for maximum output.

**L.W.**—Switch receiver to L.W., tune to 160 kc/s, feed in a 160 kc/s (187.5 m) signal and adjust **C33** (A1) for maximum output, while rocking the gang for optimum results. Tune receiver to 350 kc/s, feed in a 350 kc/s (857 m) signal and adjust **C32** (A2) for maximum output. Repeat these adjustments until no further improvement results.

**M.W. Aerial.**—Replace back cover, switch receiver to M.W., tune to 1,500 kc/s, feed in a 1,500 kc/s (200 m) signal and adjust **C28** (A2) through back cover for maximum output.

**L.W. Check.**—Remove back cover, switch receiver to L.W., tune to 350 kc/s, feed in a 350 kc/s (857 m) signal and readjust **C33** (A1) for maximum output while rocking gang for optimum results.




Front side of chassis, which contains the normal under-chassis components.

## VALVE ANALYSIS

Valve voltages and currents given in the table below are those derived from the manufacturers' information and are the average of readings taken on a number of receivers. These receivers were operated from 230 V A.C. mains, with their voltage adjustments set to the 220-230 V tapping. They were tuned to the high wavelength end of M.W. with volume control set at maximum, but there was no signal input.

Voltage readings were measured on the 400 V range of a Model 7 Avometer, chassis being the negative connection. The voltage measured across **C25** was 175 V, across **C22** was 11.8 V and across **R14** was 2 V.

| Valve | Anode | | Screen | | Cath. |
|---|---|---|---|---|---|
| | V | mA | V | mA | V |
| V1 UCH42 | 153 | 4·4 | 80 | 2·0 | — |
| | Oscillator | | | | |
| | 54 | 3·7 | | | |
| V2 UBF80 | 88 | 6·5 | 85 | 2·5 | — |
| V3 UL41 | 172 | 37·0 | 153 | 6·4 | — |
| V4 UY41 | — | — | — | — | 188 |

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