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# FERRANTI 915

DESIGNED to operate from self-contained, all-dry batteries or from A.C. mains, the Ferranti 915 is a suitcase portable superhet using four valves and a metal rectifier. The waveband ranges are 187-550 m and 1,000-2,000 m. The mains voltage range is 200-250V at 50-100 c/s, and the receiver must not be connected to D.C. mains.

Mains/battery change-over is effected by means of a 3-position switch control, the central position being "off," but a lid-operated safety switch ensures that the lid cannot be closed with the batteries still connected.

*Release date and original price: July 1951, £13 13s 2d, without batteries. Purchase tax extra.*

## CIRCUIT DESCRIPTION

Tuned frame aerial input on L.W. by **L1** and **C28** to heptode valve **(V1, Mullard DK91)** which operates as frequency changer with electron coupling. For M.W. operation, **S1** closes and shunts **L2** across **L1.**

Oscillator grid coils **L3** (M.W.) and **L4** (L.W.) are tuned by **C29.** Parallel trimming by **C30** (M.W.) and **C30, C31** (L.W.); series tracking by **C8** (M.W.) and **C8, C9** (L.W.). Oscillator anode is inductively coupled for reaction on M.W. by **L5** and capacitatively coupled on L.W. by the common impedance of **C9.**

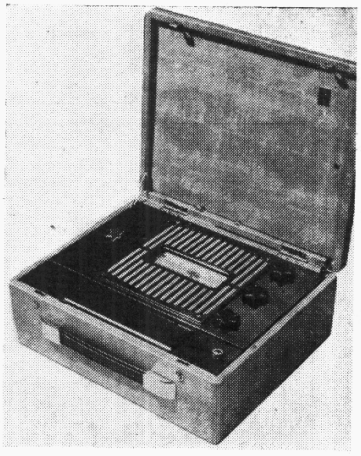
Second valve **(V2, Mullard DF91)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C4, L6, L7, C5** and **C12, L8, L9, C13.** **Intermediate frequency 470 kc/s.**

Diode signal detector is part of diode pentode valve **(V3, Mullard DAF91).** Audio frequency component in rectified output is developed across volume control **R10,** which acts as diode load, and is passed via **C16** to control grid of pentode section, which operates as A.F. amplifier. I.F. filtering by **C14, R8, C15.** D.C. potential developed across **R10** is fed back as bias via decoupling circuit **R9, C3** to **V1** and **V2** control grid circuits, giving automatic gain control.

Resistance-capacitance coupling by **R12, C19** and **R15** or **R16** between **V3** pentode and pentode output valve **(V4, Mullard DL94).** Tone correction by use of two negative feed-back paths, the first, via **C20,** being between the anodes of **V3** and **V4;** and the second, via **C23, R18** and **R19,** being between **T1** secondary and the control grid circuit of **V3.**

For battery operation, power supplies are carried by switches **S6(B)** and **S9(B)** which close in that position as indicated by the suffix **(B).** For mains operation, **S7(M), S8(M)** and **S10(M)** close. In the "off" position all the switches open. Lid-operated switches **S11, S12**

*(Continued col. 1 overleaf)*

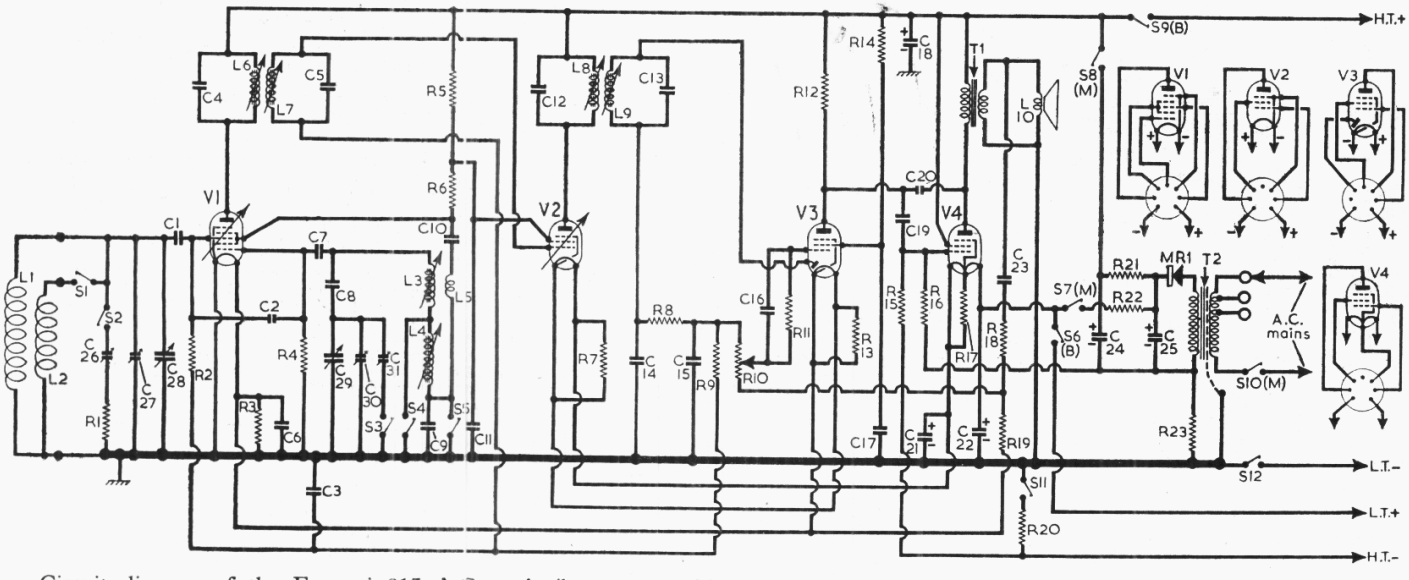


## COMPONENTS AND VALUES

| | CAPACITORS | Values | Locations |
|---|---|---|---|
| C1 | V1 C.G. ... ... | 200pF | C5 |
| C2 | Osc. neutralizing | 3pF | C4 |
| C3 | A.G.C. decoupling | 0·05μF | D3 |
| C4 | 1st I.F. trans. | 100pF | D4 |
| C5 | tuning | 100pF | D4 |
| C6 | Filament by-pass | 0·1μF | C5 |
| C7 | V1 osc. C.G. ... | 100pF | C4 |
| C8 | Oscillator trackers | 550pF | C5 |
| C9 | | 200pF | C4 |
| C10 | Reaction coupling | 200pF | C4 |
| C11 | S.G. decoupling ... | 0·05μF | C3 |
| C12 | 2nd I.F. trans. | 100pF | D3 |
| C13 | tuning | 180pF | D3 |
| C14 | I.F. by-passes ... | 100pF | C3 |
| C15 | | 100pF | C3 |
| C16 | A.F. coupling ... | 0·005μF | D3 |
| C17 | V3 S.G. decoup. | 0·05μF | D3 |
| C18* | H.T. reservoir ... | 2μF | C3 |
| C19 | A.F. coupling ... | 0·001μF | C3 |
| C20 | Neg. feed-back ... | 15pF | C3 |
| C21* | Filament by-passes | 500μF | B1 |
| C22* | | 50μF | F3 |
| C23 | Neg. feed-back ... | 0·05μF | D3 |
| C24* | H.T. smoothing ... | 32μF | F3 |
| C25* | | 32μF | F3 |
| C26† | L.W. aerial trim | 200pF | B1 |
| C27† | M.W. aerial trim | 21·5pF | D5 |
| C28† | Aerial tuning ... | 523pF | C5 |
| C29† | Oscillator tuning | 523pF | C5 |
| C30‡ | M.W. osc. trim. ... | 60pF | B2 |
| C31‡ | L.W. osc. trim ... | 120pF | B2 |

| | RESISTORS | Values | Locations |
|---|---|---|---|
| R1 | L.W. aerial damp... | 33Ω | B1 |
| R2 | V1 C.G. ... ... | 2·2MΩ | C4 |
| R3 | Filament shunt ... | 150Ω | C4 |
| R4 | V1 osc. C.G. ... | 100kΩ | C4 |
| R5 | S.G. H.T. feed ... | 18kΩ | C3 |
| R6 | Osc. anode load ... | 8·2kΩ | C4 |
| R7 | Filament shunt ... | 120Ω | C3 |
| R8 | I.F. stopper ... | 100kΩ | C3 |
| R9 | A.G.C. decoupling | 2·2MΩ | D3 |
| R10 | Volume control ... | 500kΩ | B1 |
| R11 | V3 C.G. ... ... | 2·2MΩ | D3 |
| R12 | V3 anode load ... | 1MΩ | D3 |
| R13 | Filament shunt ... | 150Ω | C3 |
| R14 | V3 S.G. feed ... | 3·9MΩ | C3 |
| R15 | V4 C.G. resistors ... | 2·2MΩ | C3 |
| R16 | | 2·2MΩ | C3 |
| R17 | Filament shunt ... | 430Ω | C3 |
| R18 | Neg. feed-back ... | 10kΩ | D3 |
| R19 | | 1kΩ | B1 |
| R20 | V4 G.B. ... ... | 200Ω | D3 |
| R21 | H.T. smoothing ... | 1kΩ | F3 |
| R22 | Filament ballast ... | 1·9kΩ | F4 |
| R23 | V4 G.B. ... ... | 56Ω | F3 |

* Electrolytic. † Variable. ‡ Pre-set.




Circuit diagram of the Ferranti 915 A.C. mains/battery portable superhet. Mains/battery change-over and on/off switching are accomplished by five switches.

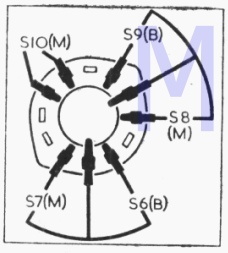



Diagram of the mains/battery/off switch unit, viewed as seen in our underside view of the chassis.

| OTHER COMPONENTS | | Approx. Values (ohms) | Locations |
|---|---|---|---|
| L1 | L.W. frame aerial | 16·0 | — |
| L2 | M.W. frame aerial | 1·3 | — |
| L3 | Oscillator tuning coils | 2·0 | B2 |
| L4 | | 4·5 | B2 |
| L5 | Osc. reaction ... | 1·0 | B2 |
| L6 | 1st I.F. trans. Pri. | 7·5 | D4 |
| L7 | 1st I.F. trans. Sec. ... | 7·5 | D4 |
| L8 | 2nd I.F. trans. Pri. | 7·5 | D3 |
| L9 | 2nd I.F. trans. Sec. ... | 5·5 | D3 |
| L10 | Speech coil ... | 2·3 | E3 |
| T1 | O.P. trans. Pri. | 690·0 | |
| | O.P. trans. Sec.... | 0·6 | D3 |
| T2 | Mains trans. Pri. total | 250·0 | |
| | Mains trans. Sec. ... | 120·0 | F5 |
| S1-S5 | Waveband switches | — | C4 |
| S6-S10 | Mains/battery sw. | — | F4 |
| S11, S12 | Safety switches ... | — | E3 |

**Circuit Description**—*continued*

prevent the batteries from being left switched on with the lid closed.

Mains H.T. current is supplied by metal rectifier **(MR1, SenTerCel RM2).** Smoothing by **R21** and electrolytic capacitors **C24, C25.** Filament current is taken from the H.T. circuit via ballast resistor **R22** and smoothed by the large capacitance of **C21, C22.**

The filaments are connected in series for mains and battery operation. Bias is obtained from the appropriate points in the filament chain. Extra bias for **V4** is obtained on mains operation via **R16** from the voltage dropped across **R23,** and on battery operation via **R15** from the voltage dropped across **R20. R3, R7, R13** and **R17** bypass the H.T. current from the valves past the filaments.

## VALVE ANALYSIS

Valve voltages and currents given in the table below are those derived from the manufacturers' information and are average figures obtained from a number of receivers operating from A.C. mains and tuned to the highest wavelength end of M.W. Readings obtained when operating from new batteries were approximately the same.

Voltage readings were measured with a Model 7 Avometer, chassis being the negative connection. The voltage measured across **R20** was 2 V, and that across **R23** was 3 V, chassis being the positive connection in these two cases. The unsmoothed voltage across **C25** was 100 V. Total current values are quoted as follows: L.T. battery, 57 mA; H.T. battery, 10 mA; A.C. mains, 83 mA.

| Valve | Anode | | Screen | |
|---|---|---|---|---|
| | V | mA | V | mA |
| V1 DK91 | 90·0 | 0·8 | 34 | 1·1 |
| V2 DF91 | 90·0 | 1·6 | 47 | 0·45 |
| V3 DAF91 | 3·5 | 0·06 | 1 | 0·02 |
| V4 DL94 | 84·0 | 4·7 | 90 | 0·9 |

## GENERAL NOTES

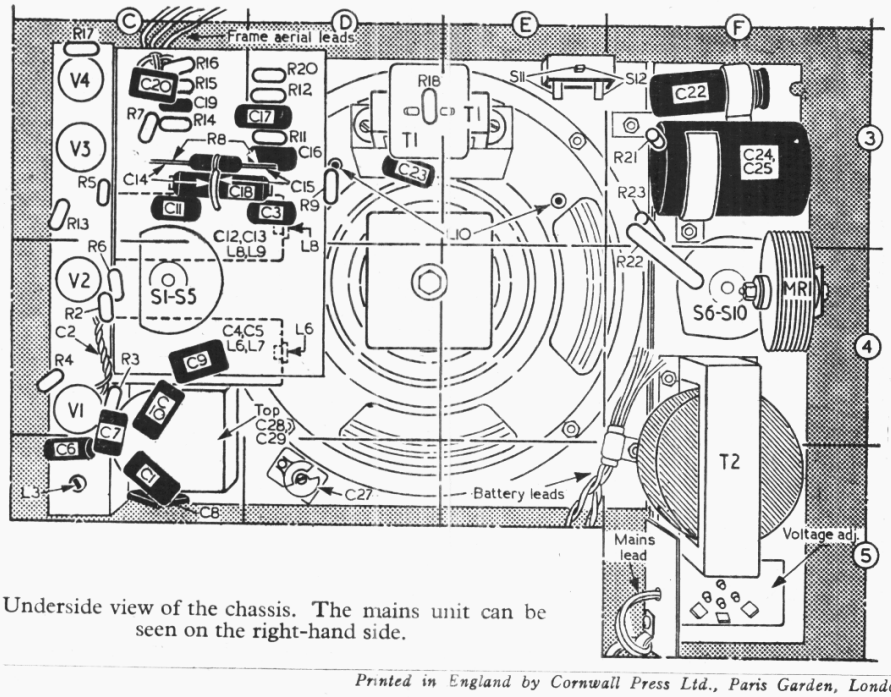
**Switches.**—**S1-S5** are the waveband switches, ganged in a single rotary unit indicated in our underside view of the chassis. A diagram showing the unit in detail appears in col 3, where it is drawn as seen from the underside of the chassis. **S1, S4** and **S5** close for M.W. operation (control knob anti-clockwise), **S2** and **S3** close for L.W.

**S6(B)-S10(M)** are the mains/battery changeover switches, their functions also including the on-off action. In the anti-clockwise position of the control knob, **S7(M), S8(M)** and **S10(M)** close for mains operation, as indicated by the suffix **(M).** In the clockwise position **S6(B)** and **S9(B)** close for battery operation. In the central position all these switches are open, and the receiver is switched "off." A diagram of the unit is shown in col. 1, where it is viewed in the same position as it is seen in our underside view of the chassis.

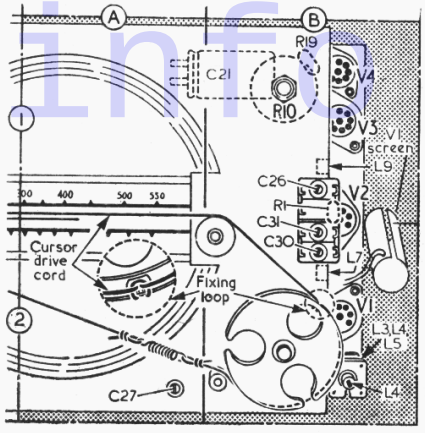
**S11, S12** are over-riding battery switches, operated by closing the lid. Their purpose is to ensure that the batteries are disconnected when the lid is closed.

**Batteries.**—The L.T. battery is rated at 7.5 V, and the H.T. battery at 90 V. Types recommended by the makers are: L.T., Drydex H1187; Ever Ready No. 38, or Vidor L5048. H.T., Drydex "Drymax" 526, Ever Ready "Batrymax" B126, or Vidor L5512. Total current is given as 57 mA L.T. and 10 mA H.T.

**Drive Cord replacement.**—About 20 inches of high-grade fishing line, plaited and waxed, is required for a new drive cord, which should be run as shown in our plan view of the chassis.




Underside view of the chassis. The mains unit can be seen on the right-hand side.




Plan view of the significant section of the chassis, with the tuning drive cord shown.

Part of the chassis is cut off in this illustration to save space, but the drive system is quite simple. The end loops terminate at the tension spring, but before running the cord a point about 4.5in from one end is folded and looped through the drive drum, as shown inset.

## CIRCUIT ALIGNMENT

To gain access to the I.F. core adjustments the chassis should be removed from its carrying case, and, with the frame aerial still connected, placed in a convenient position on the bench. When making adjustments to the I.F. tuning cores, care should be taken to see they are not screwed through to the second tuning position, which will result in over-coupling.

**I.F. Stages.**—Switch receiver to L.W. and turn gang to maximum capacitance. Connect output from signal generator, via an 0.1 $\mu$F capacitor in the "live" lead, to control grid (pin 6) of **V1** and chassis. Feed in a 470 kc/s (638.3 m) signal and adjust the cores of **L9, L8, L7** and **L6** (location references B1, D4, B2) for maximum output. Repeat these adjustments, reducing the input as the circuits come into line, until no further improvement results.

**R.F. and Oscillator Stages.**—The following adjustments must be carried out with the chassis in the carrying case, but with the escutcheon removed so that the trimmers and cores are accessible. In order to adjust the core of **L3,** the core of **L4** (B2) should be removed and the trimming tool can then be inserted through the coil former to engage in the top of **L3** core, and for this reason M.W. adjustments must always be followed by L.W. re-alignment.

Connect the signal generator output to a loop consisting of two turns of stout copper wire approximately 10in in diameter and placed 12in behind and parallel to the receiver frame aerials. Check that with the gang at maximum capacitance the cursor coincides with the 550 m mark on the tuning scale.

**M.W.**—Switch receiver to M.W., tune to 200 m, feed in a 200 m (1,500 kc/s) signal, and adjust **C30** (B2) and **C27** (A2) for maximum output. Tune receiver to 500 m, feed in a 500 m (600 kc/s) signal, and removing the core of **L4** (B2) adjust the core of **L3** (through the coil former) for maximum output. Repeat these adjustments until no further improvement results and then replace the core of **L4.**

**L.W.**—Switch receiver to L.W., tune to 1,000 m, feed in a 1,000 m (300 kc/s) signal and adjust **C31** (B2) and **C26** (B1) for maximum output. Tune receiver to 1,800 m, feed in a 1,800 m (167 kc/s) signal and adjust the core of **L4** (B2) while rocking the gang for optimum results. Repeat these adjustments until no further improvement results.

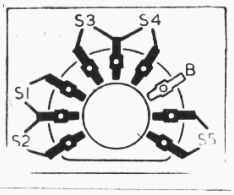



Diagram of the waveband switch unit, drawn as seen in an inverted chassis.

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