Test Report

FERGUSON Model 341BU

mains-battery portable

THIS is a four-valve superheterodyne portable receiver, covering long and medium waves and running off a.c. or d.c. mains or from self-contained dry batteries. It has a built-in frame aerial and sockets are provided for the connection of an external aerial or earth if required. The on/off switch is operated by the lid which cover the control panel and an additional safety switch is incorporated which disconnects the mains when the cabinet back is opened.

CIRCUIT DETAILS

R.F. and I.F. Stages

The signal, developed in the frame aerial and tuned by C4, is applied to the signal grid of V1, a DL91 functioning as a heptode frequency changer. On the medium wave position the long wave loading coil L1 is shorted out and the fixed trimmer C2 disconnected. An isolating capacitor C1 is fitted for use with an external aerial.

The tuned-grid oscillator section uses G1 as the grid and G2/G4 as anode. On the medium wave position the grid coil L2 and its padders C17/C18 are tuned by C14 and its trimmer C12; the long wave padder C13 and the long wave coils L3/L5 are shorted out and the l.w. trimmers C15/C16 are disconnected. A neutralising capacitor C8 is connected between the oscillator and signal grid circuits. L4 is the feedback coil.

The i.f. signal is applied to the i.f. amplifier V2 (DF91) via a permeability tuned i.f. transformer, the screen of V2 being fed from the same point as G2/G4 of the heptode. The amplified signal is coupled to the diode section of V3 by a second permeability tuned i.f. transformer.

I.f. filtering is provided by R5, C21, C22, and the load resistor R8, functioning as the manual gain control, is returned to the junction of the filament tap comprising R10 and R11. The resistors R6 and R7 form a potential divider, from the junction of which the d.c. component is fed back to the signal grid of V1 as a.g.c. control.

Audio Stages

The audio signal is applied to the grid of the pentode section via C23, the valve operating with grid leak bias derived from the grid current through R9 which is returned to its filament. Voltages developed across the anode load resistor R13 are fed via C27 to the grid of the output valve V4.

Grid bias for this stage is derived from the voltage drop across the filaments of the three other valves which are all in the negative side of the output valve filament. The V4 filament is maintained at the a.c. potential of the h.t. negative line due to C30, the audio by-pass capacitor. A resistor, R15, is in shunt with the filaments of V1, V2, V3 and part of V4, to by-pass the heater current of V4 which would otherwise flow through the other filaments and the resultant over-running would shorten valve life.

The ultimate signal is coupled to the 6½in. high sensitivity speaker via the output transformer T1. Fixed tone correction is obtained by C29.

Switching

S2 is the battery/mains change-over switch, S3/S4 is the on/off switch operated by the control panel cover and S5/S6 is the safety switch which operates only on "mains." On the "battery" position, C31 remains across the h.t. supply as a by-pass capacitor and the earth blocking capacitor C35 is connected to the negative line. On "mains" position, h.t. smoothing is by the two-section filter C31/R17/C32/R19; mains voltage is adjustable by the taps on R19. This section of the filter is common to h.t. and l.t. circuits—R18 is the filament ballast resistor.

In series with the selenium rectifier is a limiting resistor R20, and C34 is a by-pass capacitor for r.f. voltages. The chassis is not used as the h.t. and l.t. negative line but is connected thereto by R16/C10. No "mains" earth connection is provided.

SERVICE SNAPS OF THE FERGUSON MODEL 341BU

Valves: DK91 (f.c.), DF91 (i.f. amp.), DAF91 (det., a.g.c., a.f.), DL94 (o/p).
Intermediate Frequency: 470 kc/s.
Waveband Coverage: Medium waves — 187.5–550 metres; Long waves — 1,000–2,143 metres.
Volume Control: 1 megohm, inverse log.
Electrolytics: 30μF, 15V; 40 μF, 275V; 30 μF, 275V; 20 μF, 275V.
Power Supply: A.c. or d.c. mains 200–240V, or Batteries—90V and 7.5V.

R67 FERGUSON 341BU

POWER SUPPLIES

Mains Supplies

Two ranges of mains voltages are covered (200-220 and 220-240V) and adjustment is made by connecting the flexible lead to the appropriate terminal on the tapping panel beneath the dropping resistor.

Battery Supplies

The battery compartment will accommodate the following: h.t. battery (90V); Drymax 507 (Drydex), Batrymax B107 (Ever Ready) or L5508 (Vidor) l.t. battery (7.5V); H1177 (Drydex), All-dry 31 (Ever Ready), or L5042 (Vidor).

REMOVAL OF CHASSIS

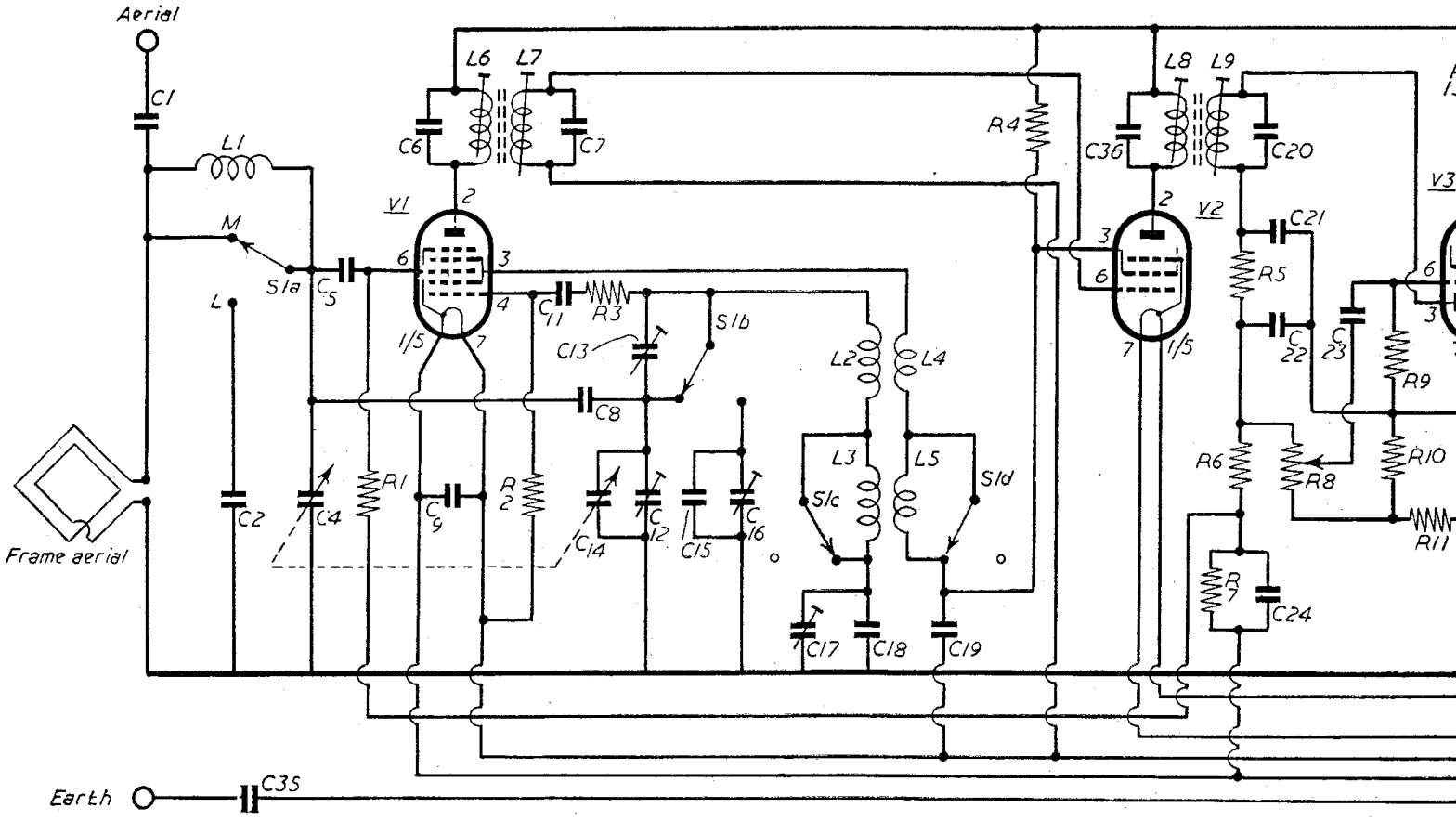
The cabinet back must be lifted before it can be swung outwards. Withdraw and unplug the batteries then unsolder the leads from the loudspeaker, the frame aerial and earth socket and the on/off switch. The switch leads are connected to a tie-down at the left-hand front edge of the chassis and should be unsoldered at this point. After the two self-tapping screws at the rear have been removed, the chassis may be withdrawn.

Note that the safety switch operates automatically when the cabinet back is opened, and if it is desired to test the receiver on mains supply under these conditions the switch must be temporarily short-circuited. Be sure to remove any such short circuit before returning the chassis to the cabinet. The safety switch is inoperative when the mains/battery switch is set for battery operation.

REMOVAL OF SPEAKER

The loudspeaker is held in position by a metal clamp secured by four bolts, when these are removed the loudspeaker and its baffle may be withdrawn from the cabinet.

Circuit diagram of the Ferguson model



DRIVE CORD DETAILS

The main difference between the alternative types of drum shown in the diagram is that the flanges are turned in opposite directions with respect to the bush. Type 1 is the earlier and Type 2 was introduced after serial number 4000 to eliminate a tendency for the cord to slip off the flange. The run of the cord is similar in both cases but the method of termination is different. Approximately 40in. of cord, allowing for tying off, are required.

With Type 1, commence by looping the cord around the boss. The free end should be passed through the slot in the drum and completely threaded around the pulleys and drive spindle in the direction shown by the arrows. The turns around the drive spindle should be clockwise, progressing inwards. The free end of the cord should be knotted round one end of the tension spring approximately ½in. inside the drum.

The other end of the spring should be anchored on the tag provided on the drum face. Although, for the sake of clarity, in the run of the cord, the drum is shown in the position it should occupy when the gang is at maximum, this position is not the most convenient for anchoring the spring. It is therefore recommended that, after the cord has been attached to the spring, the drum is carefully rotated through 90 degrees when the spring fixing tag becomes easily accessible.

The cursor should now be clipped on the drive cord, as shown in the diagram, and set to coincide with the extreme right-hand marker on the scale backing plate when the gang is at maximum.

When the second type of drum, shown in the "gang maximum" position, is fitted, the same general procedure should be followed. In this case, as the boss is on the side opposite to the flange, the start end of the cord is anchored on a tag on the drum face.

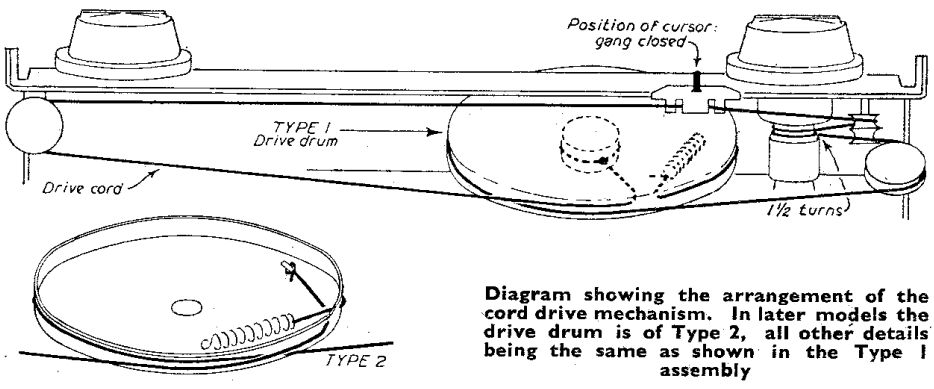


Diagram showing the arrangement of the cord drive mechanism. In later models the drive drum is of Type 2, all other details being the same as shown in the Type 1 assembly

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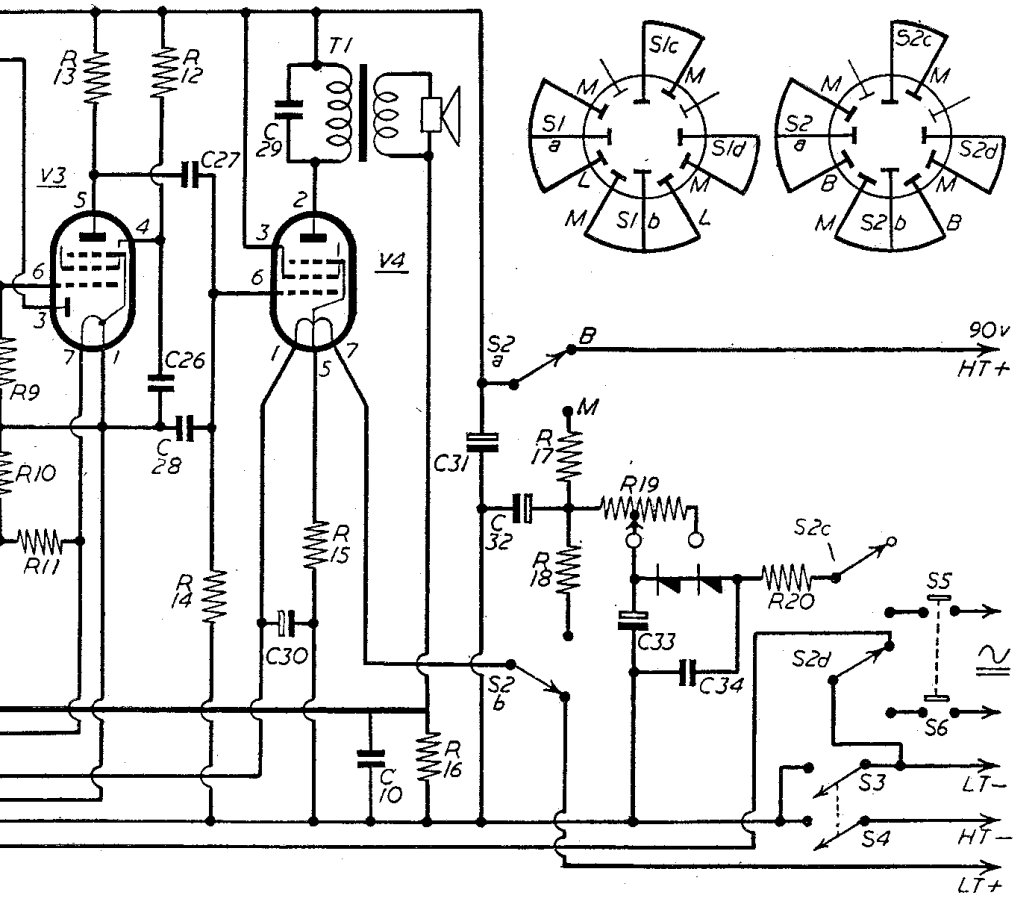


COMPONENT LIST

	Resistors		Capacitors	
R1	1MΩ	C5	100pF	
R2	100kΩ	C6	47pF±2%	
R3	3.3kΩ	C7	62pF±2%	
R4	15kΩ	C8	1.5pF ±0.5pF	
R5	100kΩ	C9	0.25μF	
R6	2.2MΩ	C10	0.25μF	
R7	3.3MΩ	C11	100pF, 10%	
R8	1MΩ pot.	C12	35pF	
R9	6.8MΩ	C13	150-750pF	
R10	470Ω, ±5%	C14	530pF swing	
R11	270Ω, ±5%	C15	100pF, ±5%	
R12	4.7MΩ	C16	4-40pF	
R13	470kΩ	C17	4-40pF	
R14	2.2MΩ	C18	520pF, ±1%	
R15	680Ω, ±5%	C19	0.1μF	
R16	150kΩ	C20	180pF, ±2%	
R17	470Ω±5%	C21	100pF	
R18	2kΩ, w.w., 65mA, ±5%	C22	100pF	
R19a	1450Ω, w.w., 65mA, ±5%	C23	0.002μF	
R19b	390Ω, w.w., 65mA, 5±%	C24	0.05μF	
R20	230Ω, w.w., 140mA, ±5%	C26	0.05μF	
		C27	0.002μF	
		C28	220pF	
		C29	0.005μF	
		C30	30μF, 15V	
		C31	40μF, 275V	
		C32	30μF, 275V	
		C33	20μF, 275V	
C1	15pF, 250V a.c.	C34	0.05μF, 300V a.c.	
C2	80pF ±1pF	C35	0.01μF	
4	530pF swing	C36	100pF, ±2%	

Valves

V1	DK91	Frequency changer
V2	DF91	I.f. amplifier
V3	DAF91	A.G.C., det., a.f.
V5	DL94	Audio output

Inductors and transformers

L1	L.W. loading	13.8Ω
L2	M.W. oscillator tuning	2.5Ω
L3	L.W. oscillator tuning	2.5Ω
L4	M.W. oscillator coupling	1.9Ω
L5	L.W. oscillator coupling	6.8Ω
L6	I.f. transformer primary	14.4Ω
L7	I.f. transformer secondary	11.1Ω
L8	I.f. transformer primary	8.0Ω
L9	I.f. transformer secondary	6.0Ω*
T1	Output transformer (primary)	706Ω
	Frame aerial	1.3Ω

**no external connection*

PRODUCTION MODIFICATIONS

The following are some of the modifications which have been made since the 341BU was originally manufactured.

From 3001, a double tuned second i.f. transformer has been used, the secondary capacitor being originally 47 p.F The i.f. filter resistor R5 was until then 47K. At this time, the 3.5 pF neutralising capacitor C25, between pin 3 of V3 and pin 4 of V2, was omitted.

From 1100, R3 was increased from 2K to 3.3K to prevent instability at h.f. due to oscillator squegging. From 1,200 onwards, the non-earthed side of C10 has been connected to V1 filament negative to prevent i.f. potentials filtering into the filament circuit and causing instability.

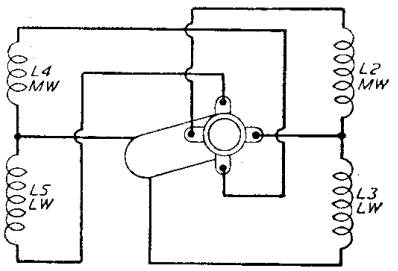
The above modifications should be incorporated in any receiver which shows a tendency to instability. It has been found possible, in later receivers, to omit the aerial trimmer C3 to simplify alignment.

VOLTAGE AND CURRENT DATA

Valve	Anode Pin	Volts	mA	Screen Pin	Volts	mA
V1	2	90	1.0	3	48	1.8
V2	2	90	1.6	3	49	0.7
V3	5	—		4	—	
V4	2	84	7.3	3	90	1.5

	Voltage	Current
H.T. (mains)	89.2V	15.5mA
H.T. (battery)	90.0V	14.3mA
L.T. (mains)	6.5V	45.5mA
L.T. (battery)	7.5V	51mA

The above readings are average figures obtained from a number of receivers and slight variations may be expected. The receivers were operating on new batteries and readings taken at 230 volts a.c. (using the 220–240V tap on R19) gave very similar results. Receivers were switched to the medium wave position; no signal was applied.



Showing the schematic arrangement of the oscillator coil connections

REMOVAL OF THE ON/OFF SWITCH

First release the loudspeaker grille by removing the four screws which secure it to the cabinet. The scale escutcheon, upon which the on/off switch is mounted, may then be withdrawn from the cabinet.

FERGUSON 341BU

Alignment Procedure

TO obtain access to the trimmers the cabinet must be removed. After removal of the two fixing screws, the chassis may be drawn backwards, complete with knobs. The switch and loudspeaker leads are of sufficient length. The switch incorporated in the lid will function when the chassis is removed, provided that the leads are not disconnected.

Note that the receiver will not operate on mains, after chassis removal, unless the safety switch at the rear is depressed. The chassis and batteries should be re-arranged in proximity to the frame aerial in such a way that conditions approximate those when the chassis is housed, otherwise alignment may not hold when the receiver is reassembled.

The six scale backing-plate indentations should be used during alignment. The right-hand pair indicate the maximum position (gang fully meshed) and the cursor should be set up against these marks before starting alignment. The lower set of marks apply to m.w. and the top set to l.w., as follows:—

Lower left-hand mark	1,500 kc/s (trim)
Centre mark	550 kc/s (pad)
Upper left-hand mark	290 kc/s (trim)
Centre mark	150 kc/s (pad)

I.F. Alignment

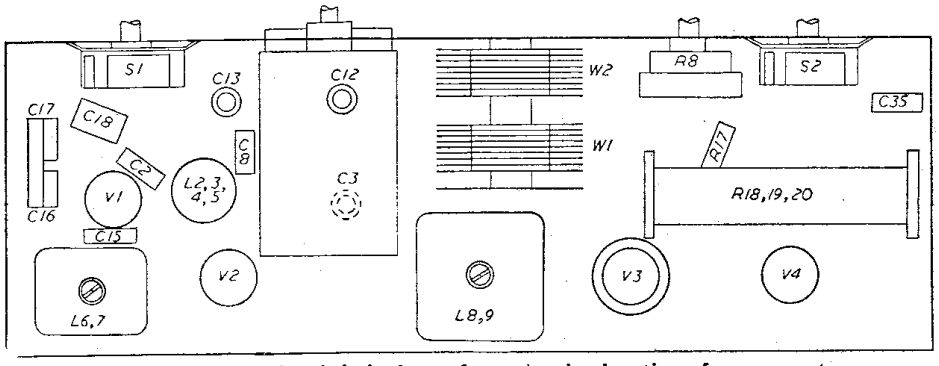
Connect signal generator via two 0.1 μF capacitors between signal grid of V1 (pin 4) and h.t. negative (pin 1 of V1). Then, with gang and volume controls at maximum, inject a signal of 470 kc/s. Adjust L9, L8, L7 and L6, in that order, for maximum output. Repeat operations until optimum results are obtained.

R.F. Alignment

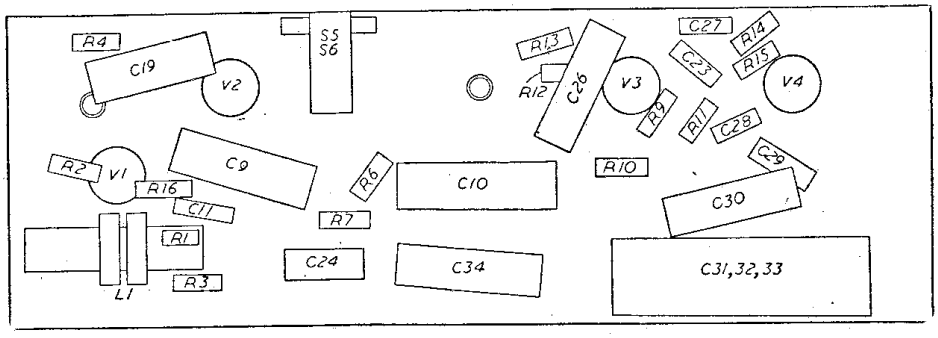
The signal generator output leads should be placed near the frame aerial and the volume control set to maximum.

Medium waves: Inject signal of 1,500 kc/s and trim C12 and C3 for maximum outout. (Note: in later receivers C3 is omitted.) Inject signal of 550 kc/s and adjust C17 (foremost of right-hand pair) for maximum output whilst slightly rocking the gang. Repeat until no further improvement is possible.

Long waves: Inject signal of 290 kc/s and trim C16 (rear-most of right-hand pair) for maximum output. Inject signal of 150 kc/s and adjust C13 (adjacent to front of gang) for maximum output whilst slightly rocking gang. Repeat until no further improvement results.



Plan view of the chassis in its latest form showing location of components



Underside view of the chassis in its latest form