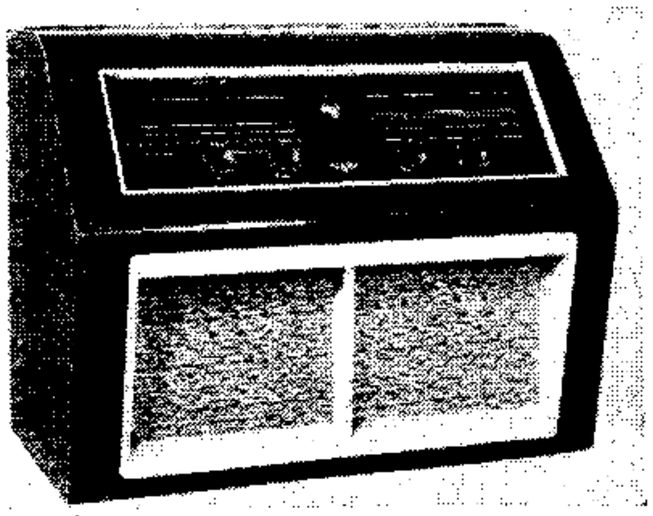
KOLSTER-BRANDES BR40

SEVEN-BAND BAND-SPREAD SUPERHET



FIVE band-spread S.W. ranges are provided in addition to M.W. and L.W. in the Kolster-Brandes BR40 receiver, which has five valves (plus rectifier and tuning indicator) and includes an R.F. amplifying stage. It is designed to operate from A.C. mains of 100-250V, 50-100 c/s. The wave ranges are 16.45-17.2 m (band 1); 19.1-20.1 m (band 2); 24.8-26.1 m (band 3); 30.45-32.05 m (band 4); 47.7-50.65 m (band 5); 195-560 m (band 6); 750-2,200 m (band 7).

On M.W. (band 6) and L.W. (band 7) arial three large sections of the gang, while on the five S.W. bands three small sections interposed between them are used. A plate aerial is fitted for use with local transmissions, and an "off" socket is provided for its plug.

Release date and original price: May, 1947; £31 10s plus purchase tax.

CIRCUIT DESCRIPTION

On M.W. (band 6) and L.W. (band 7) aerial is inductively coupled to single-tuned circuits **L13** (M.W.) and **L14** (L.W.) tuned by **C43.**

First valve **(V1, Brimar 6K7G)** is a variable-mu R.F. pentode operating as signal frequency amplifier with choke-capacitance coupling to single-tuned circuit **L21, C46** (M.W.), or aperiodic coupling (L.W.), preceding triode-hexode valve **(V2, Brimar 6K8G)** operating as frequency changer with electron coupling.

Triode oscillator grid coils **L27** (M.W.) and **L28** (L.W.) are tuned by **C47.** Parallel trimming by **C17, C49** (M.W.) and **C18, C50** (L.W.); series tracking by **C20** (M.W.) and **C19** (L.W.), in a Colpitts circuit.

On S.W. bands (bands 1-5) aerial is inductively coupled to appropriate grid coil **L2, L4, L6, L8** or **L10,** which is tuned by **C42** and precedes **V1. V1** is choke-capacitance coupled to **V2** hexode, whose grid coils **L16-L20** are tuned by **C45.** Triode oscillator coils **L22-L26** are tuned by **C48,** in association with **C16** and a temperature compensated pair **C22, C23** which effect tracking, in a Colpitts circuit, the coils being connected between anode and control grid.

Third valve **(V3, Brimar 6K7G)** is a second variable-mu R.F. pentode, operating as intermediate frequency amplifier with tuned-primary, tuned-secondary, transformer couplings **C11, L29, L30, C12** and **C24, L31, L32, C25.**

Intermediate frequency 470 kc/s.

Diode second detector is part of double diode triode valve **(V4, Brimar 6Q7G),** the second diode of which provides A.V.C. voltages.

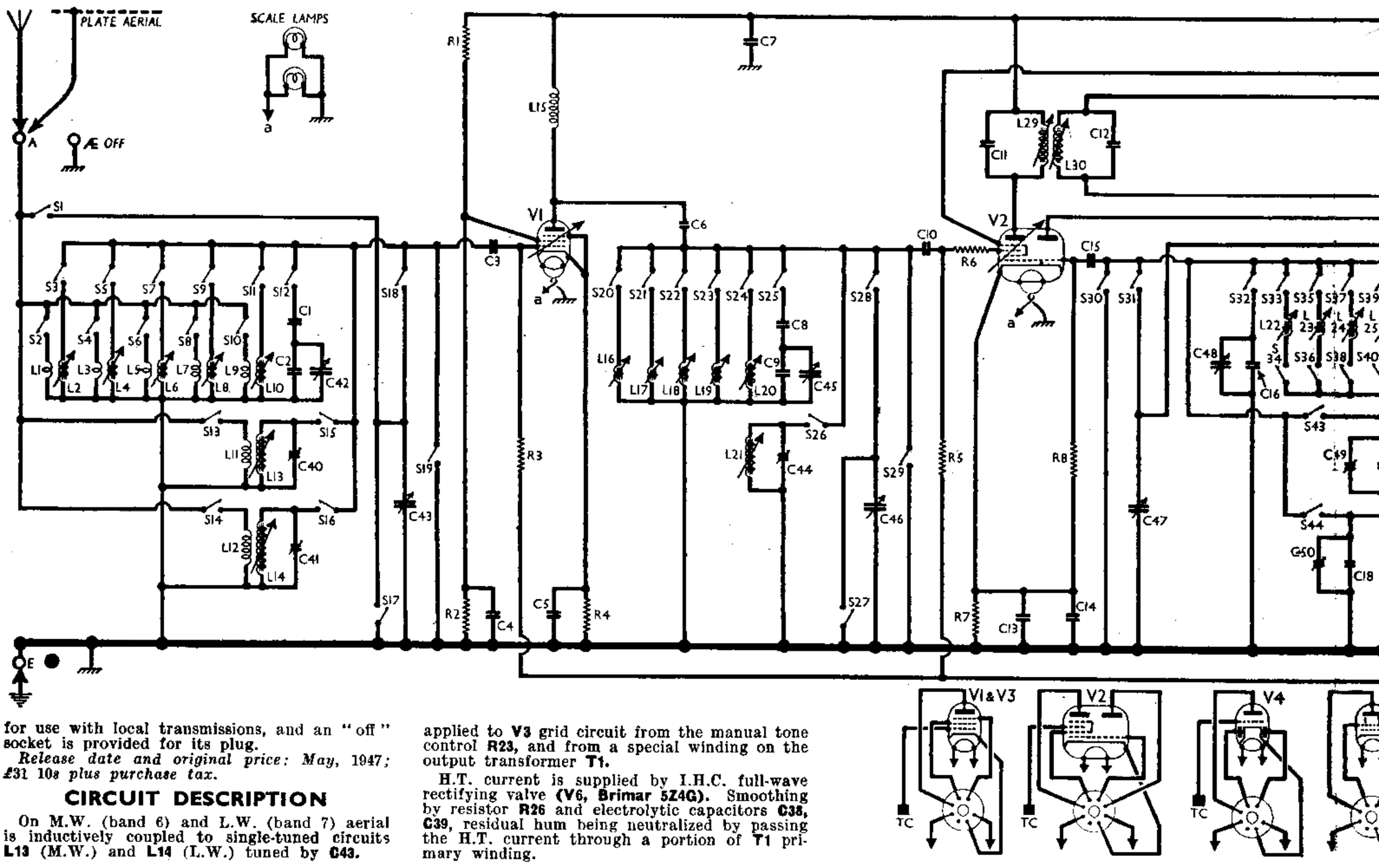
Resistance-capacitance coupling between **V4** triode and beam tetrode output valve **(V5, Brimar 6V6GT).** Mixed feed-back voltages are applied to **V3** grid circuit from the manual tone control **R23,** and from a special winding on the output transformer **T1.**

H.T. current is supplied by I.H.C. full-wave rectifying valve **(V6, Brimar 5Z4G).** Smoothing by resistor **R26** and electrolytic capacitors **C38, C39,** residual hum being neutralized by passing the H.T. current through a portion of **T1** primary winding.

COMPONENTS AND VALUES

	RESISTORS	Values (ohms)	Locations
R1	V1 S.G. H.T. potential divider ...	22,000	H6
R2		27,000	H6
R3	V1 C.G. resistor ...	220,000	H6
R4	V1 fixed G.B. ...	270	H6
R5	V2 hex. C.G. ...	220,000	H6
R6	Grid stopper ...	47	B1
R7	V2 fixed G.B. ...	270	H5
R8	V2 osc. C.G. ...	47,000	H5
R9	Osc. H.T. feed ...	22,000	H5
R10	T.I. triode load ...	1,000,000	C2
R11	V3 fixed G.B. ...	220	G6
R12	I.F. stopper ...	47,000	F6
R13	T.I. C.G. feed ...	2,200,000	G5
R14	P.U. shunt ...	470,000	B3
R15	Volume control ...	1,000,000	G4
R16	Part tone corrector	250,000	G4
R17	F.-B. coupling ...	2,200,000	F5
R18	V4 C.G. resistor ...	10,000,000	F5
R19	H.T. decoupling ...	15,000	H5
R20	V4 triode load ...	220,000	G5
R21	A.V.C. decoupling	470,000	G5
R22	A.V.C. diode load...	470,000	G5
R23	Tone control ...	500,000	F4
R24	V5 G.B. resistor* ...	253	E5
R25	T1 pri. shunt ...	27,000	E6
R26	H.T. smoothing ...	1,500	E7

* Consists of 220 Ω and 33 Ω in series.



CAPACITORS		Values (μF)	Locations
C1	Aerial S.W. track...	0·0002	I7
C2	Aerial S.W. trim ...	0·0002	I7
C3	V1 C.G. capacitor...	0·0001	I7
C4	V1 S.G. decoupling	0·1	H6
C5	V1 cath. by-pass ...	0·1	H6
C6	R.F. coupling ...	0·000025	I6
C7	H.T. R.F. by-pass	0·1	H5
C8	R.F. S.W. track ...	0·0002	I6
C9	R.F. S.W. trim. ...	0·0002	I6
C10	V2 hex. C.G. ...	0·0001	I6
C11	1st I.F. transformer tuning	0·00015	C1
C12		0·00015	C1
C13	V2 cathode by-pass capacitors ...	0·005	I5
C14		0·1	H5
C15	V2 osc. C.G. ...	0·0001	I5
C16	Osc. S.W. trim. ...	0·0002	I5
C17	Osc. M.W. trim. ...	0·00001	I5
C18	Osc. L.W. trim. ...	0·00005	I5
C19	Osc. M.W. and L.W. trackers ...	0·0003	I5
C20		0·00025	I5
C21	Osc. anode coup. ...	0·0002	I5
C22	Osc. S.W. tracking capacitors ...	0·00004	I5
C23		0·00016	I5
C24	2nd I.F. transformer tuning ...	0·00015	D2
C25		0·00015	D2
C26	V3 cathode by-pass	0·1	G6
C27	I.F. by-pass ...	0·0001	F6
C28	T.I. C.G. decoup. ...	0·01	G5
C29	A.V.C. coupling ...	0·000025	F5
C30	"Top" boost ...	0·0001	G4
C31	A.V.C. decoupling	0·1	G5
C32	A.F. coupling ...	0·005	G4
C33	Tone control ...	0·0002	F4
C34	H.T. line decoupling	2·0	F7
C35		0·1	G5
C36	A.F. coupling ...	0·01	F5
C37*	V5 cathode by-pass	25·0	E5
C38*	H.T. smoothing capacitors	16·0	D2
C39*		24·0	D2
C40‡	Aerial M.W. trim...	—	A2
C41‡	Aerial L.W. trim ...	—	A3

(*Continued next column*)

* Electrolytic. ‡Pre-set.

CAPACITORS (*continued*)		Values (μF)	Locations
C42†	Aerial S.W. tuning	0·00006	B2
C43†	Aerial M.W.; L.W. tuning	0·0005	B2
C44‡	R.F. M.W. trim ...	—	A2
C45†	R.F. S.W. tuning...	0·00006	B2
C46†	R.F. M.W.; L.W. tuning	0·0005	B2
C47†	Osc. M.W.; L.W. tuning	0·0005	B1
C48†	Osc. S.W. tuning ...	0·00006	B2
C49‡	Osc. M.W. trim ...	—	A1
C50‡	Osc. L.W. trim ...	—	A1

† Variable. ‡ Pre-set.

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	Aerial S.W.1 coup.	0·02	J7
L2	Aerial S.W.1 tune...	very low	J7
L3	Aerial S.W.2 coup.	0·03	J7
L4	Aerial S.W.2 tune...	very low	J7
L5	Aerial S.W.3 coup.	0·02	J7
L6	Aerial S.W.3 tune...	0·01	J7
L7	Aerial S.W.4 coup.	0·03	J7
L8	Aerial S.W.4 tune...	0·02	J7
L9	Aerial S.W.5 coup.	0·04	J7
L10	Aerial S.W.5 tune...	0·04	J7
L11	Aerial M.W. coup.	1·6	J7
L12	Aerial L.W. coup....	2·5	I7
L13	Aerial M.W. tune...	0·43	J7
L14	Aerial L.W. tune...	0·48	I7
L15	V1 R.F. choke ...	16·18	H6
L16	R.F. S.W.1 tune ...	very low	J6
L17	R.F. S.W.2 tune ...	very low	J6
L18	R.F. S.W.3 tune ...	0·01	J6
L19	R.F. S.W.4 tune ...	0·02	J6
L20	R.F. S.W.5 tune ...	0·04	J6
L21	R.F. M.W. tune ...	0·57	J6

(*Continued next column*)

OTHER COMPONENTS (*continued*)			Approx. Values (ohms)	Locations
L22	Osc. S.W.1 tune ...		very low	J5
L23	Osc. S.W.2 tune ...		very low	J5
L24	Osc. S.W.3 tune ...		0·02	J5
L25	Osc. S.W.4 tune ...		0·02	J5
L26	Osc. S.W.5 tune ...		0·04	J5
L27	Osc. M.W. tune ...		0·34	J5
L28	Osc. L.W. tune ...		0·5	I5
L29	1st I.F. trans.	Pri.	5·2	C1
L30		Sec.	5·2	C1
L31	2nd I.F. trans.	Pri.	5·2	D2
L32		Sec.	5·2	D2
L33	Speech coil ...		2·75	—
T1	Output trans.	Pri., total	400·0	E7
		Spkr. sec.	0·3	E7
		F.-B. sec., total	2·5	E7
T2	Mains trans.	Pri., total	30·0	G7
		Heat. sec.	0·17	G7
		Rect. heat. sec. ...	0·21	G7
		H.T. sec., total	200·0	G7
S1-S46	Waveband switches		—	—
S47, S48	Gram. P.U. switches		—	—
S49	Int. speaker switch		—	D3
S50	Mains switch, ganged R23 ...		—	F5

DISMANTLING THE SET

Removing Chassis.—Lay the cabinet, front downward on a felt pad and remove the speaker plug from its socket on the chassis deck;

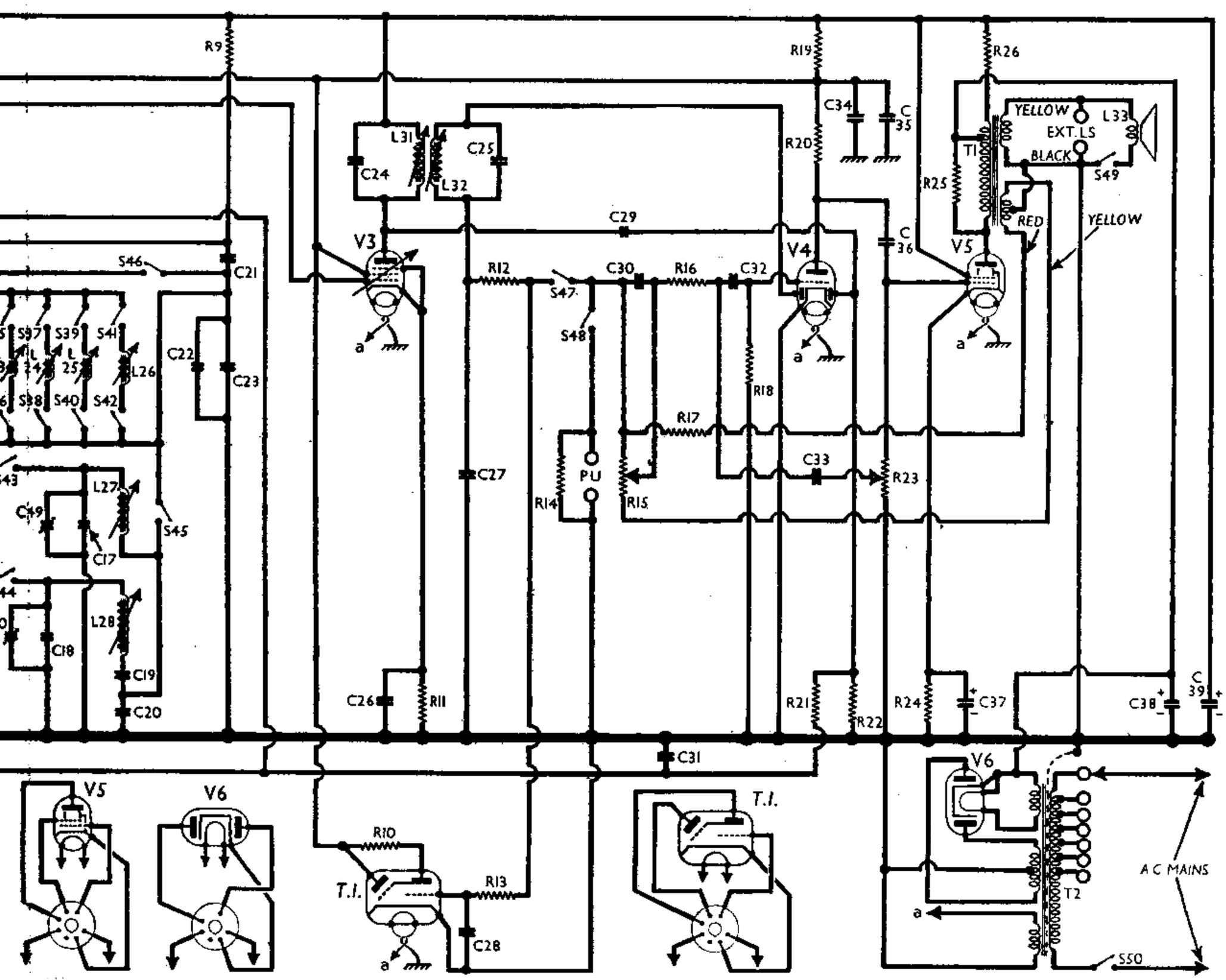
remove the two long milled-head bolts (with lock washers) from the lower left and right corners of the chassis;

grasp the sides of the chassis, lifting the rear edge slightly, and slide it out of the cabinet.

When replacing, ensure that the projecting front sections of the chassis runners are located beneath the metal clamps inside the cabinet before inserting the chassis-retaining bolts.

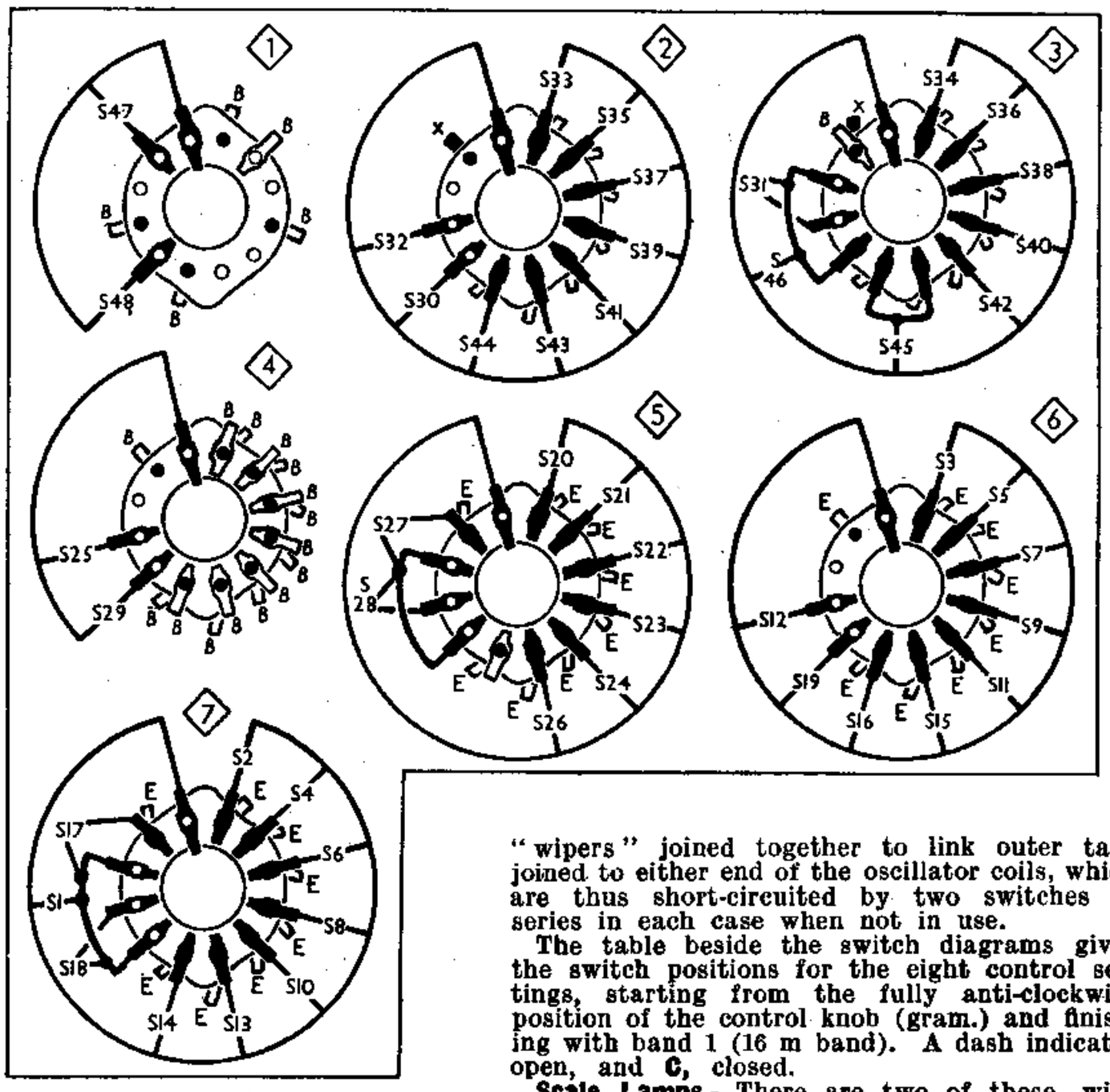
Removing Speaker.—Remove chassis as previously described, loosen the nuts of the four speaker-retaining clamps, and lift out the speaker.

When replacing, the connecting lead should emerge from the dust-bag at the bottom.



Circuit diagram of the Kolster-Brandes BR40 A.C. superhet. A special set of vanes are provided in the gang for S.W. tuning, **C42**, **C45** and **C48**. The M.W. and L.W. sections are **C43**, **C46**, and **C47**. The lead colours of the feed-back winding on **T1** are indicated, and it is essential that they are connected the correct way round. **R24** consists of a 220 Ω (from cathode) and 33 Ω (to chassis) resistor in series. Differences in earlier versions of this receiver are described overleaf.

Switch	Gram	L.W.	M.W.	S.W.5	S.W.4	S.W.3	S.W.2	S.W.1
S1	C	—	—	—	—	—	—	—
S2	—	—	—	—	—	—	—	C
S3	—	—	—	—	—	—	—	C
S4	—	—	—	—	—	—	C	—
S5	—	—	—	—	—	—	C	—
S6	—	—	—	—	—	C	—	—
S7	—	—	—	—	—	C	—	—
S8	—	—	—	—	C	—	—	—
S9	—	—	—	—	C	—	—	—
S10	—	—	—	C	—	—	—	—
S11	—	—	—	C	—	—	—	—
S12	—	—	—	C	C	C	C	C
S13	—	—	C	—	—	—	—	—
S14	—	C	—	—	—	—	—	—
S15	—	—	C	—	—	—	—	—
S16	—	C	—	—	—	—	—	—
S17	C	—	—	—	—	—	—	—
S18	—	C	C	—	—	—	—	—
S19	C	—	—	—	—	—	—	—
S20	—	—	—	—	—	—	—	C
S21	—	—	—	—	—	—	C	—
S22	—	—	—	—	—	C	—	—
S23	—	—	—	—	C	—	—	—
S24	—	—	—	C	—	—	—	—
S25	—	—	—	C	C	C	C	C
S26	—	—	C	—	—	—	—	—
S27	C	—	—	—	—	—	—	—
S28	—	C	C	—	—	—	—	—
S29	C	—	—	—	—	—	—	—
S30	C	—	—	—	—	—	—	—
S31	—	C	C	—	—	—	—	—
S32	—	—	—	C	C	C	C	C
S33	—	—	—	—	—	—	—	C
S34	—	—	—	—	—	—	—	C
S35	—	—	—	—	—	—	C	—
S36	—	—	—	—	—	—	C	—
S37	—	—	—	—	—	C	—	—
S38	—	—	—	—	—	C	—	—
S39	—	—	—	—	C	—	—	—
S40	—	—	—	—	C	—	—	—
S41	—	—	—	C	—	—	—	—
S42	—	—	—	C	—	—	—	—
S43	—	—	C	—	—	—	—	—
S44	—	C	—	—	—	—	—	—
S45	—	C	C	—	—	—	—	—
S46	C	—	—	—	—	—	—	—
S47	C	C	C	C	C	C	C	C
S48	C	—	—	—	—	—	—	—



Diagrams of the seven waveband switch units, drawn as seen from the rear of an inverted chassis. The meanings of **X** and **E** on some of the blank tags are explained below. **B** indicates unused tags.

GENERAL NOTES

Switches.—S1-S48 are the waveband and radiogram switches, ganged in seven rotary units beneath the chassis. These are indicated in our under-chassis view, and shown in detail in the diagrams at the top of this page, where they are viewed from the rear of an inverted chassis.

Actually there are many more switches than we show, as all coil circuits are short-circuited when not in circuit. This is achieved by plates on the reverse sides of the units numbered **2, 3, 5, 6** and **7**, which contact all the tags thereon except those in use. These tags are connected to the tags on the side we show by their fixing rivets, but we have omitted the switches from the circuit diagram to avoid complicating it unduly.

These tags are shown in the switch diagrams, but are left blank. Those with an **E** against them go to chassis, via their "wiper." The two tags marked **X** on units **2** and **3** are "wipers" joined together to link outer tags joined to either end of the oscillator coils, which are thus short-circuited by two switches in series in each case when not in use.

The table beside the switch diagrams gives the switch positions for the eight control settings, starting from the fully anti-clockwise position of the control knob (gram.) and finishing with band 1 (16 m band). A dash indicates open, and **C**, closed.

Scale Lamps.—There are two of these, with M.E.S. bases and large clear spherical bulbs, rated at 8 V, 0.3 A.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2-5Ω) external speaker. A thumbscrew switch between them permits the internal speaker to be muted.

CHASSIS DIVERGENCIES

Resistor R26.—This was a 2,500Ω Welwyn wire-wound enamelled unit in our chassis, rated at 5 W, but in some chassis it may be 1,500Ω, 3 W. The value is decided by the kind of output transformer used, and is critical; if a transformer or resistor is replaced, each must be suited to the other.

Output Transformer T1.—In our chassis this was as shown in our circuit diagram, where **R26** was 2,500Ω, and the transformer was coded with three coloured spots: dark blue; dark blue; light blue; on a white background. If the spot colours are dark blue; dark blue; yellow; the primary tapping is shifted slightly, and **R26** must then be 1,500Ω. There is a third case, where the tapping and **R26** agree with our sample, but where the feed-back winding is omitted; this is coded dark blue; light blue; green.

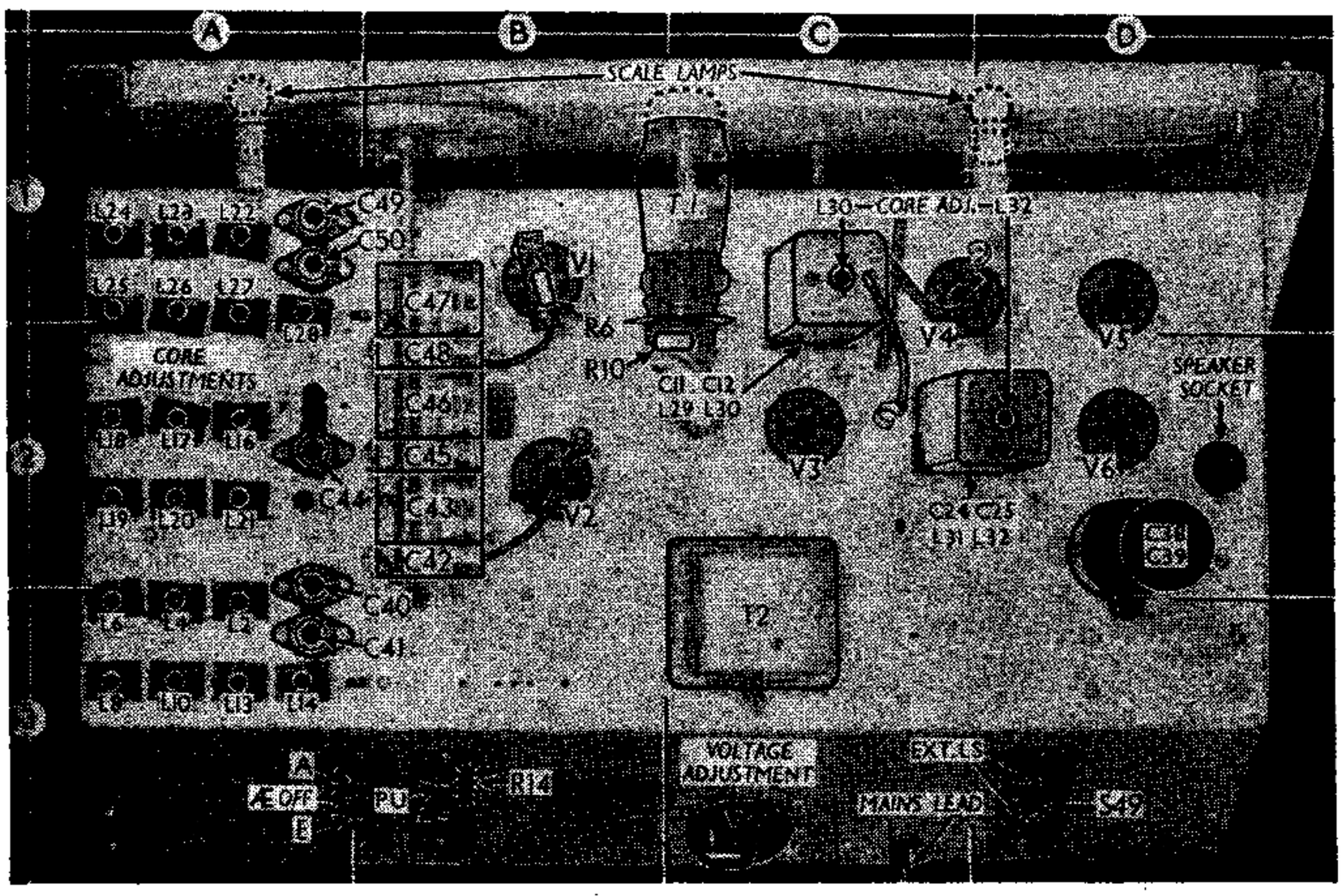
A fourth case arises from the original arrangement, where **T1** had a plain primary and no feed-back secondary. The transformer is then coded light blue and yellow but a simpler method of identifying this version is by the presence of an H.T. smoothing choke (D.C. resistance 199Ω) which replaces **R26**.

In these earlier models, feed-back was limited to the tone control circuit, which consisted of a capacitor (0.00015μF) and potentiometer between **V5** anode and chassis. The capacitor was between anode and slider, and one end of the potentiometer went to chassis; the other end went via a 47,000Ω resistor to control grid. The cathode of the tuning indicator went to the junction of the two resistors which comprise **R24**.

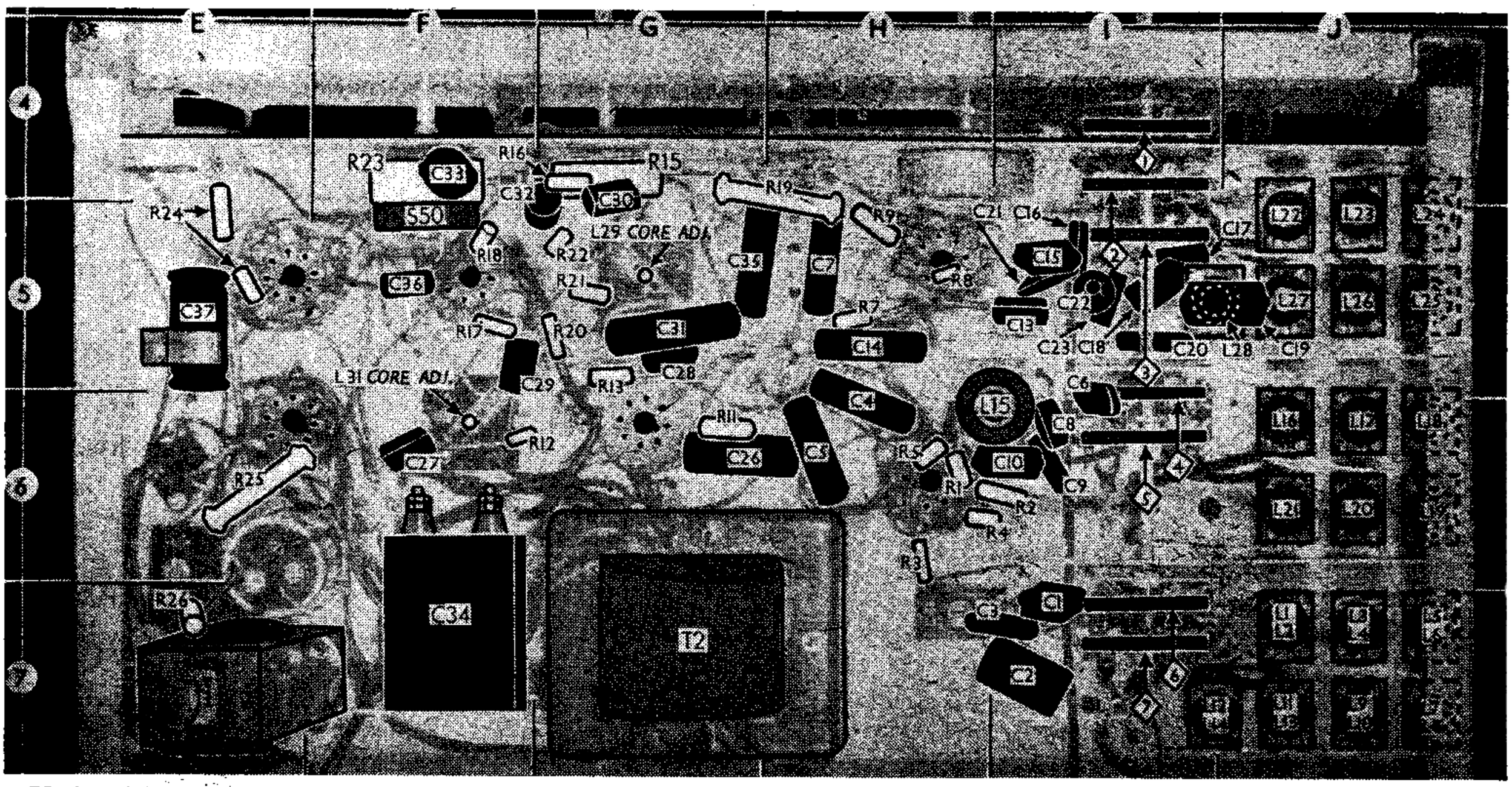
Other differences which may occur include **R1**, which may be 22,000Ω; **R9**, may be 33,000Ω, 1 W; **C17**, may be 5pF or 15pF; **C36**, may be 0.005μF; and **C34** may be electrolytic. A 100,000Ω decoupling resistor and 0.1μF capacitor may be added in **V4** triode anode feed, and there may be a 27,000Ω, 2 W resistor between **V3** screen and chassis, making the screens of **V2, V3** potential-divider fed.

VALVE ANALYSIS

Valve voltages and currents given in the table (next col.) are those measured in our receiver when it was operating on mains of 230 V, using the 225 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the M.W. band, and the volume



Plan view of the chassis, in which all the alignment adjustments, with the exception of **L29** and **L31**, are indicated.



Under-chassis view. The seven waveband switch units numbered 1–7 in diamonds are shown in detail in the diagrams at the head of cols. 2 and 3. The coil units are all uniformly arranged in three groups of seven according to their appropriate bands. The seventh is omitted in the centre group as no L.W. tuning coil is used on this band. The rear flange has been cut off the bottom of the illustration to save space.

control was at maximum, but there was no signal input.

Voltages were measured on the 400 V scale of a model 7 Avometer, chassis being the negative connection.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 6K7G	200	5·8	75	1·4
V2 6K8G	200	2·3	82	6·2
	Oscillator			
	71	4·5		
V3 6K7G	200	6·4	82	1·5
V4 6Q7G	30	0·17	—	—
V5 6V6GT	278	35·0	200	1·6
V6 5Z4G	250			
T.I. Y63	15	0·24	—	—
	Target			
	200	1·4		

† Each anode, A.C.

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set to M.W. (band 6), turn gang and volume control to maximum, connect signal generator via an 0.1 μF capacitor in the live lead to control grid (top cap) of **V3** and chassis, feed in a 470 kc/s (638.3 m) signal, and adjust the cores of **L31** and **L32** (location references F6, D2) for maximum output. Transfer "live" signal generator lead to control grid (top cap) of **V2**, and adjust the cores of **L29** (G5) and **L30** (C1) for maximum output.

R.F. and Oscillator Stages.—With the gang at maximum capacitance the cursors should coincide with the vertical black datum lines at the high wavelength ends of the scales. Owing to the interdependence of certain adjustments, the M.W. and L.W. bands cannot be aligned separately in the usual sequence, and it is important that the order adopted here should be followed. Transfer "live" signal generator lead to **A** socket, via a suitable dummy aerial.

With set still switched to M.W., tune to 500 m on scale, feed in a 500 m (600 kc/s) signal, and adjust the cores of **L27** (A1), **L21** (A2) and **L13** (A3) for maximum output. Tune to 214 m on scale, feed in a 214 m (1,400 kc/s) signal, and adjust **C49** (A1), **C44** (A2) and **C40** (A2) for maximum output.

Switch set to L.W. (band 7), tune to 1,714 m on scale, feed in a 1,714 m (175 kc/s) signal, and adjust the cores of **L28** (A1) and **L14** (A3) for maximum output. Tune to 857 m on scale, feed in an 857 m (350 kc/s) signal, and adjust **C50** (A1) and **C41** (A3) for maximum output. Repeat the L.W. adjustments, while rocking the gang slightly, for optimum results.

Switch set to M.W. and check the accuracy of the 500 m and 214 m adjustments, repeating them if necessary.

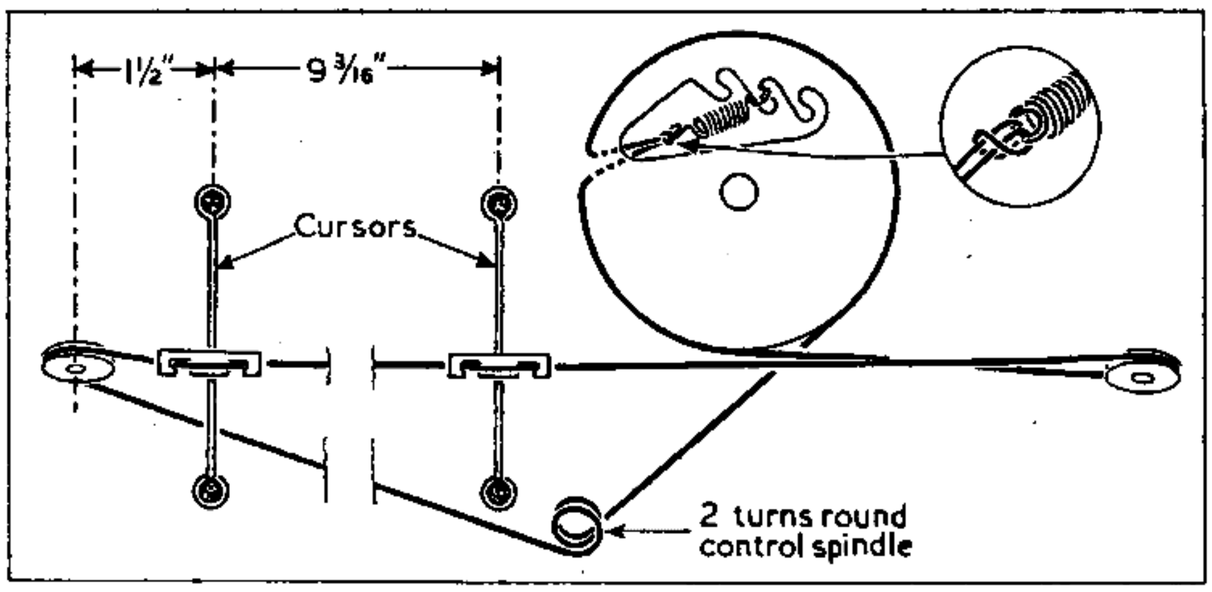
Band-spread S.W. Bands.—The following table gives the procedure for the five S.W. bands, the operation in each case consisting only of setting signal generator and receiver scales accurately and adjusting the appropriate coil cores. It should be noted, however, that unless a crystal-controlled signal generator is used, the receiver calibration is likely to be only approximately correct, and should be finally checked against S.W. broadcast stations of known wavelength.

Receiver		Sig. Gen.	Adjustment	
Band	Scale Setting (Mc/s)	Wave-length (m)	Cores	Loca-tions
5	6·1	49·18	L26, L20, L10	A1
4	9·6	31·25	L25, L19, L8	A2
3	11·8	25·42	L24, L18, L6	A3
2	15·3	19·61	L23, L17, L4	
1	17·8	16·85	L22, L16, L2	

DRIVE CORD REPLACEMENT

Access to the drive cord system is obtained by removing the scale panel (four nuts, screws and lock-washers at corners, and the K.B. motif at centre); the tuning indicator light excluder (four self-tapping screws) and the scale backing plate (four self-tapping screws). With the cord in position, it then appears as shown in the sketch below when viewed from the front with the gang at minimum.

The length of the cord is 54ins. overall, when tied in a loop. (When the loop is stretched between two pins they should therefore be 27in apart.) Having first formed the loop with a non-slip knot, loop it on to the tension spring as shown inset in the sketch.



Sketch showing the drive cord system as seen from the front, with the scale and backing plate removed and the gang turned to minimum.

The cord should be fitted as indicated, and the spring hooked to the centre anchor provided on the drum. Some slackness or tightness can be taken up by transferring the spring to one of the other two anchors. Before hooking up the spring, however, the backing plate must be slipped between the horizontal (front) length of cord and the remaining portions, which run behind the backing plate, while the cord is slack.

The two cursors should be slipped on to the cord at the positions indicated, while the gang is at maximum. A certain range of cursor adjustment after fitting the scale panel can be made by turning the drive drum on the gang spindle. The felt pads should rub against the backing plate.

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