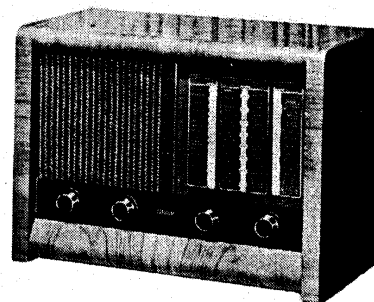


"TRADER" SERVICE SHEET
1028

FERGUSON
321A and 322RG



The Ferguson 321A table model.

COMPONENTS AND VALUES

CAPACITORS		Values	Locations	
C1	Aerial coupling	0-001 μ F	F3	
C2		50pF	F3	
C3		V1 C.G. ...	200pF	G3
C4		V1 S.G. decoupl. ...	0-1 μ F	G3
C5		1st I.F. trans. tun- ing ...	100pF	A2
C6	V1 osc. C.G. ...	100pF	A2	
C7		50pF	G3	
C8	A.G.C. decoupling	0-1 μ F	G4	
C9	S.W. osc. trimmer	20pF	G3	
C10	L.W. osc. trimmer	30pF	F3	
C11	Oscillator trackers	3,550pF	G3	
C12		560pF	G3	
C13		500pF	G4	
C14		200pF	G3	
C15	Osc. anode coup. ...	0-1 μ F	G4	
C16	V2 S.G. decoupl. ...	50pF	F4	
C17	A.G.C. coupling ...	100pF	B2	
C18	2nd I.F. trans. tun- ing ...	180pF	B2	
C19	I.F. bypasses	100pF	B2	
C20		100pF	B2	
C21	A.F. coupling	0-005 μ F	F4	
C22	H.T. by-pass	0-1 μ F	E3	
C23	I.F. by-pass	500pF	F4	
C24	A.F. coupling	0-001 μ F	E4	
C25	Part tone control...	0-02 μ F	E4	
C26	Tone corrector	0-05 μ F	E4	
C27*	V4 cath. by-pass...	50 μ F	E3	
C28*	G.B. decoupl. ...	0-1 μ F	E4	
C29*	H.T. smoothing	32 μ F	C2	
C30*		24 μ F	D4	
C31*		24 μ F	D4	
C32		24 μ F	D4	
C33†	Mains R.F. filter...	0-01 μ F	E3	
C34†	S.W. aerial trim...	40pF	F3	
C35†	M.W. aerial trim...	40pF	F3	
C36†	L.W. aerial trim...	40pF	F3	
C37†	Aerial tuning	§528pF	B1	
C38†	Oscillator tuning...	§528pF	B2	
C39†	S.W. osc. trim...	40pF	F4	
C40†	M.W. osc. trim...	40pF	F4	
C41†	L.W. osc. trim...	40pF	F4	
C41†	L.W. osc. tracker...	350pF	G4	

RESISTORS		Values	Locations
R1	M.W. aerial shunt	2-3k Ω	F3
R2	Scale lamp ballast	1-5 Ω	G4
R3	V1 C.G. ...	1M Ω	G3
R4	V1 S.G. H.T. pot. ...	22k Ω	G4
R5	divider	33k Ω	G3
R6	V1 osc. C.G. ...	47k Ω	G3
R7	Tracker shunt	3-3k Ω	G3
R8	Osc. anode feed ...	27k Ω	G4
R9	Osc. stabilizer	250 Ω	F3
R10	V2 S.G. feed	100k Ω	G4
R11	A.G.C. diode load	470k Ω	F4
R12	I.F. stopper	100k Ω	B2
R13	Volume control	500k Ω	E3
R14	V3 C.G. ...	3-3M Ω	F4
R15	H.T. decoupling	100k Ω	E4
R16	V3 anode load	220k Ω	E4
R17	V3 S.G. feed	1M Ω	E4
R18	Tone control	2-5k Ω	D3
R19	Part tone control...	27k Ω	E4
R20		3-3k Ω	E4
R21	V4 C.G. ...	1M Ω	E4
R22	V1, V2 G.B.	470k Ω	E4
R23		47k Ω	E4
R24		165 Ω	E3
R25*		680 Ω	E4
R26	V4 G.B. ...	680 Ω	E4
R27		820 Ω	D4

FOUR receiving valves and a rectifier are used in the Ferguson 321A, a 3-band superhet designed to operate from A.C. mains of 200-250 V, 40-100 c/s. The waveband ranges are 16-55 m, 190-500 m and 750-2,000 m. The A.C./D.C. version 321U is covered separately in *Service Sheet 1029*.

The 322RG is a console autoradiogram employing a chassis that with the exception of the scale assembly is identical with that in the 321A.

Release date, both models, October 1951. Original prices: 321A, £19 16s 6d; 322RG, £45 10s 6d.

CIRCUIT DESCRIPTION

Aerial input and R.F. tuning circuits, frequency changer (V1, Mullard ECH42), oscillator and I.F. amplifier (V2, Mullard EBF80) are quite straightforward.

Intermediate frequency 470 kc/s. Diode signal detector is part of V2, audio frequency component in rectified output being developed across volume control R13, which acts as diode load, and passed via C21 to control grid of pentode valve (V3, Mullard EF41).

Second diode of V2 is fed via C16 from anode of pentode section and the voltage developed across its load resistor R11 is fed back, giving automatic volume control.

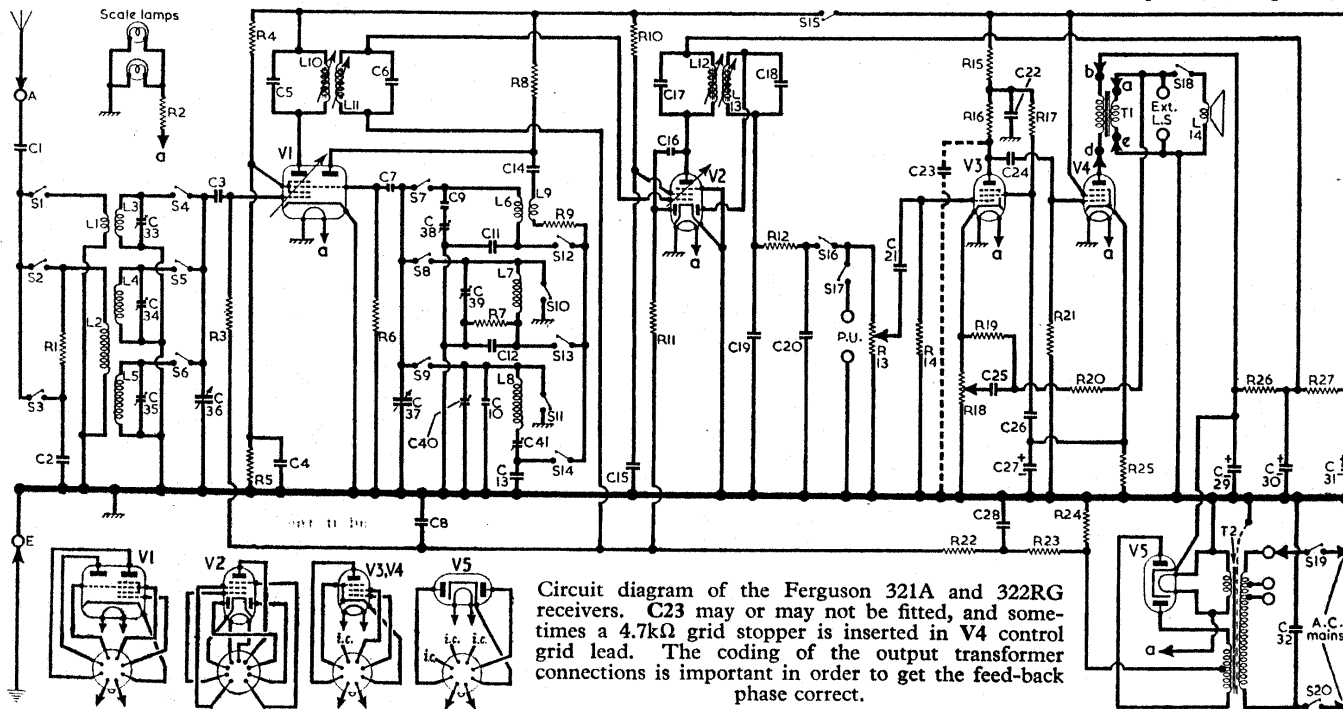
Resistance-capacitance coupling by R16, C24 and R21 between V3 and pentode output valve (V4, Mullard EL41). Speech coil voltages appearing across secondary winding of output transformer T1 are fed back, via R20, C25, R18 and R19 to V3 cathode, giving variable tone control.

The value of C24 and position of C26 are selected to produce rapid attenuation at very low frequencies, in order to offset the feed-back, which becomes positive. Provision is made for the connection of a low impedance external speaker across T1 secondary winding, rotation of the speaker plug opening S18 and muting the internal speaker.

H.T. current is supplied by I.H.C. full-wave rectifying valve (V5, Mullard EZ40).

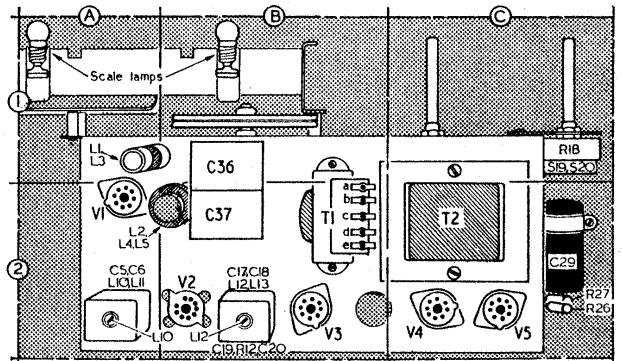
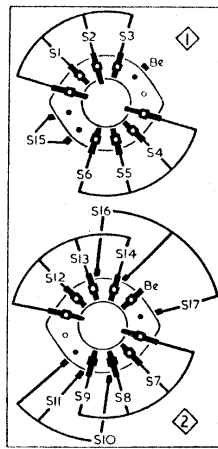
*Electrolytic. †Variable. ‡Pre-set. §Swing.

*Two 330 Ω resistors in parallel. §Swing.



Circuit diagram of the Ferguson 321A and 322RG receivers. C23 may or may not be fitted, and sometimes a 4.7k Ω grid stopper is inserted in V4 control grid lead. The coding of the output transformer connections is important in order to get the feed-back phase correct.

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	Aerial coupling coils ...	2.3	A1
L2		28.0	B2
L3		—	A1
L4	Aerial tuning coils	2.6	B2
L5		30.0	B2
L6	Oscillator tuning coils ...	—	G3
L7		2.5	G3
L8	15.0	G3	
L9	Osc. reaction coil ...	1.0	G3
L10	1st I.F. trans. {Pri.	8.0	A2
L11		{Sec.	8.0
L12	2nd I.F. trans. {Pri.	8.0	B2
L13		{Sec.	8.0
L14	Speech coil	2.5	—
T1	O.P. {b-d ...	460.0	B2
	trans. {a-c ...		
T2	H.T. sec., total	44.0	C2
	Heater sec.	760.0	
S1-S17	Waveband switches	—	F3
S18	Int. L.S. switch ...	—	E4
S19, S20	Mains sw., g'd R18	—	D3



Above.—Plan view of the chassis. The tags of T1 are coded to agree with the diagram overleaf.
Left.—Waveband switch units as seen from rear of inverted chassis.

VALVE ANALYSIS

Valve voltages and currents given in the table below are derived from the manufacturer's information and were measured on a receiver which was operating from 230 V A.C. mains. Voltage readings were taken on the 10 V and 400 V ranges of a Model 7 Avometer, chassis being the negative connection. The voltage drop across R24 was 2.6 V.

Valves	Anode		Screen		Cath.
	V	mA	V	mA	
V1 ECH42	250 115	2.7 4.7	100	3.7	—
V2 EBF80	268	4.3	80	1.7	—
V3 BF41	35	0.5	20	0.1	1.0
V4 EL41	205	35.0	250	5.0	6.8
V5 EZ40	285†	—	—	—	285.0

†A.C. voltage.

GENERAL NOTES

Switches.—S1-S14 are the waveband switches, and S15-S17 are the radio/gram change-over switches, ranged in two rotary units. These are indicated in our underside view of the chassis, and shown in detail in the diagrams inset beside our plan view of the chassis, where they are drawn as seen from the rear of an inverted chassis. The table below then gives the switch positions for the four control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open, and C, closed.

Scale Lamps.—These are two M.E.S. types, with small clear spherical bulbs, rated at 6.5 V, 0.3 A.

Switches	Gram.	L.W.	M.W.	S.W.
S1	—	—	—	C
S2	C	C	—	—
S3	—	C	—	—
S4	—	—	—	C
S5	—	—	C	—
S6	—	C	—	—
S7	—	—	—	C
S8	—	—	C	—
S9	—	C	—	—
S10	—	—	—	C
S11	—	—	C	—
S12	—	—	—	C
S13	—	—	C	—
S14	—	C	—	—
S15	—	C	C	—
S16	—	C	C	C
S17	C	—	—	C

External Speaker.—A special plug is provided at the rear of the chassis for connecting a low impedance (about 2.3 Ω) external speaker. When the plug is turned a few degrees anti-clockwise in its sockets, S18 opens and mutes the internal speaker.

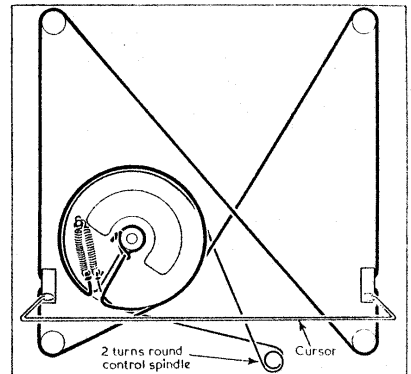
Feed-back Modification.—Originally C26 was returned to V3 cathode instead of V4, and C24 was 0.05 μF. A grid stopper of 4.7 kΩ was fitted in V4 C.G. circuit, and C23 in V3 anode circuit. The change was made during production because it was found that at frequencies below 80 c/s the sense of the feed-back tended to become positive, resulting in instability.

Drive Cord Replacement.—There are two separate cords for tuning drive and cursor drive. The former requires about two feet of fine gauge nylon braided glass yarn, and the latter about five feet of normal gauge plaited flax fishing line. The method of running these two cords

is shown in the sketch below, where they are viewed from the front with the gang at minimum.

CIRCUIT ALIGNMENT

The following adjustments may be made without removing the chassis from its cabinet, access to the under-chassis trimmers and core adjust-



Front view of tuning drive system.

ments being gained by removing the cabinet base cover (six wood screws).

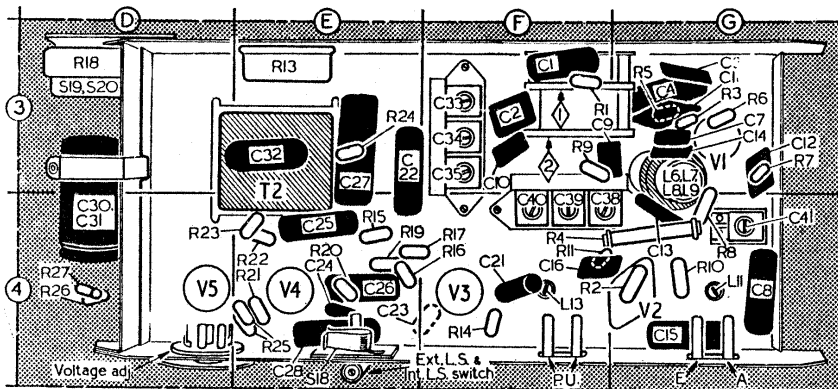
I.F. Stages.—Connect output of signal generator to junction of C36 and C3, and turn volume control and gang to maximum. Switch set to M.W., feed in a 470 kc/s (638.3 m) signal and adjust the cores of L13 (location reference F4), L12 (B2), L11 (G4) and L10 (A2) for maximum output.

R.F. and Oscillator Stages.—Check that with the gang at maximum capacitance, the cursor coincides with the tops of the tuning scales and is horizontal. Transfer signal generator leads to A and E sockets via a suitable dummy aerial.

L.W.—Switch set to L.W., tune to 857 m (spot on scale), feed in an 857 m (350 kc/s) signal and adjust C40 (F4) and C35 (F3) for maximum output. Tune to 1,875 m, feed in a 1,875 m (160 kc/s) signal and adjust C41 (G4) for maximum output. Repeat these adjustments until no further improvement results.

M.W.—Switch set to M.W., tune to 200 m (spot on scale), feed in a 200 m (1,500 kc/s) signal and adjust C39 (F4) and C34 (F3) for maximum output. Check calibration at 517 m (580 kc/s) and if there is a large error check the capacitance of C12, replacing it if it falls outside the stated tolerance. If C12 is not faulty it may be found necessary to replace the coil unit L6, L7, L8, L9.

S.W.—Switch set to S.W., tune to 17.7 m (spot on scale), feed in a 17.7 m (17 Mc/s) signal and adjust C38 (F4) and C33 (F3) for maximum output, "rocking" the gang when adjusting C33 to obtain optimum results. Check calibration at 50 m (6 Mc/s) and if there is a large error replace C11, if faulty, or the coil unit.



Underside view of the chassis. Some components are mounted outside at one end.