"TRADER" SERVICE SHEET

1138

FERGUSON 325 SERIES

Covering Table Models 325A, 325U and Radiograms 326RG, 326URG

EMPLOYING a negative feed-back tone control circuit, the Ferguson 325A is a 4-valve (plus rectifier) 3-band A.C. table superhet, designed to operate from A.C. mains of 200-250 V, 50 c/s. The wavebands covered are 15.7-55.4 m, 184-575 m and 733-2,050 m.

Model 325U is the A.C./D.C. version of model 325A, and models 326RG and 326URG are the A.C. and A.C./D.C. 3-speed auto-radiogram versions respectively.

Release date, all models, August 1953. *Original prices:* 325*A*, 325*U*, £19 17*s* 6*d*; 326*RG*, £54 17*s*; 326*URG*, £61 4*s* 3*d*. *Purchase tax extra.*

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1** (S.W.) and **L2** (M.W. and L.W.) to single-tuned circuits **L3, C34** (S.W.), **L4, C34** (M.W.) and **L5, C34** (L.W.), which precede triode hexode valve **(V1, Mullard ECH42** (A.C. model) or **UCH42** (A.C./D.C. model)**)** operating as frequency changer with internal coupling. **R1, C2** shunts the aerial input circuit on M.W., and **C2** shunts it on L.W., to move its resonance outside the tuning range. The **E** socket is isolated from chassis in the A.C./D.C. model by **C40.**

Second valve **(V2, Mullard EBF80** (A.C. model) or **UBF80** (A.C./D.C. model)**)** is a double diode variable-mu R.F. pentode, its pentode section operating as intermediate frequency amplifier with tuned transformer couplings **C5, L10, L11, C6** and **C17, L12, L13, C18.**

Intermediate frequency 470 kc/s

One diode section of **V2** operates as signal detector, the audio frequency component in its rectified output being developed across volume control **R15,** which acts as diode load, and passed via **C21** to control grid of pentode A.F. amplifier **(V3, Mullard EF41** (A.C. model) or **UF41** (A.C./D.C. model)**).**

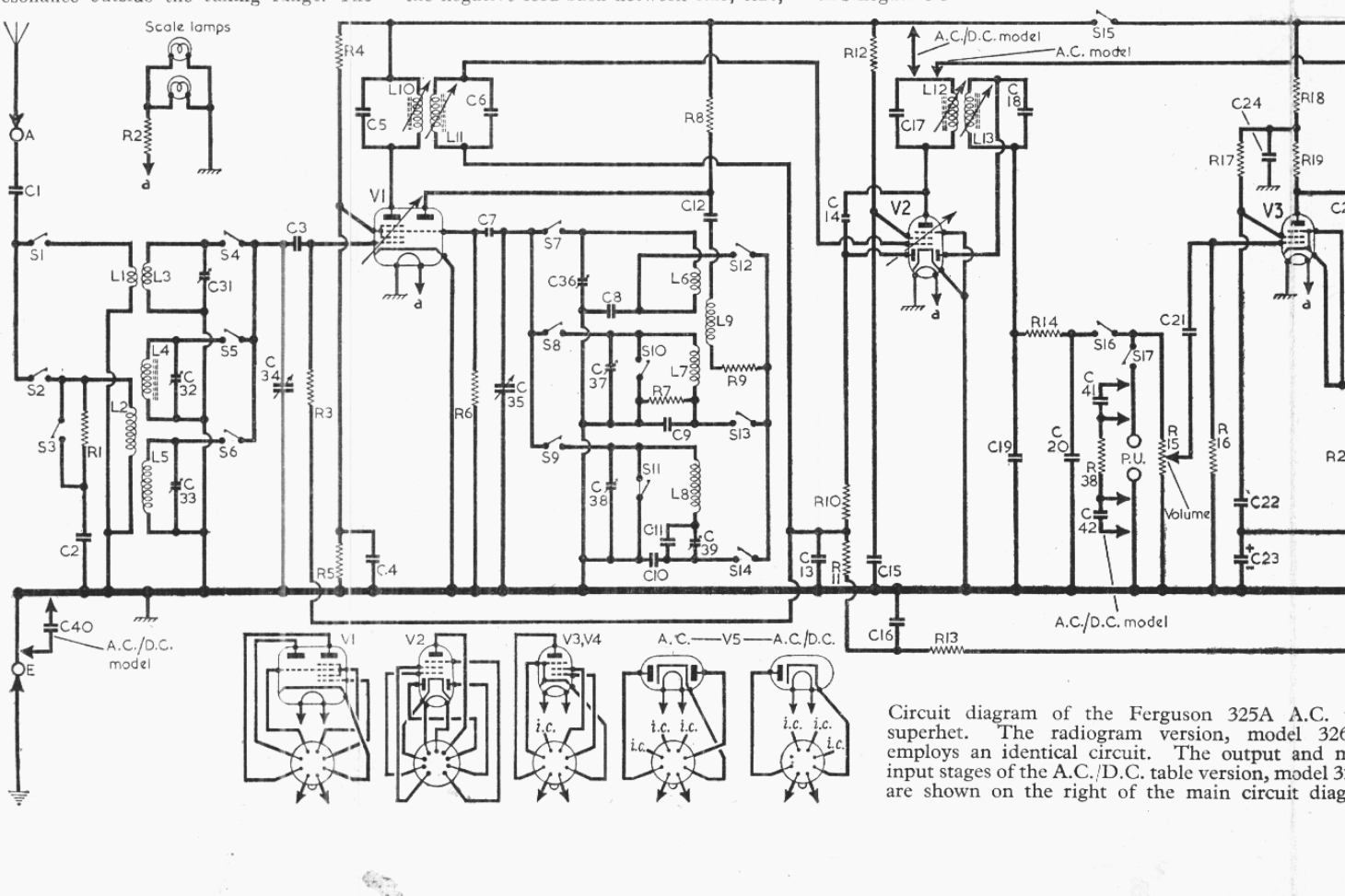
Provision is made for the connection of a gramophone pick-up across the volume control via **S17,** which closes in the gram position of the waveband control. **S15** and **S16** open in this position to prevent radio break-through. In the A.C./D.C. model the pick-up is shunted by **R38** and isolated from chassis by **C41** and **C42.**

Resistance-capacitance coupling by **R19, C25** and **R20** between **V3** and pentode output valve **(V4, Mullard EL41** (A.C. model) or **UL41** (A.C./D.C. model)**).** Variable tone control by **R25** in the negative feed-back network **R23, R24, R25, C26** between the speech coil circuit and **V3** cathode. In the A.C./D.C. model, a third winding **c** is provided on the output transformer **T3** to supply the feed-back network **R28, R29, R30, C44,** and a phase-correcting capacitor **C43** is added between the top end of the network and **V4** anode.

In the A.C. model, H.T. current is supplied by I.H.C. full-wave rectifying valve **(V5, Mullard EZ40).** Smoothing by **R26, R27** and electrolytic capacitors **C27, C28** and **C29.** The heaters of all the valves, including **V5,** are fed from winding **a** on transformer **T2.**

In the A.C./D.C. model, H.T. current is supplied by I.H.C. half-wave rectifying valve **(V5, Mullard UY41).** Smoothing by **R32, R33** and electrolytic capacitors **C45, C46** and **C47.** The valve heaters, together with the scale lamps and ballast resistor **R37,** are connected in series across the mains input. **R34** protects the scale lamps, and **R36** protects **V5** from current surges. In the event of scale lamp failure, **R35 (Brimistor CZ2)** carries the heater current and prevents **R34** from being overloaded.

Bias for **V1** and **V2** is obtained from the voltage dropped across **R22** (A.C. model) or **R31** (A.C./D.C. model) in the H.T. negative lead to chassis, the negative side of the reservoir capacitor being taken to this negative line.



Circuit diagram of the Ferguson 325A A.C. superhet. The radiogram version, model 326 employs an identical circuit. The output and m input stages of the A.C./D.C. table version, model 3 are shown on the right of the main circuit diag

Appearance of models 325A and 325U.

RADIOGRAM MODELS

Model 326RG.—This is an A.C. console radiogram, employing a chassis identical to that used in model 325A, together with a 3-speed Garrard RC75 A.C. record changer.

Model 326URG.—This is an A.C./D.C. console radiogram and employs a Garrard RC75 3-speed A.C./D.C. record changer. It uses a 325U chassis but differs from the 325U circuit shown below in the following respects.

C40 is increased to 0.05 μF, **C42** is reduced to 0.05 μF. A 150 kΩ resistor is inserted between **C41** and **S17.** **R38** is removed, and a 1 MΩ resistor is shunted from the lower end of **S17** to chassis. An 0.005 μF capacitor is connected across winding **a** on **T3.** The scale lamps, together with **R34** and **R35,** are removed from the chassis side of the mains input circuit and connected between the junction of **C48** and **L16,** and the junction of **R36** and **R37.** A 1 amp fuse is connected between **S20** and **L16.**

COMPONENTS AND VALUES

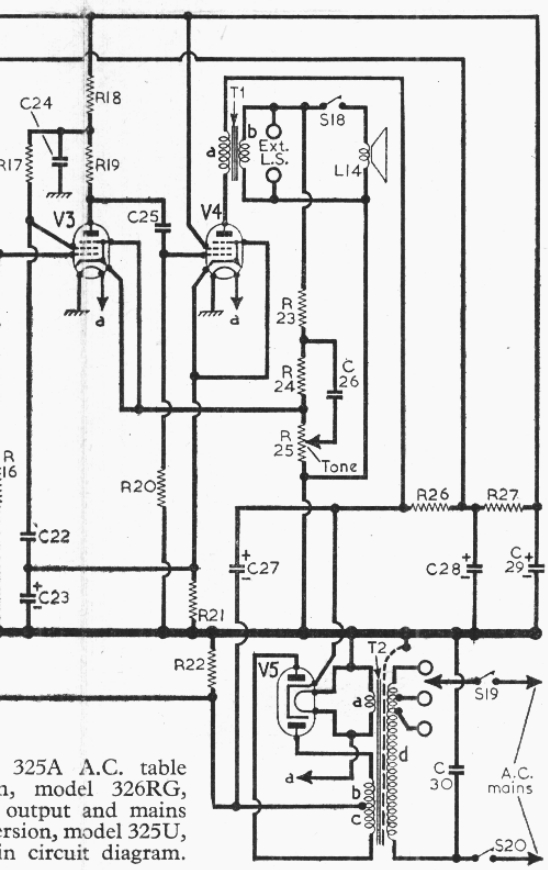
Resistors	A.C. Models	A.C./D.C. Models	Locations
R1	3·3kΩ	3·3kΩ	F3
R2	1·5Ω	—	F4
R3	1MΩ	1MΩ	G3
R4	22kΩ	18kΩ	G4
R5	33kΩ	27kΩ	G3
R6	47kΩ	47kΩ	G3
R7	3·3kΩ	3·3kΩ	G3
R8	27kΩ	22kΩ	G4
R9	250Ω	220Ω	F3
R10	470kΩ	470kΩ	F4
R11	470kΩ	470kΩ	E4
R12	100kΩ	68kΩ	G4
R13	470kΩ	470kΩ	E4
R14	100kΩ	100kΩ	B2
R15	500kΩ	500kΩ	E3
R16	3·3MΩ	3·3MΩ	F4
R17	1MΩ	4·7MΩ	E4
R18	100kΩ	100kΩ	E4
R19	220kΩ	1MΩ	E4
R20	1MΩ	1MΩ	E4
R21	180Ω	270Ω	E4
R22	47Ω	—	E3
R23	3·3kΩ	—	B1
R24	27kΩ	—	E4
R25	2·5kΩ	—	D3
R26	680Ω	—	D4
R27	820Ω	—	D4
R28	—	10kΩ	—
R29	—	47kΩ	—
R30	—	2·5kΩ	—
R31	—	33Ω	—
R32	—	680Ω	—
R33	—	1·5kΩ	—
R34	—	330Ω	—
R35	—	¶	—
R36	—	130Ω	—
R37	—	1·1kΩ*	—
R38	—	47kΩ	—

* Tapped at 700Ω + 200Ω + 200Ω from L16.
¶ Brimistor CZ2.

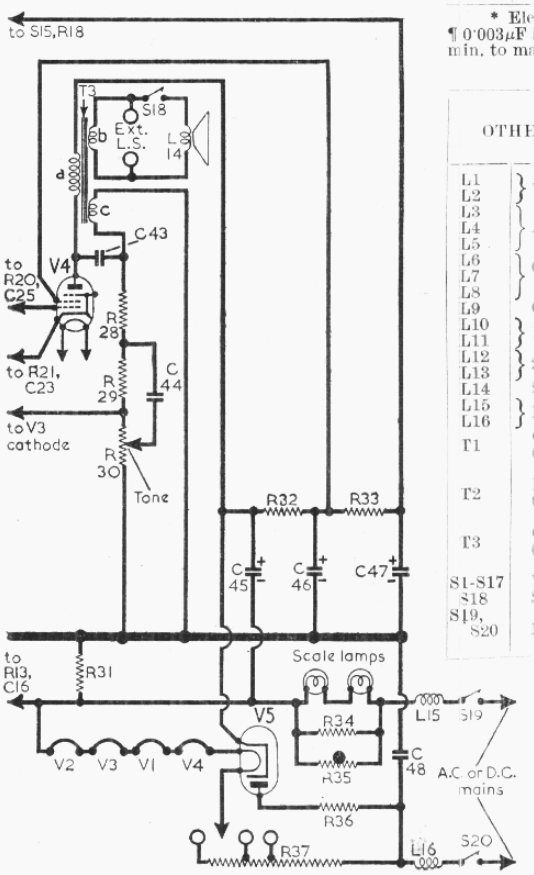
CAPACITORS	Values	Locations
C1 Aerial coupling	0·001μF	F3
C2 Aerial shunt	500pF	F3
C3 V1 C.G.	200pF	G3
C4 V1 S.G. decoupling	0·1μF	G3
C5 1st I.F. trans. tuning	100pF	A2
C6 1st I.F. trans. tuning	100pF	A2
C7 V1 osc. C.G.	50pF	G3
C8 S.W. osc. tracker	3,550pF	G3
C9 M.W. osc. tracker	560pF	G3
C10 L.W. osc. trackers	500pF	F3
C11 L.W. osc. trackers	200pF	G4
C12 Osc. anode coup.	200pF	G3
C13 A.G.C. decoupling	0·1μF	G4
C14 A.G.C. coupling	50pF	F4
C15 V2 S.G. decoupling	0·1μF	G4
C16 G.B. decoupling	0·1μF	E4
C17 2nd I.F. trans. tuning	100pF	B2
C18 2nd I.F. trans. tuning	180pF	B2
C19 I.F. by-passes	100pF	B2
C20 I.F. by-passes	100pF	B2
C21 A.F. coupling	0·005μF	F4
C22 V3 S.G. decoupling	0·05μF	E4
C23* V4 cath. by-pass	50μF	E3
C24 V3 anode decoup.	0·1μF	E4
C25 A.F. coupling	0·001μF¶	E4
C26 Part tone control	0·02μF	E4
C27* H.T. smoothing	32μF	D3
C28* H.T. smoothing	24μF	C1
C29* H.T. smoothing	24μF	C1
C30 Mains R.F. by-pass	0·01μF	E3
C31‡ S.W. aerial trim.	15pF	F3
C32‡ M.W. aerial trim.	40pF	F3
C33‡ L.W. aerial trim.	65pF	F3
C34† Aerial tuning	528pF§	B1
C35† Oscillator tuning	528pF§	B2
C36‡ S.W. osc. trim.	15pF	F4
C37‡ M.W. osc. trim.	40pF	F4
C38‡ L.W. osc. trim.	65pF	F4
C39‡ L.W. osc. tracker	80pF	G4
C40 "E" socket isolator	0·005μF	—
C41 P.U. isolators	0·005μF	—
C42 P.U. isolators	0·1μF	—
C43 Tone corrector	100pF	—
C44 Part tone control	0·01μF	—
C45* H.T. smoothing	32μF	—
C46* H.T. smoothing	24μF	—
C47* H.T. smoothing	24μF	—
C48 Mains R.F. by-pass	0·01μF	—

* Electrolytic. † Variable. ‡ Pre-set.
¶ 0·003μF in A.C./D.C. models § "Swing" value, min. to max.

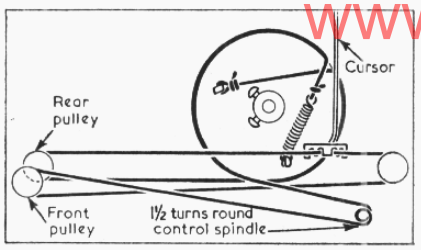
OTHER COMPONENTS	Approx. Values (ohms)	Locations
L1 Aerial coupling coils	2·3	A1
L2 Aerial coupling coils	28·0	A1
L3	—	A1
L4 Aerial tuning coils	2·6	A1
L5 Aerial tuning coils	30·0	A1
L6	—	G3
L7 Oscillator tuning coils	2·5	G3
L8 Oscillator tuning coils	15·0	G3
L9 Osc. reaction coil	1·0	G3
L10 1st I.F. trans Pri.	8·0	A2
L11 1st I.F. trans Sec.	8·0	A2
L12 2nd I.F. trans Pri.	8·0	B2
L13 2nd I.F. trans Sec.	6·0	B2
L14 Speech coil	2·5	—
L15 Mains filter chokes	3·4	—
L16 Mains filter chokes	3·4	—
T1 O.P. trans (A.C. model) a	460·0	B1
T1 O.P. trans (A.C. model) b	—	B1
T2 Mains trans. a	—	C1
T2 Mains trans. b	380·0	C1
T2 Mains trans. c	380·0	C1
T2 Mains trans. d, total	44·0	C1
T3 O.P. trans. (A.C./D.C. model) a	290·0	—
T3 O.P. trans. (A.C./D.C. model) b	—	—
T3 O.P. trans. (A.C./D.C. model) c	13·0	—
S1-S17 Waveband switches	—	F3
S18 Speaker switch	—	E4
S19, S20 Mains sw., g'd R25	—	D3



325A A.C. table
n, model 326RG,
output and mains
ersion, model 325U,
in circuit diagram.



The circuit on the immediate left shows the principal differences in the A.C./D.C. table model 325U as compared with the A.C. model 325A.



Turning drive system for gram models, viewed from the front.

VALVE ANALYSIS

Valve voltages and currents given in the tables below are those derived from the manufacturers' information. They were measured on receivers operating from A.C. mains of 230 V, with voltage adjustments set to the 220-230 V tappings. The receivers were tuned to the high wavelength end of the M.W. band, but there was no signal input.

Voltages were measured on the 10 V and 400 V ranges of a Model 7 Avometer, chassis being the negative connection in every case. The negative voltage measured across **R22** was 2.6 V; across **R31** it was 2.1 V.

A.C. Model

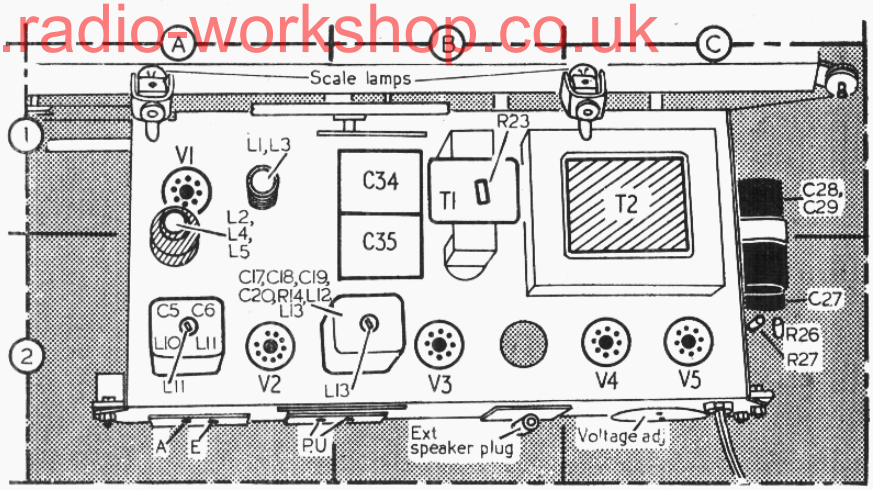
Valve	Anode		Screen		Cath.
	V	mA	V	mA	V
V1 ECH42	250	2·7	100	3·7	—
	Oscillator 115	4·7			
V2 EBF80	268	4·3	80	1·7	—
V3 EF41	35	0·5	20	0·1	1·0
V4 EL41	265	35·0	250	5·0	6·8
V5 EZ40	270*	—	—	—	235·0†

* A.C. reading. † Cathode current, 61 mA.

A.C./D.C. Model

Valve	Anode		Screen		Cath.
	V	mA	V	mA	V
V1 UCH42	184	2·3	75	4·7	—
	Oscillator 75	4·4			
V2 UBF80	184	3·7	82	1·5	—
V3 UF41	‡	‡	‡	‡	0·25
V4 UL41	218	40·0	212	7·0	12·5
V5 UY41	—	—	—	—	322·0§

‡ Very low. § Cathode current, 64mA.



Plan view of the A.C. chassis. The external speaker switch plug is indicated.

CIRCUIT ALIGNMENT

In the table models, all the trimmer and core adjustments can be made accessible by removing the cabinet base and back covers. In the gram models, however, it is necessary to remove the chassis.

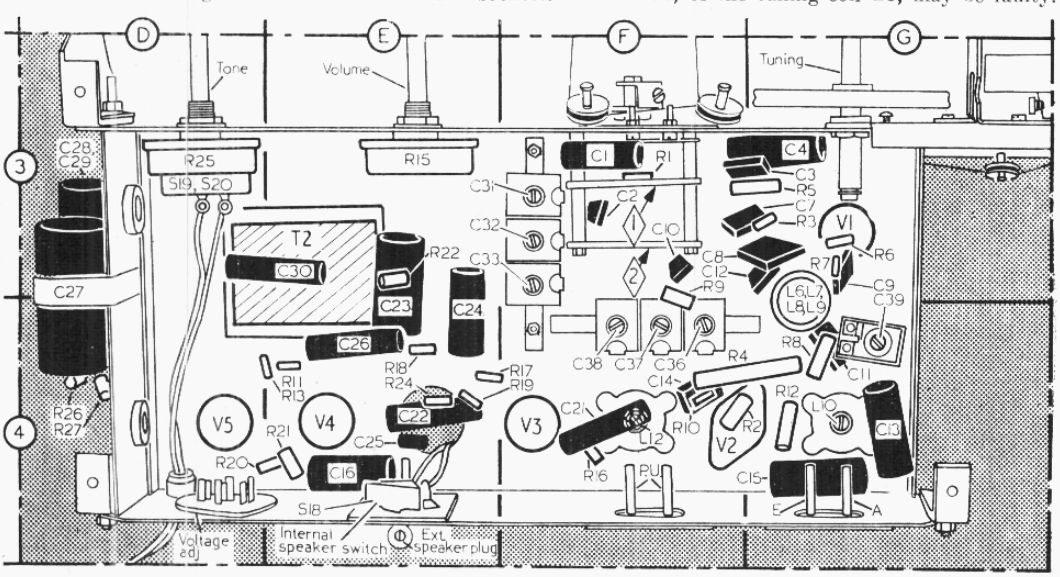
I.F. Stages.—Switch receiver to M.W. and turn gang to maximum capacitance. Connect output of signal generator, via an 0.1 μF capacitor in each lead, to control grid (pin 6) of **V1** and chassis. Feed in a 470 kc/s (638.3 m) signal and adjust the cores of **L13** (location reference B2), **L12** (F4), **L11** (A2) and **L10** (G4) for maximum output.

R.F. and Oscillator Stages.—In the gram models the tuning scale is fixed to the cabinet, and as the chassis is removed to give access to the trimmers, the calibration points given in the following alignment instructions must be marked off in pencil on to the scale backing plate to form a substitute tuning scale. The positions of these calibration points relative to the right-hand end of the backing plate (viewed from front of chassis) are shown in the substitute tuning scale sketch at the head of columns 2 and 3. Transfer generator leads to **A** and **E** sockets.

L.W.—Switch receiver to L.W., tune to 857 m, feed in an 857 m (350 kc/s) signal and adjust **C38** (F4) and **C33** (F3) for maximum output. Tune receiver to 1,875 m, feed in a 1,875 m (160 kc/s) signal and adjust **C39** (G4) for maximum.

M.W.—Switch receiver to M.W., tune to 200 m, feed in a 200 m (1,500 kc/s) signal and adjust **C37** (F4) and **C32** (F3) for maximum output. Tune receiver to 517 m, feed in a 517 m (580 kc/s) signal and check the calibration. If an error of more than $\pm\frac{1}{16}$ inch is found between the cursor setting and the calibration mark, the fixed tracker **C9** may be faulty.

S.W.—Switch receiver to S.W., tune to 17.7 m, feed in a 17.7 m (17 Mc/s) signal and adjust **C36** (F4) and **C31** (F3) for maximum output rocking the gang while adjusting **C31** to obtain optimum results. Tune receiver to 50 m, feed in a 50 m (6 Mc/s) signal and check the calibration. Although fixed tracking is employed, some small adjustment can be made at this end of the band by moving the length of wire terminating **L6** inside the coil former. Should an error greater than $\pm\frac{1}{16}$ inch still exist between the cursor setting and the calibration mark, the fixed capacitor **C8**, or the tuning coil **L6**, may be faulty.



Underside view of the chassis showing all the R.F. and oscillator trimmers. The internal speaker switch **S18** is operated by rotating the external speaker plug.

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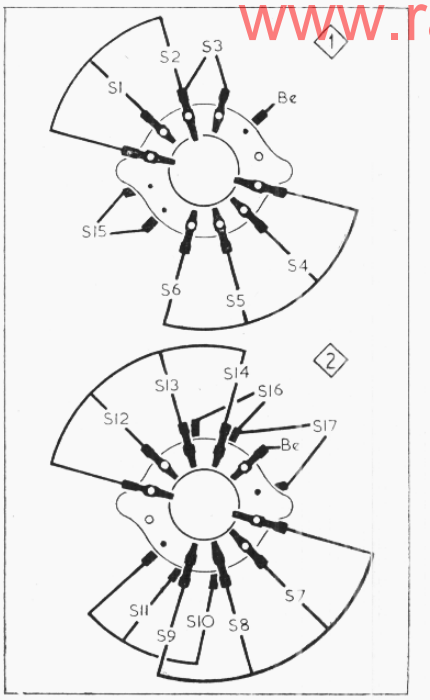
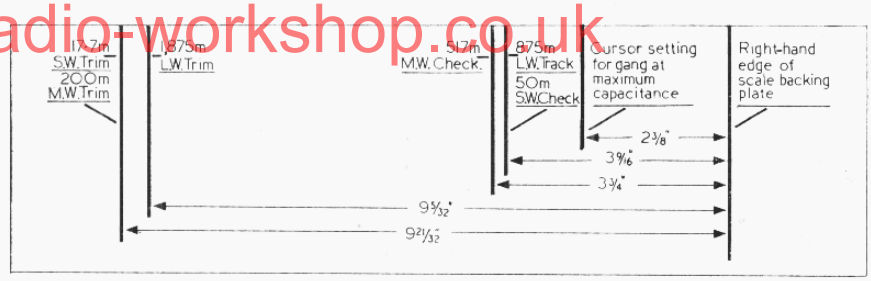


Waveband switch units.



Positions of the calibration points on the scale backing plate in the gram models.

GENERAL NOTES

Switches.—**S1-S17** are the waveband and radio/gram change over switches, ganged in two rotary units beneath the chassis. These units are indicated in our underside view of the chassis, and shown in detail in the diagrams above where they are drawn as seen from the rear of an inverted chassis. The associated switch table below gives the switch operations for the four control positions starting from the fully anti-clockwise setting of the knob. A dash indicates open and **C** closed.

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	C
S12	—	—	—	C
S13	—	—	C	—
S14	—	C	—	—
S15	—	C	C	C
S16	—	C	C	C
S17	C	—	—	—

Scale lamps.—In the A.C. models these are 6.5 V, 0.3 A lamps with M.E.S. bases and small clear spherical bulbs. In the A.C./D.C. models 8 V, 0.15 A lamps are used.

Tuning Drive Replacement, Table Models.—About 66 inches of high-quality flax fishing line, plaited and waxed, is required for a new drive cord. The drive should be run as shown in the sketch (the upper one (on right) at foot of cols. 2 and 3) starting off with the gang at maximum capacitance and securing one end of the drive cord to the drive drum bush. When the two cursors are finally replaced on the cord, they should be positioned so that with the gang at maximum capacitance they coincide with the high wavelength ends of their respective tuning scales.

Tuning Drive Replacement, Gram Models.—About 72 inches of high-quality flax fishing line, plaited and waxed, is required for a new drive cord. First, the scale backing plate and the waveband indicator should be removed. The cord should then be run as shown in the sketch in col. 4, starting off with the gang at maximum capacitance and anchoring one end of the cord to the tag on the front of the drive drum.

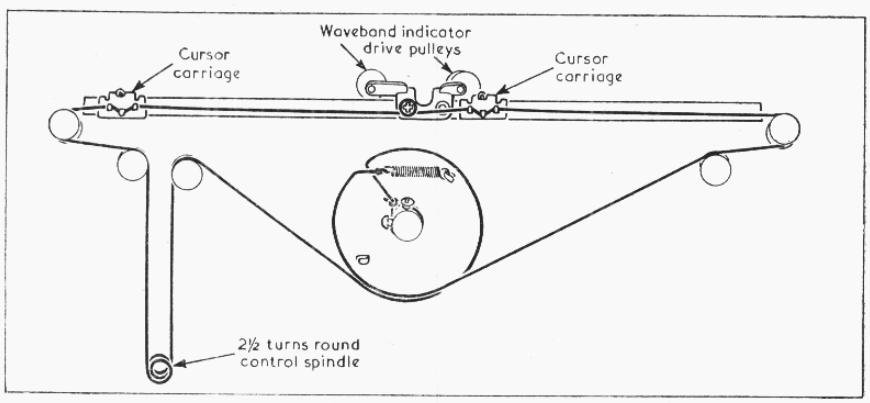
Waveband Indicator Drive.—For the table models about 42 inches of cord is required and should be run as shown in the lower sketch below, first threading the eyelet on to the cord and then tying the free ends of the cord to the drive drum.

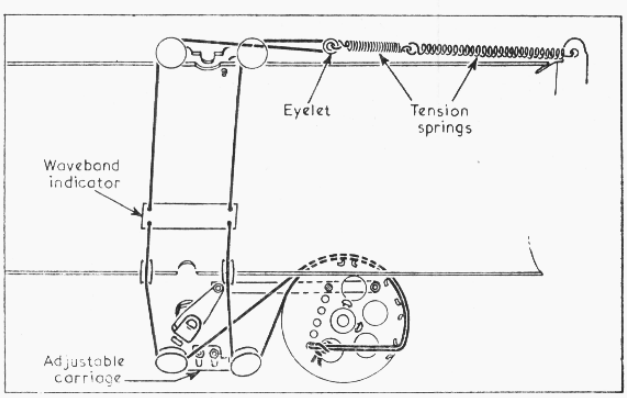
The waveband indicator used in the gram models consists of a sliding metal bar which is pulled against the tension of a spring by an arm on the switch spindle. The bar and arm are connected by a cord which passes round a pulley and is connected to a tag on the back of the bar. This tag also serves as an anchor point for the tension spring, the other end of the spring being hooked through a hole in the top flange of the tuning scale frame. When fitting a new cord, the length between the knotted ends of the cord should be 6 inches.

MODIFICATIONS

A.C. Table Models 325A.—Some early receivers were fitted with mains transformer whose H.T. secondary voltage was 290-0-290 V. In these receivers **R26** was 470 Ω, **R27** was 1.8 kΩ, and the voltage across **C27** was 310 V. The H.T. feed to **V4** anode circuit was taken from the junction of **R26** and **R27.**

Model 326RG.—Early versions of this receiver incorporated all the items listed above. In addition **C31, C33, C36** and **C38** had a maximum capacitance of 40 pF each. A 20 pF capacitor was connected in series with **C36,** and a 30 pF capacitor was connected in parallel with **C38.**





Above : Sketch of the tuning drive system as used in table models 325A and 325U.

Left : Sketch of the waveband indicator drive system as used in the table models.