"TRADER" SERVICE SHEET

1213

KOLSTER-BRANDES

5-valve (plus rectifier
on M.W. and L.W. A

THE Kolster-Brandes LR10FM is a five-valve (plus rectifier) A.M./F.M. table receiver designed for operation from 200-250 V A.C. mains of 50 c/s. An internal ferrite rod aerial is provided for A.M. reception, and a plate aerial for F.M. reception, but provision is also made for the connection of external aerials. The waveband ranges are : F.M., 87.5-100Mc/s; A.M., 186-571 m and 1,000-2,140 m.

Release date and original price: June, 1955, £18 11s. *Purchase tax extra.*

CIRCUIT DESCRIPTION

A.M. aerial tuning coils **L8** (M.W.) and **L9** (L.W.) are mounted at opposite ends of a length of ferrite rod to form the A.M. internal aerial. Provision is made for the connection of an external aerial (aerial socket A2), which is coupled to the tuned circuits by **C10** and the common impedance of **C16.** Aerial tuning is by **C19,** switch **S5** closing on M.W. and L.W.

Section **b** of **V2 (Brimar 12AH8)** operates as A.M. mixer, and section **a** as oscillator. Oscillator grid coils **L10** (M.W.) and **L11** (L.W.) are tuned by **C23,** switch **S6** closing on M.W. and L.W. Parallel trimming by **C25** (M.W.) and **C26** (L.W.); series tracking by **C28** (M.W.) and **C27, C28** (L.W.). Reaction coupling from anode circuit across the common impedance of **C28** (M.W. and L.W.).

V3 (Brimar 6BJ6) is a variable-mu R.F. pentode operating as single-valve A.M. intermediate frequency amplifier with tuned transformer couplings **C32, L14, L15, C33** and **C36, L16, L17, C37.**

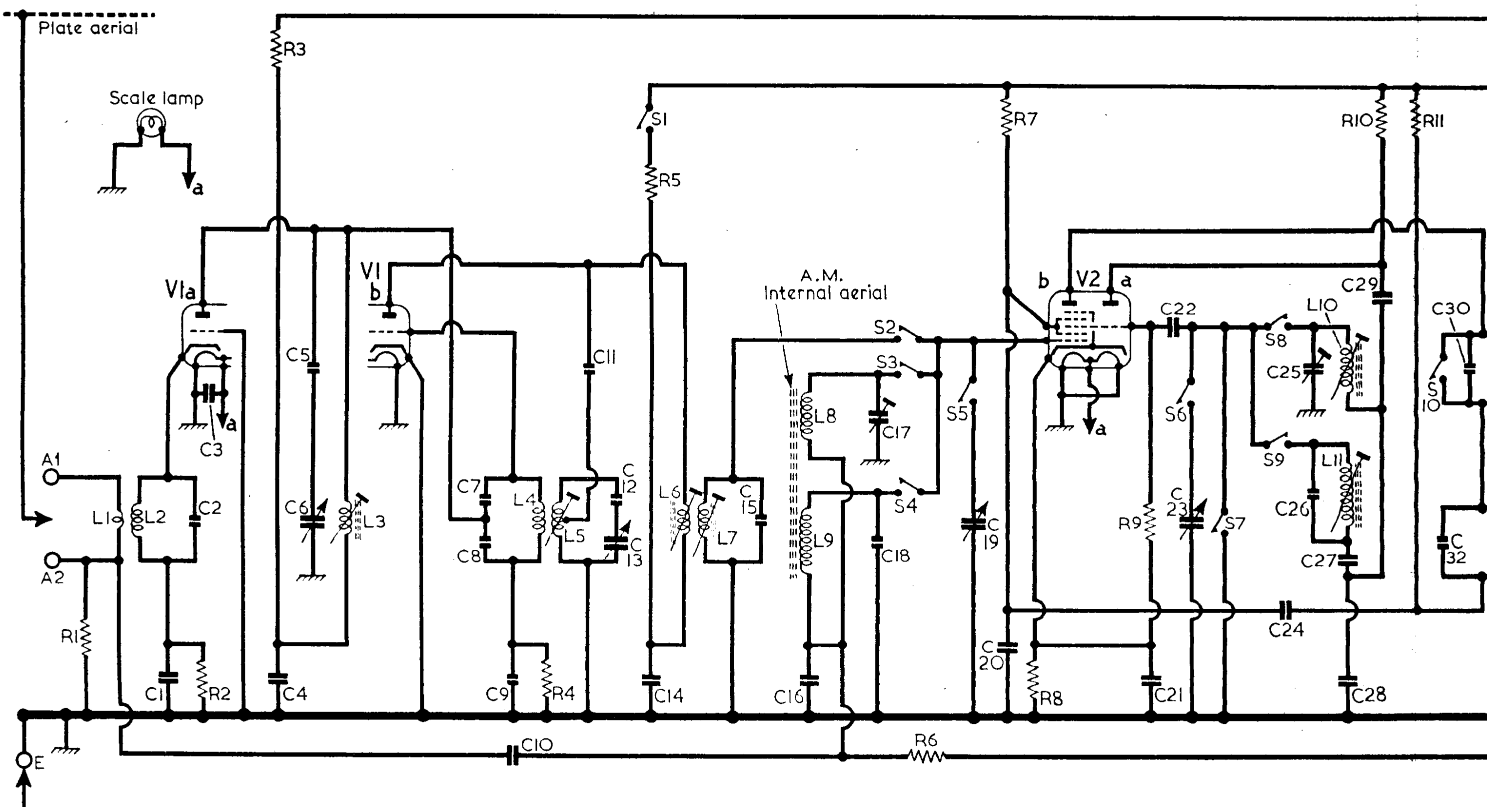
A.M. intermediate frequency 422kc/s.

Diode section **a** of triple diode triode valve **(4, Brimar EABC80)** functions as A.M. signal detector, and the audio frequency component in its rectified output is developed across volume control **R19,** which operates as A.M. diode load, switch **S11** closing on M.W. and L.W. I.F. filtering by **C41, R18** and the capacitance of the screened leads. The A.F. signal developed across **R19** is passed via **C45** to grid of triode section **d** of **V4** which operates as A.F. amplifier. Bias for **V4d** is obtained from the "contact" potential developed across the high value grid leak **R20.**

D.C. potential developed across **R18, R19** is fed back as bias to **V2b** and **V3,** giving automatic gain control on the A.M. bands.

Provision is made for the connection of a gramophone pick-up across the volume control via **S13,** which closes in the gram position of the waveband switch control. Switches **S11** and **S12** open in this position to prevent radio break-through.

Resistance-capacitance coupling by **R21, C46** and **R22** between **V4d** and pentode output valve **(V5, Brimar EL84).** Fixed tone correction in anode circuit by **R26,**



Circuit diagram of the Kolster-Brandes LR10FM. The F.M. and A.M. intermediate frequency transformers are identified as sequence. Coils **L8, L9** are mounted on a length of ferrite rod to form the internal A.M. aerial.

S LR10FM A.M./F.M. RECEIVER

tifier) A.C. table superhet designed for operation
N. A.M. bands and on the F.M. Band II range

C51. Variable tone control in control grid circuit by **R23, C47.**

H.T. current is supplied by I.H.C. full-wave rectifying valve **(V6, Brimar EZ80).** H.T. smoothing by **R24, R25** and electrolytic capacitors **C48, C49, C50.** Residual hum is neutralized by passing H.T. current through section **a** of the output transformer primary winding.

Operation on F.M.

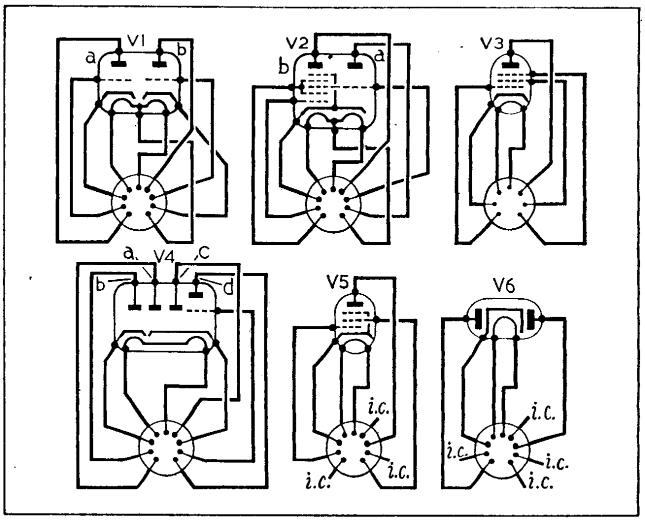
Co-axial 75Ω F.M. aerial input via aperiodic coupling transformer **L1, L2** to earthed-grid R.F. amplifier, section **a** of **V1 (Brimar 12AT7).**

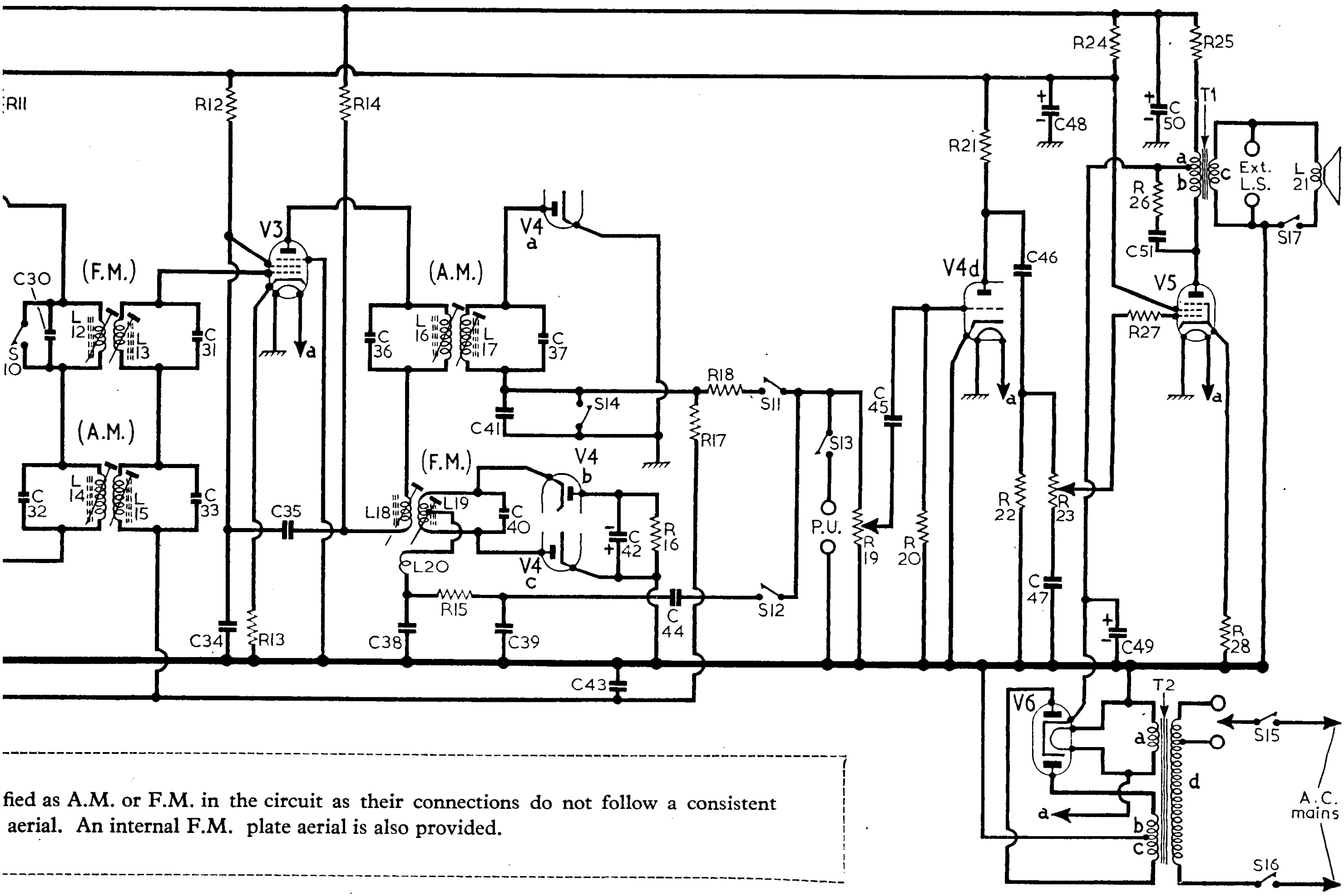
Second valve, section **b** of **V1**, is a triode operating as F.M. oscillator/mixer valve with tuned oscillator anode circuit **L5, C12, C13,** and reaction coupling from the grid circuit via **L4.**

The amplified output from **V1a** is coupled by R.F. tuned circuit **C5, C6, L3** to **V1b** grid circuit via **C7, C8,** which form

(*Continued in col. 9*)

Diagrams of the valve base connections, drawn as seen from the free ends of the valve pins.





fied as A.M. or F.M. in the circuit as their connections do not follow a consistent aerial. An internal F.M. plate aerial is also provided.

COMPONENT VALUES AND LOCATIONS

CAPACITORS		Values	Locations
C1	V1a Cath. by-pass ...	0·001μF	H4
C2	F.M. aerial tune. ...	35pF	H4
C3	Heater by-pass ...	0·002μF	G4
C4	H.T. decoupling ...	0·001μF	H3
C5	} F.M. R.F. tuning ... {	50pF	H3
C6†		—	A2
C7	} F.M. coupling, R.F. {	20pF	A2
C8	to osc.	10pF	A2
C9	V1b C.G.	7pF	A2
C10	A.M. aerial coup....	470pF	H4
C11	V1b anode coup....	20pF	G4
C12	} F.M. osc. tuning ... {	24pF	H3
C13†		—	A1
C14	H.T. decoupling ...	0·002μF	G4
C15	1st F.M. I.F.T. tuning	5pF	A2
C16	A.M. aerial coup....	0·003μF	H4
C17‡	M.W. aerial trim....	60pF	B2
C18	L.W. aerial trim....	75pF	G3
C19†	A.M. aerial tuning	—	A2
C20	V2b S.G. decoup....	470pF	G4
C21	V2 cath. by-pass...	0·01μF	G4
C22	A.M. osc. C.G. ...	100pF	G3
C23†	A.M. osc. tuning ...	—	A1
C24	H.T. decoupling ...	0·01μF	F4
C25‡	M.W. osc. trim. ...	60pF	B1
C26	L.W. osc. trim. ...	75pF	F3
C27	} Osc. trackers ... {	125pF	F3
C28		450pF	G3
C29	V2a anode coup. ...	0·001μF	F4
C30	} 2nd F.M. { Pri....	5pF	F4
C31	I.F.T. tun. Sec....	5pF	B2
C32	} 1st A.M. { Pri. ...	88pF	B2
C33	I.F.T. tun. Sec....	88pF	B2
C34	V3 S.G. decoup. ...	0·002μF	F4
C35	H.T. decoupling ...	0·01μF	E4
C36	} 2nd A.M. { Pri. ...	88pF	B2
C37	I.F.T. tun. Sec....	88pF	B2
C38	A.F. load ...	300pF	E4
C39	De-emphasis ...	0·001μF	F3
C40	3rd F.M. I.F.T. tuning	40pF	E4
C41	I.F. by-pass ...	300pF	F4
C42*	D.C. reservoir ...	2μF	E3
C43	A.G.C. decoupling	0·04μF	F3
C44	} A.F. couplings ... {	0·02μF	F3
C45		0·05μF	E3
C46		0·02μF	E3
C47	Tone control ...	1,500pF	D3
C48*	} H.T. smoothing ... {	10μF	C2
C49*		30μF	C2
C50*		20μF	C2
C51	Tone corrector ...	0·01μF	E4

* Electrolytic. † Variable. ‡ Pre-set.

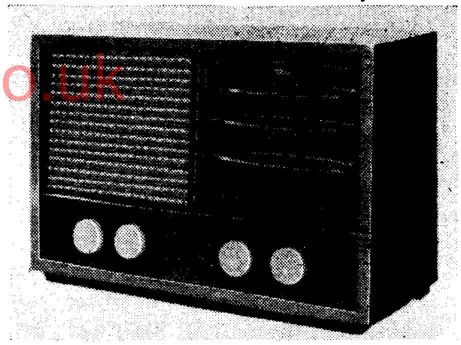
RESISTORS		Values	Locations
R1	A.M. aerial shunt...	3·3kΩ	H4
R2	V1a G.B.	150Ω	H4
R3	H.T. feed	2·2kΩ	G4

(*Continued next col.*)

RESISTORS (*Continued*)		Values	Locations
R4	V1b C.G.	22kΩ	A2
R5	H.T. feed	220Ω	G4
R6	A.G.C. decoupling	220kΩ	B1
R7	V2b S.G. feed ...	27kΩ	G4
R8	V2 G.B.	220Ω	G4
R9	V2a C.G.	47kΩ	G4
R10	V2a anode load ...	27kΩ	G4
R11	H.T. feed	10kΩ	F3
R12	V3 S.G. feed ...	33kΩ	F4
R13	V3 G.B.	68Ω	F4
R14	H.T. feed	2·2kΩ	E4
R15	De-emphasis ...	47kΩ	E4
R16	D.C. load	39Ω	E3
R17	A.G.C. decoupling	2·2MΩ	F3
R18	I.F. stopper ...	100kΩ	F3
R19	Volume control ...	500kΩ	E3
R20	V4d C.G.	10MΩ	E3
R21	V4d anode load ...	470kΩ	E3
R22	V5 C.G.	220kΩ	D3
R23	Tone control ...	250kΩ	D3
R24	} H.T. smoothing ... {	1kΩ	E4
R25		820Ω	D4
R26	Tone corrector ...	4·7kΩ	D3
R27	V5 C.G. stopper ...	47kΩ	E3
R28	V5 G.B.	100Ω	E3

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	} F.M. aerial coupling {	—	H4
L2	coils	—	H4
L3	F.M. R.F. coil ...	—	H3
L4	} F.M. oscillator coils {	—	A2
L5		—	A2
L6	} F.M. I.F.T. { Pri. ...	0·6	B2
L7	Sec....	0·6	B2
L8	} Internal A.M. aerial {	0·5	B1
L9	coils	14·0	B1
L10	M.W. osc. coil ...	4·5	F3
L11	L.W. osc. coil ...	9·5	F3
L12	} 2nd F.M. { Pri. ...	0·8	B2
L13	I.F.T. Sec. ...	0·8	B2
L14	} 1st A.M. { Pri. ...	20·0	B2
L15	I.F.T. Sec. ...	20·0	B2
L16	} 2nd A.M. { Pri. ...	20·0	B2
L17	I.F.T. Sec. ...	20·0	B2
L18	} 3rd F.M. { Pri ...	0·6	B2
L19	I.F.T. Sec. (tot.)	0·6	B2
L20	Tert. ...	—	B2
L21	Speech coil	2·5	—
T1	O.P. trans. { a ...	5·0	
	b ...	700·0	B1
	c ...	—	
T2	Mains trans. { a ...	—	
	b ...	175·0	
	c ...	175·0	C1
	d, total	38·0	
S1-S14	Waveband switches	—	G3
S15, S16	Mains sw., g'd R23	—	D3
S17	Int. speaker sw. ...	—	C2

Dealers are reminded that if the component numbers given in the accompanying tables are used when ordering replacement parts, it is advisable to mention the fact on the order, as these numbers may differ from those used in the manufacturers' circuit diagram.



Appearance of the K.-B. LR10FM.

Circuit Description—*continued*

two arms of a bridge neutralizing circuit to reduce oscillator radiation and prevent interaction between the R.F. and oscillator circuits. Oscillator tuning by **C13** and R.F. tuning by **C6**, which are parts of the tuning gang.

The I.F. signal in **V1b** output is coupled via I.F. transformer **L6**, **L7**, **C15** to section **b** of **V2**, which functions as 1st F.M. I.F. amplifier when the receiver is switched to F.M., **S2** being closed.

F.M. intermediate frequency 10.7 Mc/s.

V3 operates as second I.F. amplifier with tuned transformer couplings **C30**, **L12**, **L13**, **C31** and **L18**, **L19**, **L20**, **C40**.

Diode sections **b** and **c** of **V4** operate in a ratio detector circuit, whose A.F. output is developed across **C38** and fed via de-emphasis circuit **R15**, **C39** to the volume control circuit. Limiting by "flywheel" effect of D.C. reservoir **C42**.

V2b is neutralized by **C24**, **C20** and **V3** is neutralized by **C35**, **C34**, these capacitors forming part of a bridge circuit with the inter-electrode capacitances of the valves.

MODIFICATIONS

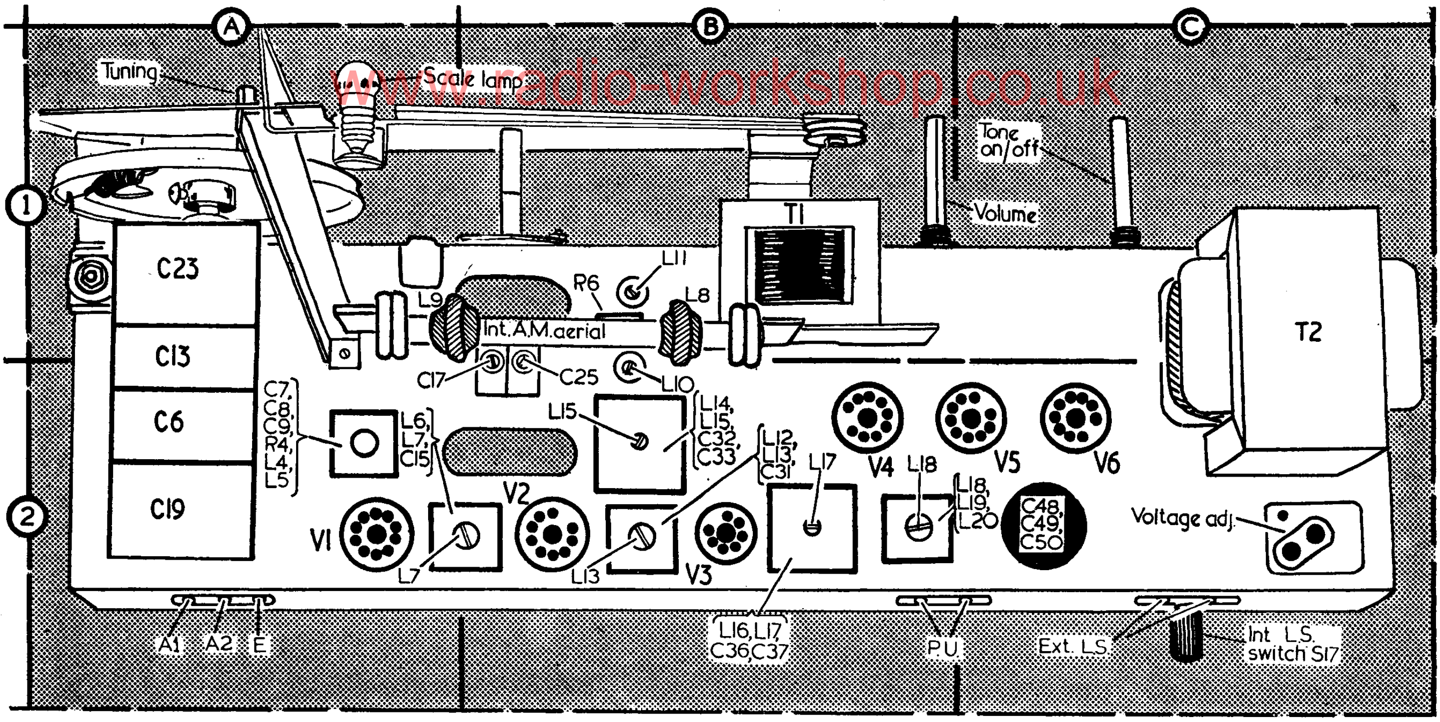
Earlier Receivers.—These differed from our sample model in the following respects. **C44** was omitted, the junction of **R15**, **C39** being connected directly to **S12**. **R18** was omitted, the junction of **L17**, **C41** being connected directly to **S11**, **R17**. **R27** was omitted, the slider of the tone control being connected directly to **V5** control grid. A grid stopper was originally inserted between the junction of **C45**, **R20** and the grid of **V4d**.

Later Receivers.—**S14** is connected across **C43** instead of across **C41**. **R3** is connected to the junction of **R5**, **S1** instead of to the H.T. positive line.

GENERAL NOTES

Switches.—**S1-S14** are the waveband/gram switches ganged in two rotary units beneath the chassis. These units are identified by diamond enclosed numbers 1 and 2 in the underchassis illustration, in which arrows pointing to the units indicate the direction in which they are viewed in the detailed diagram of the units in col. 4 overleaf. In the associated switch table, which appears immediately below the switch diagrams, the switch operations for the four control settings are given, starting with the control

(*Continued col. 1 overleaf*)



Plan illustration of the chassis. The internal speaker switch **S17** in location C2 is unscrewed to mute the internal speaker.

General Notes—*continued*

fully anti-clockwise. A dash indicates open, and **C**, closed.

Scale lamp.—This is a 6.3 V, 0.3 A lamp, with a small clear spherical bulb and an M.E.S. base.

Drive Cord Replacement.—About 48in of nylon braided glass yarn is required for a new drive cord. With the gang turned to minimum capacitance, one end of the cord should be tied to the drive spring. Anchor the free end of the spring to the drive drum as indicated in the sketch of the drive cord system at the foot of columns 8 and 9. In the sketch the system is drawn as seen from the front of the receiver, looking through the scale backing plate.

Take the cord out through the slot in the drum periphery and run on anti-clockwise round the drum, carrying on as indicated in the sketch. Finally, tie off the other end of the drive cord to the spring. When the drive cord is correctly tensioned, the spring should be extended to approximately one inch.

Internal and External Aerials.—An internal plate aerial is fitted in the cabinet and can be used for F.M. reception by plugging it into the **A1** aerial socket. An internal ferrite rod aerial **L8, L9** is provided for A.M. reception. Provision is made on both F.M. and A.M. bands for the connection of an external aerial and earth.

For F.M. reception an external dipole can be connected via 75Ω co-axial feeder to the **A1** and **A2** aerial sockets. For A.M. reception an external aerial and earth can be connected to the **A2** and **E** sockets.

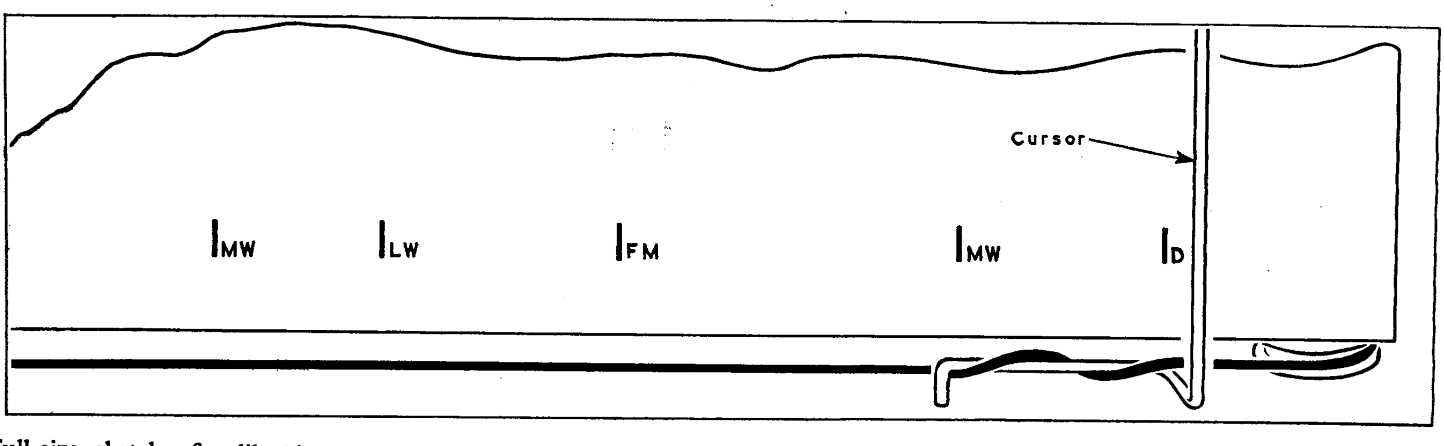
VALVE ANALYSIS

Valve voltages and currents in the table (next column) are those measured in our sample receiver when it was operating from A.C. mains of 230 V. Readings for **V1** were taken with the receiver switched to F.M., but the remaining readings were taken with the receiver switched to M.W., and tuned to a point at the high wavelength end of the band where there was no signal pick-up.

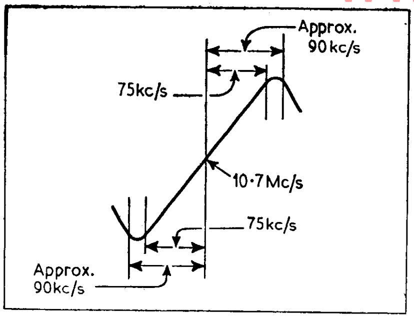
Voltages were measured on an Avo Electronic Testmeter, and as this instrument has a high internal resistance, allowance should be made for the current drawn by other types of meter. Chassis was the negative connection.

Valves	Anode		Screen		Cath.
	V	mA	V	mA	V
V1 12AT7 a	150·0	7·0	—	—	1·0
V1 12AT7 b	160	13·5	—	—	—
V2 12AH8 a	44	4·5	—	—	2·4
V2 12AH8 b	90	4·2	83	3·5	2·4
V3 6BJ6 ...	176	8·0	85	3·0	0·6
V4 EABC80 a-c	—	—	—	—	—
V4 EABC80 d	73	0·28	—	—	—
V5 EL84 ...	200	44·0	195	5·0	4·0
V6 EZ80 ...	222*	—	—	—	225†

* A.C. each anode. † Cathode current, 70mA.

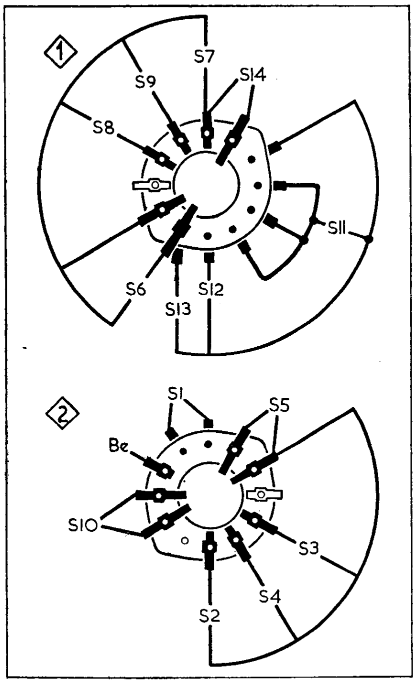


Full-size sketch of calibration on scale backing plate. It can be clipped in place during alignment if marks become obliterated.



F.M. I.F. response curve.

Switch Diagrams and Table



Diagrams of the waveband switch units as seen from the rear of an inverted chassis. The units are identified in the under-chassis view by numbers 1 and 2 in diamonds. The associated switch table appears below.

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

CIRCUIT ALIGNMENT

Equipment Required. — A spot-frequency signal generator covering the range of 140 kc/s to 1,700 kc/s. An F.M. signal generator (sine wave or externally wobbulated) covering the F.M. intermediate frequency of 10.7 Mc/s and the frequency range of 85 Mc/s to 100 Mc/s, with a deviation of at least ±150 kc/s. An Avometer Model 8, or similar multi-range meter. An oscilloscope.

A.M. I.F. Stages.—Switch receiver to M.W., and turn gang to maximum capacitance. Connect output of spot-frequency signal generator, via an 0.1μF capacitor in the "live" lead, to control grid (pin 2) of **V2b** and chassis. Feed in a 422 kc/s signal and, first fully unscrewing the cores of **L15** (location reference B2) and **L16** (E4), adjust the cores of **L17** (B2), **L16** (E4), **L14** (F4) and **L15** (B2) in that order, for maximum output. Do not re-adjust unless complete procedure is repeated.

R.F. and Oscillator Stages.—Check that with the gang at maximum capacitance, the cursor coincides with datum line "D" on the scale backing plate. As the tuning scale is fixed to the cabinet, reference must be made to calibration marks on the scale backing plate when the chassis is removed from the cabinet for alignment purposes. A full-size sketch of these calibration marks is shown at the foot of columns 1-3 and direct reference can be made to it if the calibration marks on the scale backing plate become obliterated.

The spot-frequency signal generator should be connected to the **A2** and **E** sockets via an all-wave dummy aerial, and its output should be progressively reduced to prevent overloading as the sensitivity increases during alignment.

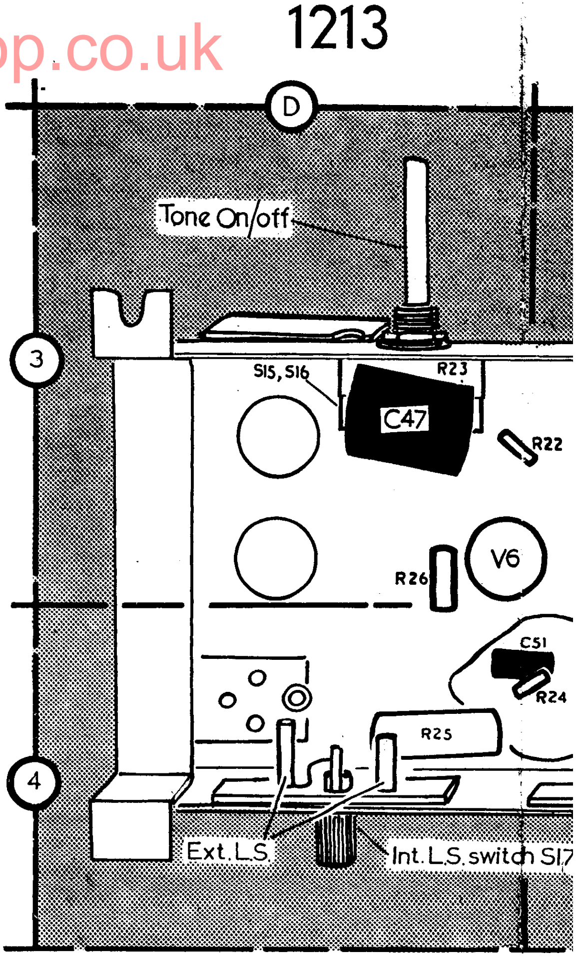
M.W.—Switch receiver to M.W. and tune to right-hand side "MW" calibration mark on scale backing plate. Feed in a 600 kc/s (500m) signal and adjust the core of **L10** (B1) for maximum output. Tune receiver to left-hand side "MW" calibration mark on scale backing plate, feed in a 1,400 kc/s (214.3m) signal and adjust **C25** (B2) and **C17** (B2) for maximum output. Repeat these operations whilst rocking the gang for optimum results.

L.W.—Switch receiver to L.W. and tune to "LW" calibration mark on scale backing plate. Feed in a 225 kc/s (1,333m) signal and adjust the core of **L11** (B1) for maximum output.

F.M. I.F. Stages.—Switch receiver to F.M. Set multi-range meter to 10 V D.C. range and connect it across **C42** (E3), taking the positive lead to chassis. Connect output of F.M. signal generator, via an 0.001μF capacitor in the "live" lead, to control grid (pin 1) of **V3** and chassis.

Fully unscrew the cores of **L19** (E4), **L13** (B2) and **L7** (A2) and, feeding in an unmodulated 10.7 Mc/s signal, adjust the core of **L18** (B2) for maximum output on the meter.

Transfer "live" F.M. signal generator lead, with 0.001μF capacitor, to anode (pin 1) of **V1a.** Feeding in an unmodulated 10.7 Mc/s signal, adjust the output of the F.M. signal generator so that the meter reading does not exceed 5 V.

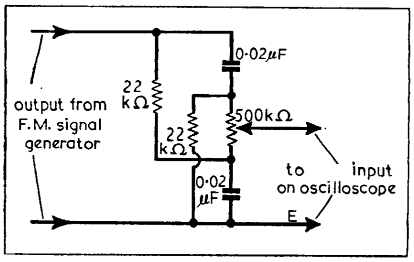


Underchassis illustration, identifying the waveband swi

Now adjust cores **L18** (C2), **L12** (F4), **L13** (B2), **L6** (G4) and **L7** (A2) in that order for maximum output on meter.

Connect two accurately matched 47kΩ resistors in series across **C42** in place of meter. Set meter to 250μA D.C. range and connect it between the junction of these resistors and the junction of **R15, C39.**

Adjust the core of **L19** (E4) for zero current reading on the meter. This is carried out by screwing the core slowly in from the fully unscrewed position. The current will start at or near zero, then rise to a positive peak, decrease again, and pass through zero to a negative peak. The point at which the current passes



Circuit for correcting phase shift in wobbulator sync output to oscilloscope.

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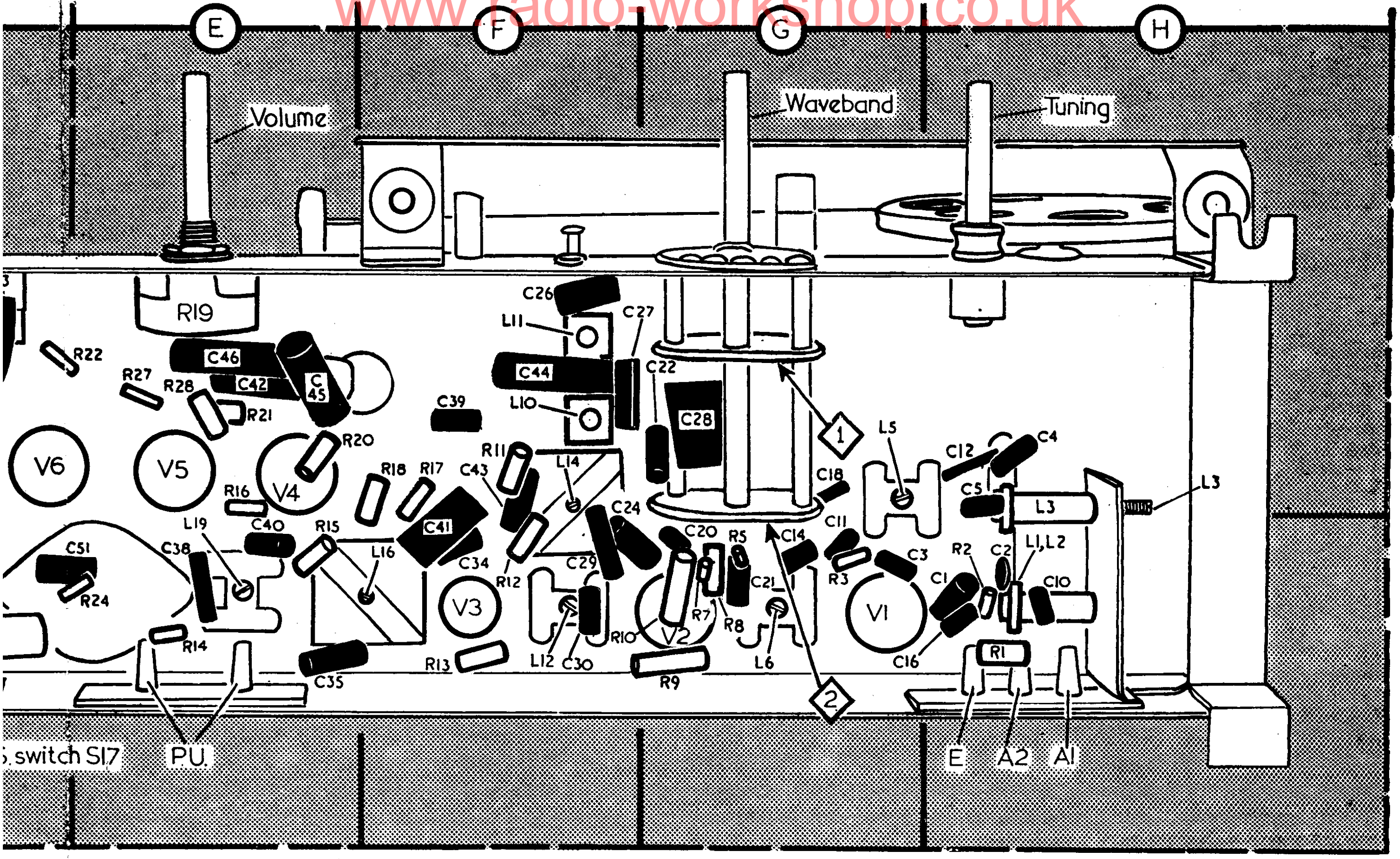


'aveband switch units in location reference G3, G4. These units are shown in detail in column 4, together with their associated switch table.

through zero is the correct setting of the core.

F.M. I.F. Response Curve.—Connect the "Y" amplifier terminals on oscilloscope across the outer tags of the volume control, using a screened lead.

With the output of the F.M. signal generator connected via an 0.001μF capacitor to the anode (pin 1) of **V1a** and chassis, feed in a 10.7 Mc/s signal deviated $\pm$150 kc/s, and check that the response curve on the oscilloscope is similar to that shown in the diagram in column 4. The response curve should consist of a straight line over the centre portion, with a fold over at each end symmetrically placed about the centre intermediate frequency of 10.7 Mc/s.

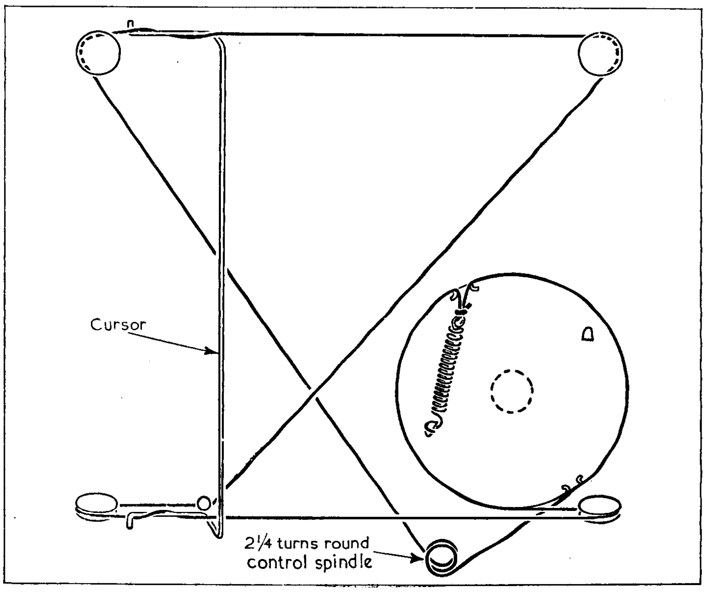
A slight adjustment of the core of **L19** may be necessary to achieve optimum linearity and symmetry of the response curve.

In cases where the "X" deflection of the oscilloscope is driven by a sine waveform from the signal generator, a double image of the curve may be present, having the appearance of two response curves slightly displaced from each other. This is due to phase shift, and the two curves can be made to coincide by inserting a phase-shift network in the leads from the signal generator to the oscilloscope.

The circuit of a suitable phase shift network is shown at the foot of col. 6. By adjusting the 500kΩ variable control, the two curves can be made to merge into one another, thereby ensuring easier and more accurate alignment of the discriminator circuit.

F.M. R.F. and Oscillator Stages.—With the receiver switched to F.M., tune to "FM" calibration mark on the scale backing plate. Connect output of F.M. signal generator via a 75Ω co-axial feeder to the **A1** and **A2** aerial sockets.

Feed in a 93 Mc/s signal, deviated by $\pm$25 kc/s and adjust the cores of **L5** (G4) and **L3** (H4) for maximum sound output.



Sketch of the tuning drive system, drawn as seen from the front of the chassis, looking through the scale backing plate, with the gang set to minimum capacitance.