KOLSTER-BRANDES GR40

10-Band Superhet with Seven Band-spread Ranges

SEVEN band-spread ranges are provided on the Kolster-Brandes GR40, in addition to the normally tuned S.W., M.W., and L.W. bands. The waveband ranges are 1,000-2,300 m, 188-560 m, 58.7-188 m (designated the Trawler band) and band-spread coverages of 5.95-6.3 Mc/s for the 49-m band, 7.0-7.4 Mc/s (42 m), 9.35-9.9 Mc/s (31 m), 11.5-12.1 Mc/s (25 m), 14.8-15.8 Mc/s (19 m), 17.2-18.4 Mc/s (16 m) and 20.8-22.4 Mc/s (13 m). Each band is calibrated on a 9in scale on a rotary drum.

Provision is made for the connection of a gramophone pick-up and an external speaker, and switches are provided to mute radio and the internal speaker. The mains transformer is double-wound, and a third wire is provided in the mains cable for an earth connection.

Release date and original price: August, 1951; £27 6s 3d plus purchase tax.

CIRCUIT DESCRIPTION

Aerial input on the normal S.W. tuning band, designated the Trawler band, is via a tapping in the tuning coil **L1.** On M.W. and L.W. coupling is via the capacitative potential dividers **C1, C2** (M.W.) and **C1, C3** (L.W.) to single-tuned circuits **L2, C42** and **L3, C42** respectively. On these ranges **S18** is closed and **S19** open. They precede a variable-mu R.F. pentode valve **(V1, Brimar 6BA6)** which operates as signal frequency amplifier.

On the seven band-spread ranges **S18** opens, and **S1, S19** close, and the band-spread coils **L4** (49 m), **L5** (42 m), **L6** (31 m), **L7** (25 m), **L8** (19 m), **L9** (16 m) and **L10** (13 m) are variably tuned by **C42** in conjunction with band-spreading capacitors **C4, C5.** Aerial coupling is via **C1** to the junction of **C4, C5.**

Aperiodic resistance-capacitance coupling by **R4, C10** and **R6** is employed on the three normal broadcast bands between **V1** and a heptode valve **(V2, Brimar 6BE6)** which operates as frequency changer with electron coupling. On the band-spread ranges the control grid circuit of **V2** is fixed-tuned by **C12** and coils **L11** (49 m), **L12** (42 m), **L13** (31 m), **L14** (25 m), **L15** (19 m), **L16** (16 m) and **L17** (13 m) to the mid-points of their respective bands.

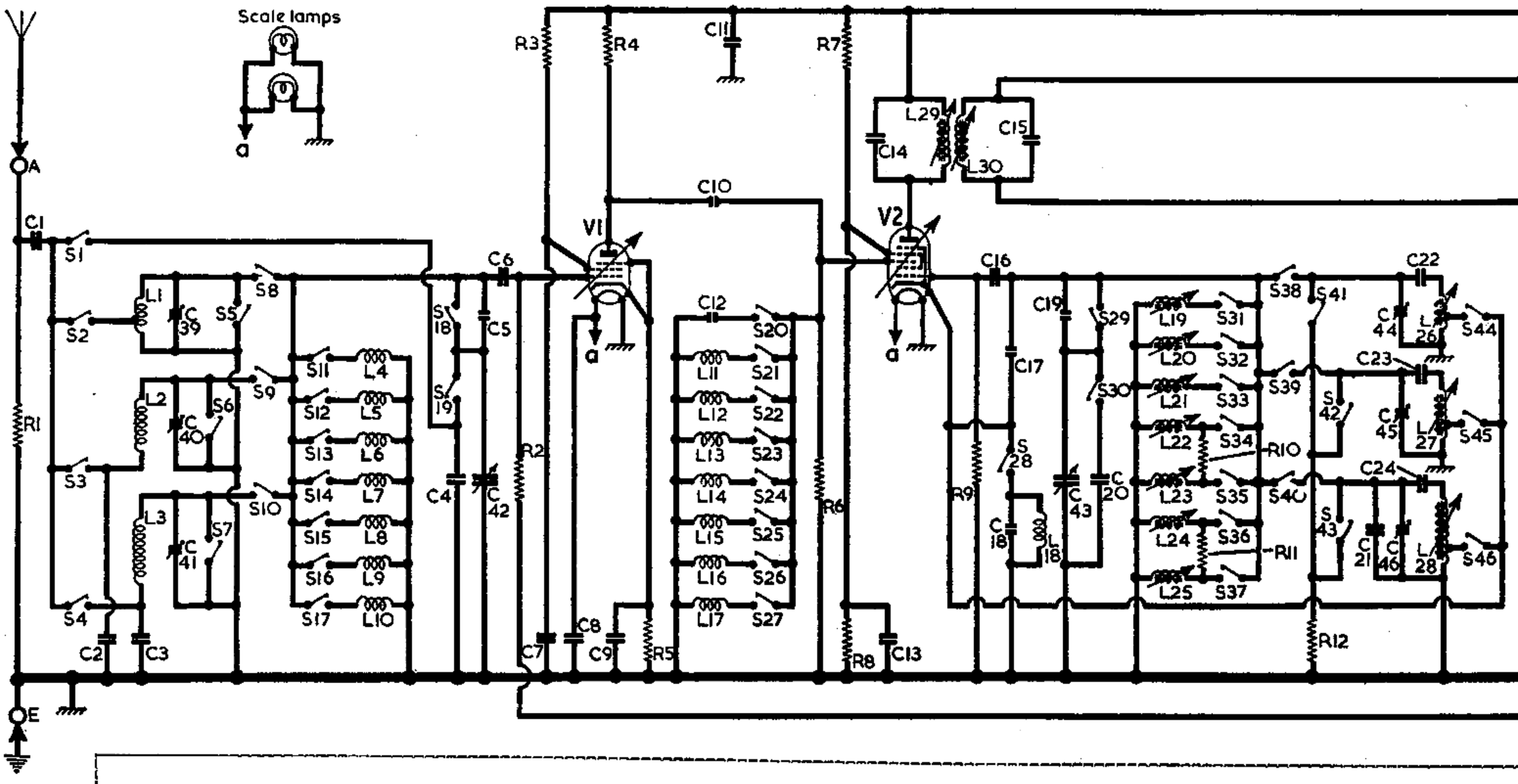
In the oscillator circuit, on the three normal waveband ranges **S29** closes, **S30** opens, and oscillator coils **L26** (S.W.), **L27** (M.W.) and **L28** (L.W.) are tuned by **C43.** Parallel trimming by **C44** (S.W.), **C45** (M.W.) and **C21, C46** (L.W.); series tracking by **C22** (S.W.), **C23** (M.W.) and **C24** (L.W.), in the high potential sides of the circuit. Reaction coupling from cathode via coil tappings.

For band-spread operation, **S29** opens, **S30** closes, and the band-spread coils **L19** (49 m), **L20** (42 m), **L21** (31 m), **L22** (25 m), **L23** (19 m), **L24** (16 m) and **L25** (13 m) are tuned by **C20, C43** via band-spreading capacitor **C19.** Reaction coupling from cathode across common impedance of **L18, C18** in A.C. potential divider **C17, L18, C18.**

Third valve **(V3, Brimar 6BA6)** is a variable-mu R.F. pentode, operating as intermediate frequency amplifier with tuned transformer couplings **C14, L29, L30, C15** and **C28, L31, L32, C29.**

Intermediate frequency 422 kc/s.

Diode signal detector is part of double diode triode valve **(V4, Brimar 6AT6).** Audio frequency component in rectified output, developed across manual volume control **R18,** which acts as diode load, is passed via **C32** to control grid of triode section. I.F. filtering by **C30, R15** and **C31.** D.C. potential developed across **R18** is fed back as bias via decoupling



Circuit diagram of the Kolster-Brandes GR40 A.C. superhet. The three normally-tuned waveband coils are drawn vertically, ar horizontally. Reading from top to bottom the bands are respectively: trawler, M.W., L.W., and then 49 m, 42 m, 31 m, 25 m, **V1** is aperiodically coupled to **V2,** but on the band-spread ranges the coils are fixed-tune

circuit **R16, C26** to R.F., F.C. and I.F. stages, giving automatic gain control.

Resistance-capacitance coupling, via **R21, C34** and **R22,** between **V4** triode and beam tetrode output valve **(V5, Brimar 6V6GT).** Variable tone control by **R22** and **C33,** giving negative feed-back between control grids of **V5** and **V4.** Tone correction by negative feed-back between winding **e** on output transformer **T1** and lower end of volume control **R18.**

To prevent negative feed-back voltages appearing at the top end of **R18** and operating the signal diode, a balanced bridge circlit is formed by windings **d, e** on **T1** and resistors **R17, R18,** the junction of **R17, R18** being at zero feed-back potential. **C37, R25** and **R26** form a frequency correcting network in the feed-back path.

H.T. current is supplied by I.H.C full-wave rectifying valve **(V6, Brimar 6X4).** Smoothing by **R23** and electrolytic capacitors **C35, C36,** residual hum being neutralized by passing the H.T. current through a section of **T1** primary. **V6** is connected to the same heater winding on **T2** as the other valves.

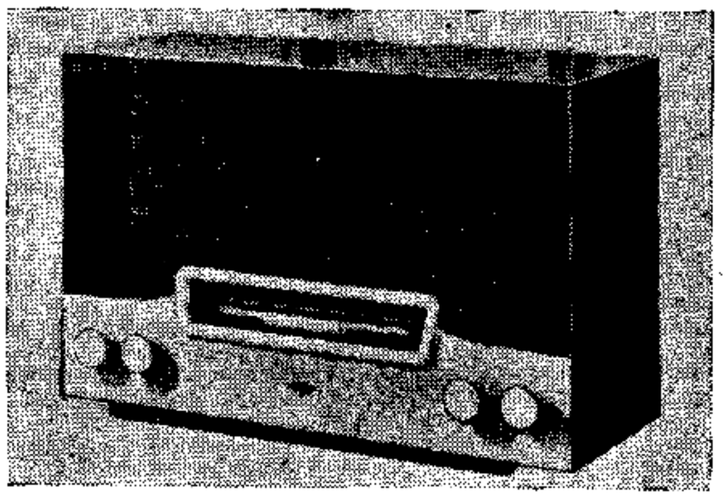
DISMANTLING THE SET

Removing Chassis.—Remove four control knobs (recessed grub screws) :

unsolder leads from speech coil tags on speaker;

remove four 2BA cheese-head chassis bolts, with shake-proof and claw washers, and withdraw chassis from cabinet.

When replacing, the speaker leads are connected to the outer speaker tags, the centre tag being blank.

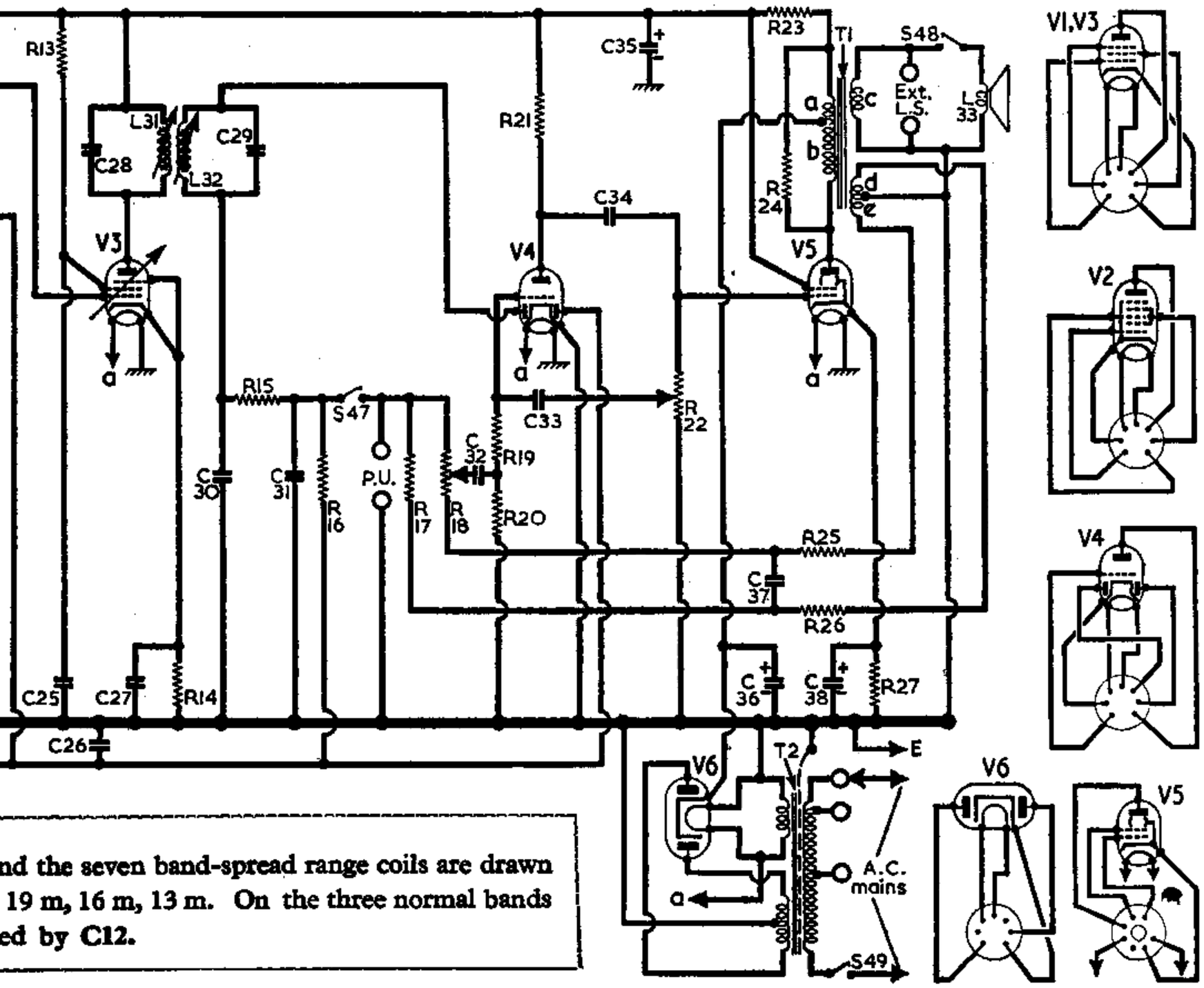


COMPONENTS AND VALUES

	RESISTORS	Values	Locations
R1	Mod. hum shunt ...	10kΩ	F5
R2	V1 C.G.	220kΩ	E4
R3	V1 S.G. feed ...	33kΩ	E4
R4	V1 anode load ...	15kΩ	E4
R5	V1 G.B.	68Ω	E4
R6	V2 C.G.	220kΩ	E4
R7	V2 S.G. pot. divider	10kΩ	E4
R8		27kΩ	E4
R9	V2 osc. C.G. ...	22kΩ	E4
R10	Oscillator damping	15kΩ	E5
R11		10kΩ	F5
R12	Oscillator shunt ...	100Ω	E5
R13	V3 S.G. feed ...	33kΩ	D4
R14	V3 G.B.	68Ω	D4
R15	I.F. stopper ...	47kΩ	D4
R16	A.G.C. decoupling	2MΩ	D4
R17	Feed-back neut. ...	4·7MΩ	D3
R18	Volume control ...	5MΩ	D3
R19	V4 C.G.	100kΩ	D3
R20		10MΩ	D3
R21	V4 anode load ...	470kΩ	D4
R22	Tone control ...	500kΩ	C3
R23	H.T. smoothing ...	820Ω	C3
R24	T1 shunt	47kΩ	C3
R25	Neg. feed-back ...	240Ω	D3
R26		2·2kΩ	C3
R27	V5 G.B.	240Ω	D3

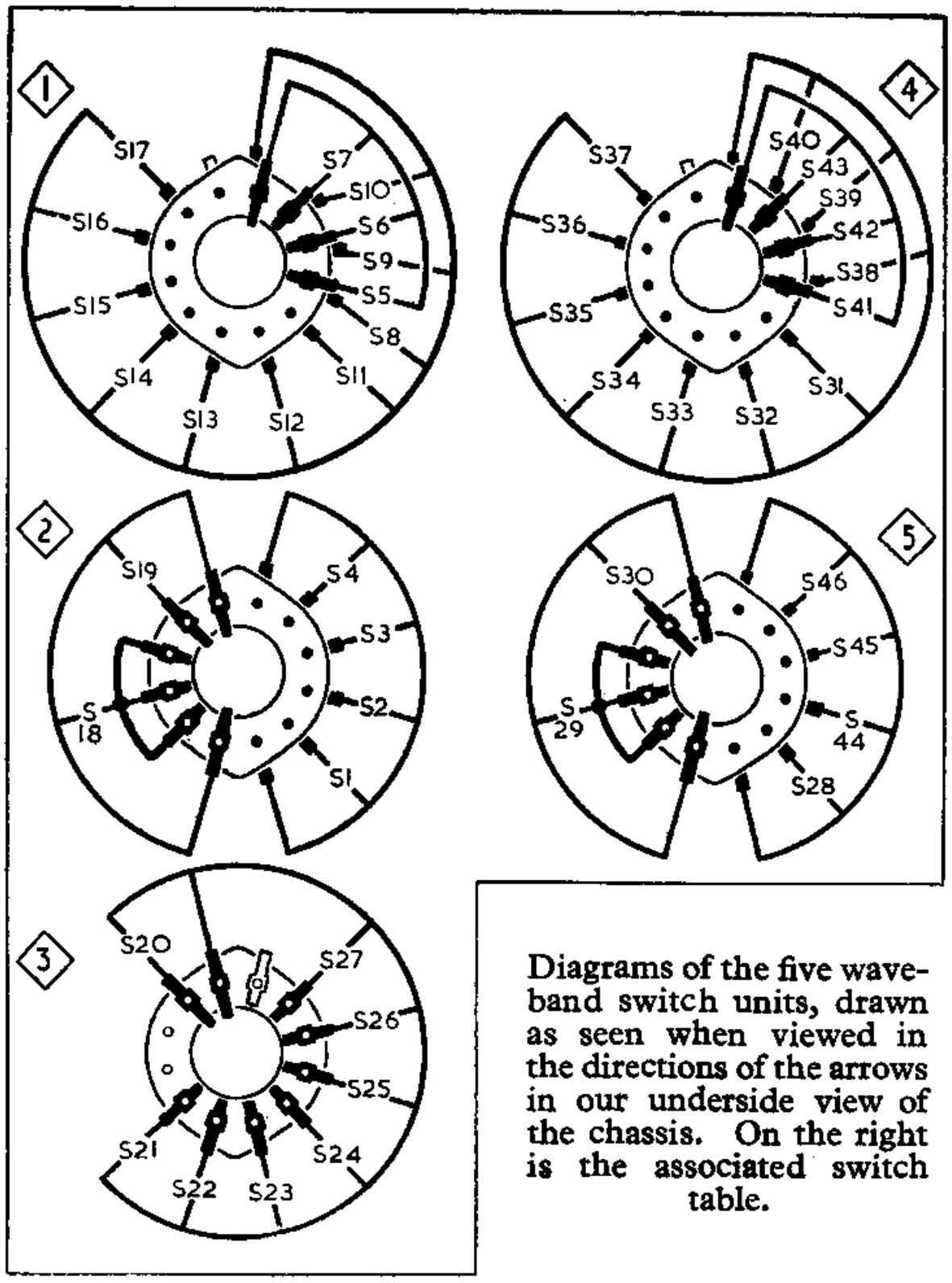
	CAPACITORS	Values	Locations
C1	Aerial series ...	0·005μF	F5
C2	M.W. coupler ...	0·005μF	E3
C3	L.W. coupler ...	0·005μF	E3
C4	Band-spread trim.	100pF	F3
C5	Band-spreader ...	40pF	F3
C6	V1 C.G.	100pF	E4
C7	V1 S.G. decoup. ...	0·02μF	E4
C8	Heater by-pass ...	0·1μF	E4
C9	V1 cath. by-pass ...	0·02μF	E4
C10	R.F. coupling ...	25pF	E4
C11	H.T. decoupling ...	2μF	E3
C12	Band-spread tune...	34pF	E4
C13	V2 S.G. decoup. ...	0·02μF	E4
C14	1st I.F. trans. tuning	250pF	B2
C15		250pF	B2
C16	V2 osc. C.G. ...	100pF	E5
C17	Oscillator coupling	20pF	E5
C18		60pF	E4
C19	Band-spreader ...	§40pF	E5
C20	Band-spread trim.	100pF	F5
C21	L.W. osc. trim. ...	100pF	E5
C22	S.W. osc. tracker...	0·002μF	E4
C23	M.W. osc. tracker...	550pF	E5
C24	L.W. osc. tracker...	200pF	E5
C25	V3 S.G. decoup. ...	0·02μF	D4
C26	A.G.C. decoupling	0·02μF	D5
C27	V3 cath. by-pass ...	0·1μF	D5
C28	2nd I.F. trans. tuning	250pF	B1
C29		250pF	B1
C30	I.F. by-passes ...	100pF	D4
C31		100pF	D4
C32	A.F. coupling ...	0·005μF	D3
C33	Part tone control...	100pF	D3
C34	A.F. coupling ...	0·02μF	D3
C35*	H.T. smoothing ...	32μF	B1
C36*		32μF	B1
C37	Neg. feed-back ...	0·1μF	D3
C38*	V5 cath. by-pass ...	25μF	C4
C39‡	S.W. aerial trim. ...	—	A1
C40‡	M.W. aerial trim....	—	A1
C41‡	L.W. aerial trim. ...	—	A1
C42†	Aerial tuning ...	—	A1
C43†	Oscillator tuning ...	—	A1
C44‡	S.W. osc. trim. ...	—	A2
C45‡	M.W. osc. trim. ...	—	A2
C46‡	L.W. osc. trim. ...	—	A2

* Electrolytic. † Variable. ‡ Pre-set. § 33pF + 7pF (negative temp. coeff.), in parallel.



nd the seven band-spread range coils are drawn
19 m, 16 m, 13 m. On the three normal bands
ed by C12.

	OTHER COMPONENTS	Approx. Values (ohms)	Locations
L1	Aerial tuning coils	1·6	E3
L2		8·0	E3
L3		35·0	E4
L4	Band-spread aerial tuning coils ...	—	F3
L5		—	F4
L6		—	F3
L7		—	F4
L8		—	F3
L9		—	F4
L10		—	F3
L11		—	F4
L12		—	F4
L13		—	F4
L14	Band-spread R.F. tuning coils ...	—	F4
L15		—	F4
L16		—	F4
L17		—	F4
L18	B-s osc. coup. ...	10·0	E5
L19	Band-spread osc. tuning coils ...	—	E5
L20		—	F4
L21		—	F4
L22		—	F5
L23		—	F5
L24		—	F5
L25		—	F5
L26	Oscillator tuning coils	1·2	E5
L27		4·0	E5
L28		9·5	E5
L29	1st I.F. trans. Pri.	5·0	B2
L30	Sec.	5·0	B2
L31	2nd I.F. trans. Pri.	5·0	B1
L32	Sec.	5·0	B1
L33	Speech coil ...	2·8	—
T1	O.P. trans. a ...	2·0	B1
	b ...	200·0	
	c ...	—	
	d ...	3·0	
	e ...	1·0	
T2	Primary, total ...	30·0	B1
	H.T. sec., total ...	216·0	
	Heater secondary...	—	—
S1-S46	Waveband switches	—	E3
S47	P.U. switch ...	—	D5
S48	Int. L.S. switch ...	—	D5
S49	Mains sw., g'd R22	—	C3



Diagrams of the five waveband switch units, drawn as seen when viewed in the directions of the arrows in our underside view of the chassis. On the right is the associated switch table.

Switch	L.W.	M.W.	S.W.	49 m	42 m	31 m	25 m	19 m	16 m	13 m
S1	—	—	—	C	C	C	C	C	C	C
S2	—	—	C	—	—	—	—	—	—	—
S3	—	C	—	—	—	—	—	—	—	—
S4	C	—	—	—	—	—	—	—	—	—
S5	C	C	—	C	C	C	C	C	C	C
S6	C	—	C	C	C	C	C	C	C	C
S7	—	C	C	C	C	C	C	C	C	C
S8	—	—	C	—	—	—	—	—	—	—
S9	—	C	—	—	—	—	—	—	—	—
S10	C	—	—	—	—	—	—	—	—	—
S11	—	—	—	C	—	—	—	—	—	—
S12	—	—	—	—	C	—	—	—	—	—
S13	—	—	—	—	—	C	—	—	—	—
S14	—	—	—	—	—	—	C	—	—	—
S15	—	—	—	—	—	—	—	C	—	—
S16	—	—	—	—	—	—	—	—	C	—
S17	—	—	—	—	—	—	—	—	—	C
S18	C	C	C	—	—	—	—	—	—	—
S19	—	—	—	C	C	C	C	C	C	C
S20	—	—	—	C	C	C	C	C	C	C
S21	—	—	—	C	—	—	—	—	—	—
S22	—	—	—	—	C	—	—	—	—	—
S23	—	—	—	—	—	C	—	—	—	—
S24	—	—	—	—	—	—	C	—	—	—
S25	—	—	—	—	—	—	—	C	—	—
S26	—	—	—	—	—	—	—	—	C	—
S27	—	—	—	—	—	—	—	—	—	C
S28	—	—	—	C	C	C	C	C	C	C
S29	C	C	C	—	—	—	—	—	—	—
S30	—	—	—	C	C	C	C	C	C	C
S31	—	—	—	C	—	—	—	—	—	—
S32	—	—	—	—	C	—	—	—	—	—
S33	—	—	—	—	—	C	—	—	—	—
S34	—	—	—	—	—	—	C	—	—	—
S35	—	—	—	—	—	—	—	C	—	—
S36	—	—	—	—	—	—	—	—	C	—
S37	—	—	—	—	—	—	—	—	—	C
S38	—	—	C	—	—	—	—	—	—	—
S39	—	C	—	—	—	—	—	—	—	—
S40	C	—	—	—	—	—	—	—	—	—
S41	C	C	—	C	C	C	C	C	C	C
S42	C	—	C	C	C	C	C	C	C	C
S43	—	C	C	C	C	C	C	C	C	C
S44	—	—	C	—	—	—	—	—	—	—
S45	—	C	—	—	—	—	—	—	—	—
S46	C	—	—	—	—	—	—	—	—	—

VALVE ANALYSIS

Valve voltages and currents given in the table below were measured in our receiver when it was operating from A.C. mains of 230 V. The receiver was tuned to the highest wavelength end of M.W. with the volume control at maximum, but there was no signal input.

Voltage readings were measured with an Avo Electronic TestMeter, and as this instrument draws no appreciable current, allowance must be made for the current drawn by other types. Chassis was the negative connection.

Valve	Anode		Screen		Cath.
	V	mA	V	mA	V
V1 6BA6	75	7·0	100	3·0	0·7
V2 6BE6	190	3·4	90	6·4	—
V3 6BA6	190	8·0	95	3·0	0·7
V4 6AT6	57	0·28	—	—	—
V5 6V6GT	220	36·0	190	3·0	9·0
V6 6X4	200†	—	—	—	223·0

† A.C. voltage each anode.

GENERAL NOTES

Switches.—**S1-S46** are the waveband switches, ganged in five rotary units beneath the R.F. section of the chassis. They are indicated in our underside view of the chassis, where they are identified by the numbers **1-5** in diamond surrounds, with arrows to show which way round they are viewed in the diagrams seen above, where they are shown in detail. It should be noted that whereas units **1, 2, 4, 5** are drawn as seen from the front of an inverted chassis, **3** is viewed from the rear of an inverted chassis.

The table beside the diagrams gives the switch positions for the ten control settings, starting from the fully anti-clockwise position of the control spindle. A dash indicates open, and **C**, closed.

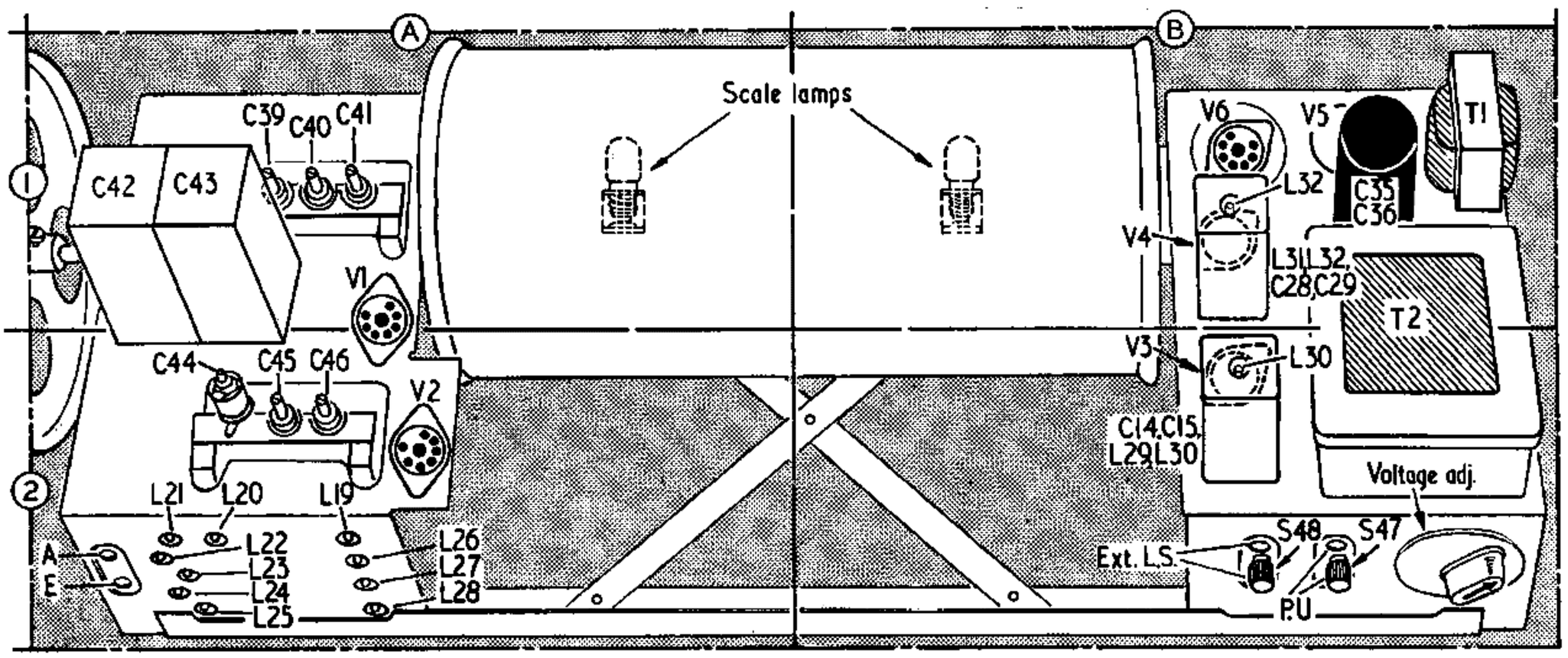
S47 and **S48** are respectively the gram pick-up and internal speaker switches, associated with the sockets for the external connections. They are of the screw-in type.

S49 is the Q.M.B. mains switch, ganged with the tone control **R22.**

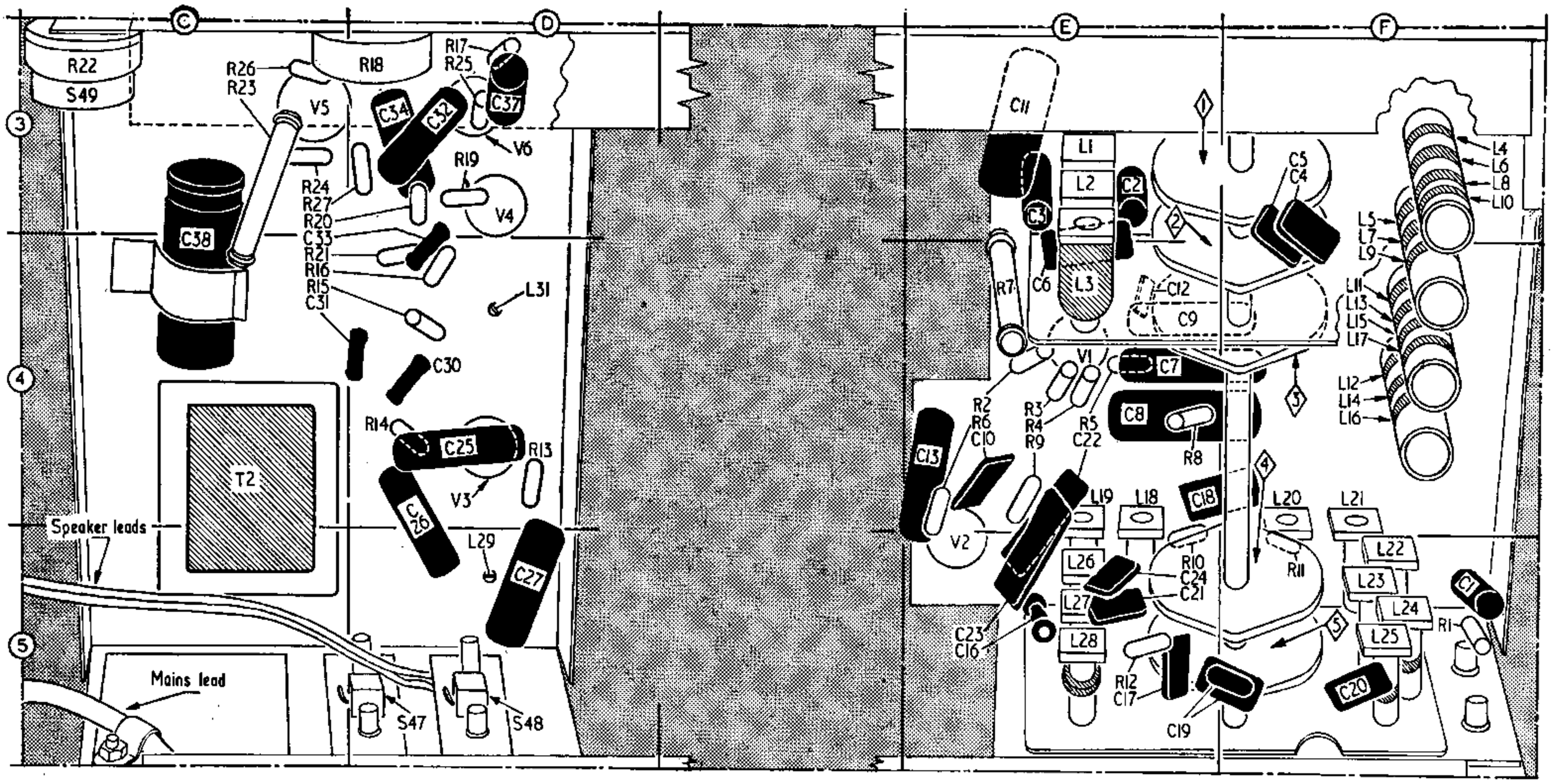
Scale Lamps.—These are two M.E.S. type lamps, with clear tubular bulbs, rated at 6.5 V, 0.3 A. They are located inside the tuning scale drum, and access to them for replacement is gained by removing the scale sheet. This is done by removing the two screws holding its ends to the drum wheels at each end, and unwinding the sheet. Leads to the lamps are passed into the drum through a hollow tube at its centre.

External Speaker.—Two sockets are provided at the rear of the chassis for the connection of a low impedance (about 3-4 Ω) external speaker. A screw-type switch **S48**, which mutes the internal speaker, is operated by a knob between the two sockets.

Valve V6.—This in our receiver was a 6X4, an indirectly heated miniature full-wave rectifier on a 7-pin American button base. The valve specified in the makers' manual was the Brimar 7Z4, which has a loctal base, whose connections are: 1, heater; 2, blank; 3, anode; 4, 5, blank; 6, anode; 7, cathode; 8, heater.



Plan view of the chassis, which consists of two sections separated by the rotary scale drum. On the left are the R.F. and oscillator stages, and on the right the I.F., output and mains input stages.



Underside drawings of the two units of the chassis, with the space between them, which is occupied by the drum, omitted. The five wave band switch units are indicated by the numbers 1-5 in diamond surrounds.

CIRCUIT ALIGNMENT

I.F. Stages.—Remove chassis from cabinet and connect output of signal generator, via an 0.1μF capacitor in the "live" lead, to control grid (pin 7) of **V2** and chassis. Tune receiver to highest wavelength end of M.W. and turn volume control to maximum. Feed in a 422 kc/s (710.8 m) signal and adjust the cores of **L32** (location reference B1), **L31** (D4), **L30** (B2) and **L29** (D5) for maximum output. Repeat these adjustments.

R.F. and Oscillator Stages.—The following adjustments can be made without removing the chassis from its cabinet. Check that with the gang at maximum capacitance, the cursor coincides with the white dots in the ends of the tuning scales. Connect output of signal generator via a suitable dummy aerial to **A** and **E** sockets. When adjusting aerial trimmers, "rock" gang for optimum results.

L.W.—Switch set to L.W., tune to white calibration dot at 175 kc/s, feed in a 175 kc/s (1,714 m) signal and adjust the core of **L28** (A2) for maximum output. Tune set to 250 kc/s, feed in a 250 kc/s (1,200 m) signal and adjust **C46** (A2) and **C41** (A1) for maximum output. Repeat these operations until the calibration is correct at both ends of band.

M.W.—Switch set to M.W., tune to 500 m, feed in a 500 m (600 kc/s) signal and adjust the core of **L27** (A2) for maximum output. Tune set to 214.3 m, feed in a 214.3 m (1,400 kc/s) signal and adjust **C45** (A2) and **C40** (A1) for maximum output. Repeat these adjustments until calibration is correct at both ends of the band.

S.W.—Switch set to Trawler band, tune to 2 Mc/s, feed in a 2 Mc/s (150 m) signal and adjust the core of **L26** (A2) for maximum output. Tune set to 4.5 Mc/s, feed in a 4.5 Mc/s (66.67 m) signal and adjust **C44** (A2) and **C39** (A1) for maximum output. Repeat these adjustments until calibraton is correct at both ends of band.

49 m.—Switch set to 49 m, tune to 6.1 Mc/s, feed in a 6.1 Mc/s (49.18 m) signal and adjust the core of **L19** (A2) for maximum output.

42 m.—Switch set to 42 m, tune to 7.2 Mc/s, feed in a 7.2 Mc/s (41.67 m) signal and adjust the core of **L20** (A2) for maximum output.

31 m.—Switch set to 31 m, tune to 9.6 Mc/s, feed in a 9.6 Mc/s (31.25 m) signal and adjust the core of **L21** (A2) for maximum output.

25 m.—Switch set to 25 m, tune to 11.8 Mc/s, feed in a 11.8 Mc/s (25.42 m) signal and adjust the core of **L22** (A2) for maximum output.

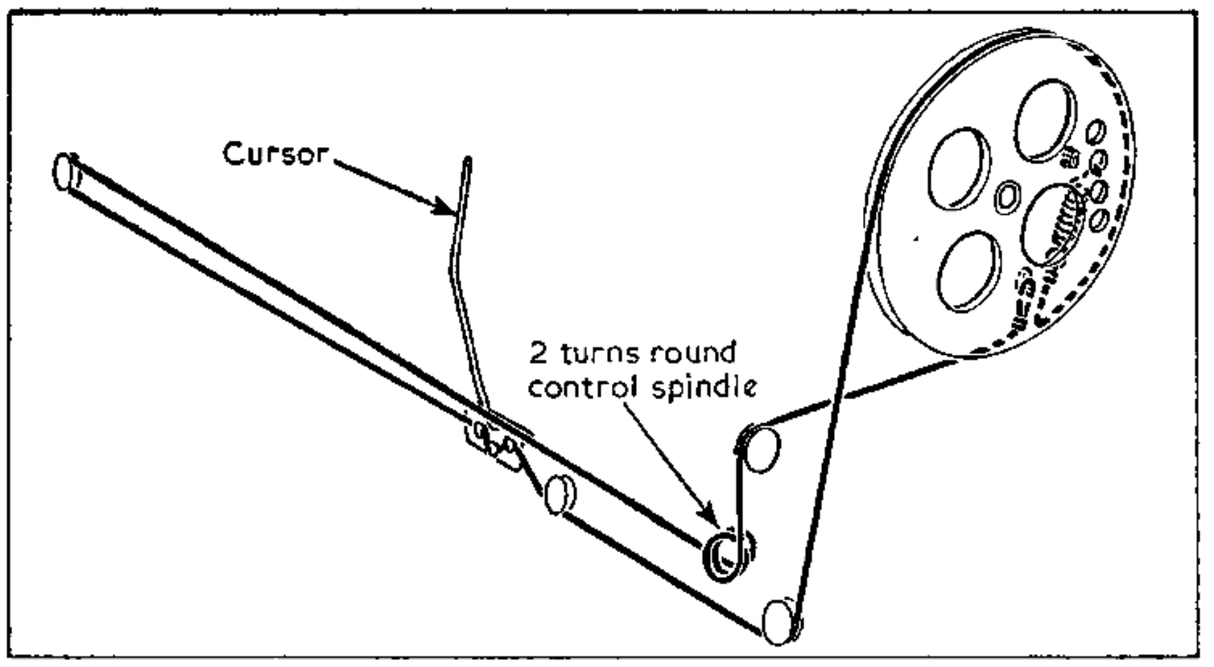
19 m.—Switch set to 19 m, tune to 15.3 Mc/s, feed in a 15.3 Mc/s (19.61 m) signal and adjust the core of **L23** (A2) for maximum output.

16 m.—Switch set to 16 m, tune to 17.8 Mc/s, feed in a 17.8 Mc/s (16.85 m) signal and adjust the core of **L24** (A2) for maximum output.

13 m.—Switch set to 13 m, tune to 21.6 Mc/s, feed in a 21.6 Mc/s (13.89 m) signal and adjust the core of **L25** (A2) for maximum output.

DRIVE CORD REPLACEMENT

Six feet of nylon braided glass yarn is required for a new tuning drive cord, which should be run as shown in the accompanying sketch. Here the complete system is shown as seen when viewed from the front right-hand corner of the chassis, with the gang at maximum capacitance.



Sketch showing the course followed by the tuning drive cord. It is drawn as seen from the front right-hand corner of the chassis, with the gang at maximum.

Four anchor holes are provided in the gang drum for the tension spring, so the actual length of cord is not very critical, and the length we give leaves an ample margin for tying off. The cursor can be fitted afterwards, and should be adjusted so that it covers the white dot at the high wavelength ends of the scales when the gang is at maximum capacitance.

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