BUSH SUG26

Superhet A.C. Console

PUSH-PULL output is provided in the Bush SUG26, a console receiver designed to operate from A.C. mains only of 100-250 V, 40-100 c/s. The total consumption is quoted as 60 W, and the audio output power as 8 W.

The receiver is a 3-band superhet employing six valves (plus a rectifier) with provision for a gramophone pick-up that may be left permanently connected. The waveband ranges are 16-50 m, 182-560 m and 830-2,068 m.

There is also provision for connecting an external speaker, with an internal speaker switch. Negative feed-back applied on radio is modified for P.U. operation.

Release date and original price : July 1951, £31 10s 7d. *Purchase tax extra.*

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1** (S.W.), **L2** (M.W.) and **L3** (L.W.) to single tuned circuits **L4, C36** (S.W.), **L5, C36** (M.W.) and **L6, C36** (L.W.) which precede triode hexode valve **(V1, Mullard ECH42),** operating as frequency changer with internal coupling. Two aerial sockets are provided, **A1** and **A2.** Socket **A1** connects the aerial directly to the coupling coils, giving maximum sensitivity. Socket **A2** connects the aerial via a small capacitor **C1** to the coupling coils, giving selective tuning. **C2** shifts the resonance of the L.W. input.

Oscillator grid coils **L7** (S.W.), **L8** (M.W.) and **L9** (L.W.) are tuned by **C37.** Parallel trimming by **C38** (S.W.), **C39** (M.W). and **C13, C40** (L.W.); series tracking by **C11** (M.W.) and **C12** (L.W.). Inductive reaction coupling from oscillator anode via **L10** (S.W.), **L11** (M.W.) and **L12** (L.W.). Stabilization on S.W. by **R5.**

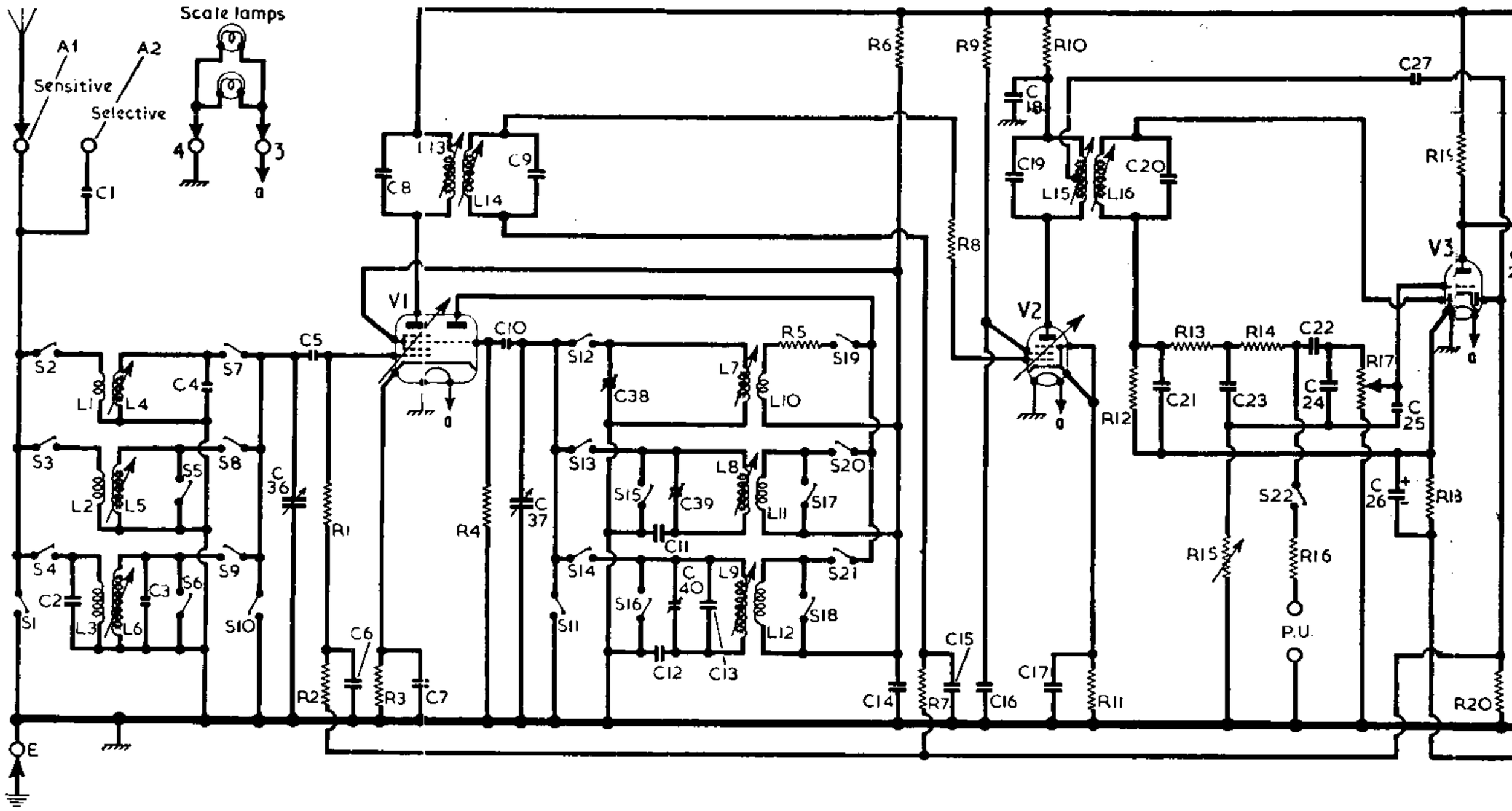
Second valve **(V2, Mullard EF41)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C8, L13, L14, C9** and **C19, L15, L16, C20.**

Intermediate frequency 465 kc/s.

Diode signal detector is part of double diode triode valve **(V3, Mullard EBC41).** Audio frequency component in rectified output is developed across load resistor **R12** and passed via **R13, R14, C22** and manual volume control **R17** to control grid of triode section, which operates as A.F. amplifier.

I.F. filtering by **C21, R13, R14** and the capacitance of the screened leads in the diode circuit, and by **C28** in the triode anode circuit. Variable tone control by **C23, R14, C24** and **C25,** in association with the variable resistor **R15.** Provision is made for the connection of a high impedance gramophone pick-up across **R17,** via **C22** and switch **S22.** When **S22** closes, **S1, S10** and **S11** close also to prevent radio break-through.

Second diode of **V3** is fed via **C27** from a tapping on **L15,** and the resulting D.C. potential developed across load resistor



Circuit diagram of the Bush SUG26 superhet. The variable tone control circuit is unusual, and consists of **C23, R14, C24** and **R15** in the circuit. Fixed negative feed-back is applied from the speech coil circuit to the cathode of **V3,** and it is modified on gram by the closing of swit numbered interconnecting points around the scale lamps and output transformer circuit represent the pins of an octal-type connecter between t certain components mounted in the cabinet.

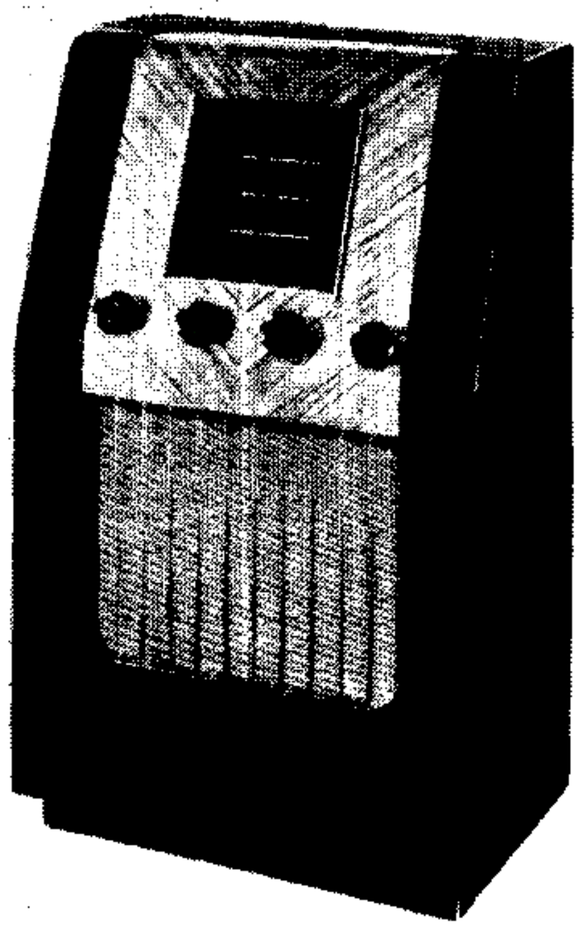
R20 is fed back as grid bias via decoupling circuit **R2, C6, R7** and **C15** to frequency changer and I.F. valves, giving automatic gain control.

Resistance - capacitance coupling by **R19, C29** and **R23, R24** between **V3** triode anode and **V5,** one half of beam tetrode push-pull output stage **(V5, V6 Mullard EL41's).** A proportion of **V3** output, that developed across **R24** in potential divider **R23, R24,** is applied to double diode triode valve **(V4, Mullard EBC41)** operating as phase invertor.

V4 output is resistance-capacitance coupled by **R21, C30** and **R26** to the second half of push-pull output stage, **V6.** Bias for **V5, V6** is developed across common bias resistor **R29.** Fixed tone correction in anode circuit by **C35.** Further tone correction is obtained by feeding back a proportion of the speech coil voltage, that developed across **R33** in potential divider **R32, R33,** to the cathode circuit of **V3.**

On gram the feed-back voltage is decreased by shunting **R31** via **S23** across **R33.** Grid stoppers **R27, R28** prevent the build up of parasitic oscillations. Provision is made for the connection of a low impedance external speaker, and speaker switch **S24** permits the internal speaker to be disconnected if desired.

H.T. current is supplied by I.H.C. full-wave rectifying valve **(V7, Mullard EZ40).** Smoothing by **R25, R30** and electrolytic capacitors **C31, C32** and **C33.** A single heater winding is used on **T2** to feed all the valve heaters, including **V7.**



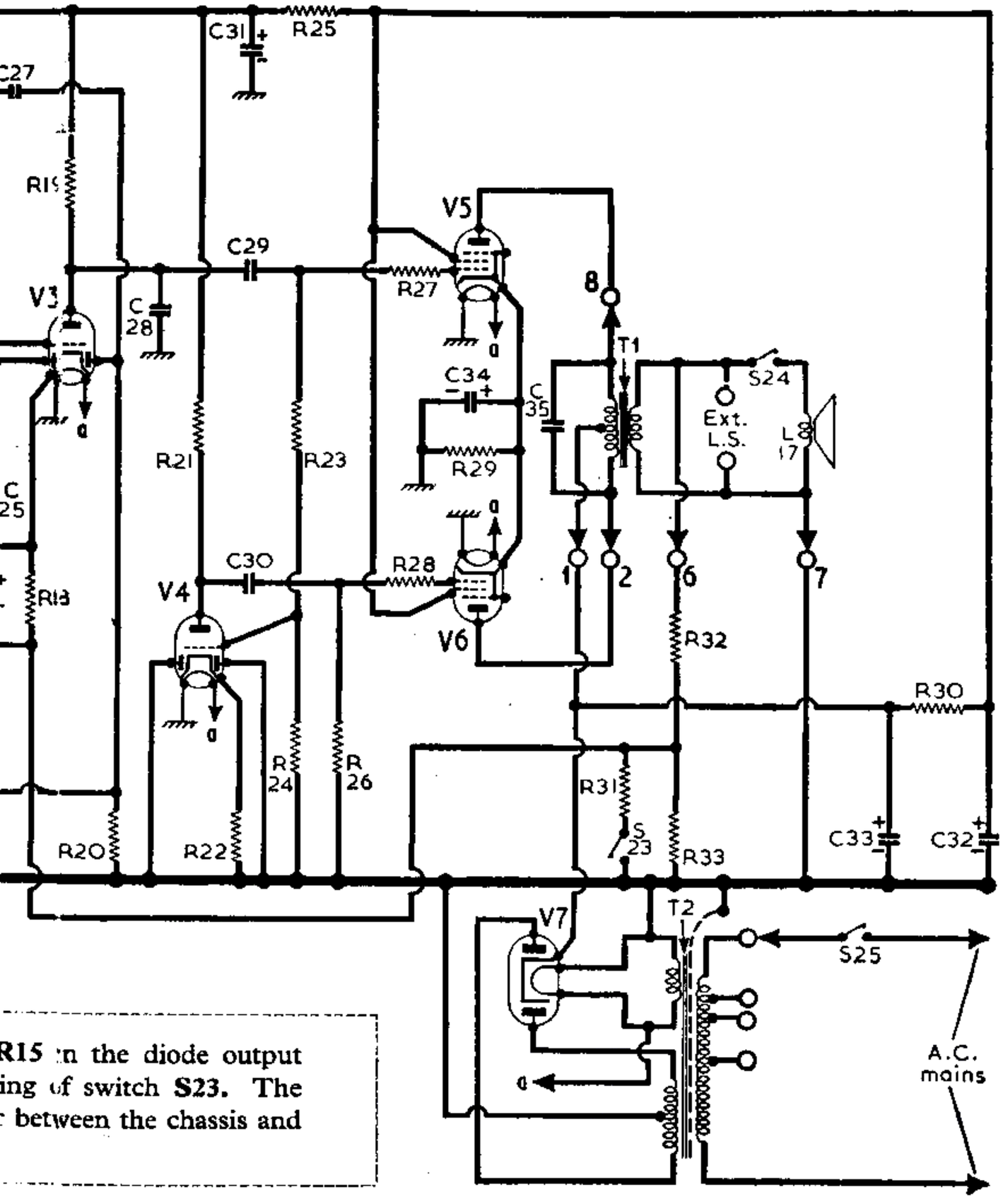
The appearance of the Bush SUG26 console superhet receiver.

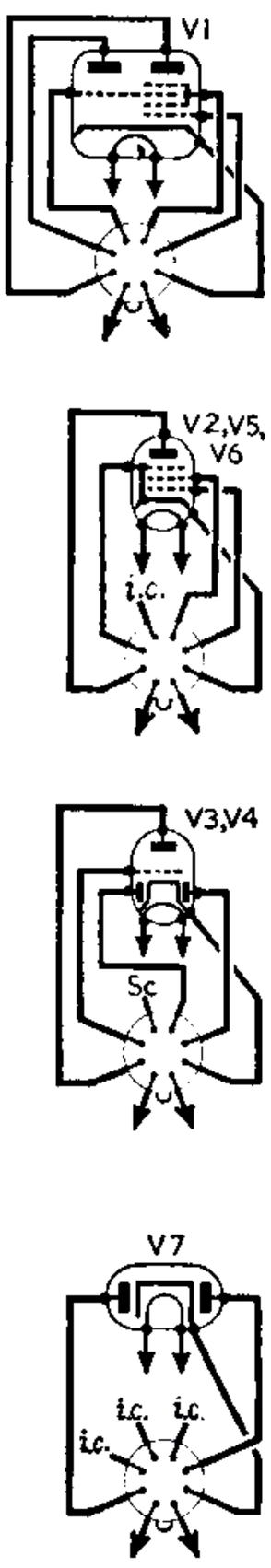
COMPONENTS AND VALUES

	CAPACITORS	Values	Locations
C1	Aerial series ...	47pF	G4
C2	L.W. aerial shunt...	800pF	F4
C3	L.W. aerial trim. ...	60pF	F4
C4	S.W. aerial trim. ...	20pF	G4
C5	V1 C.G.	50pF	F4
C6	A.G.C. decoupling	0·1μF	F4
C7	V1 cath. by-pass ...	0·05μF	F3
C8, C9	1st I.F. trans. tuning	110pF	B2
		110pF	B2
C10	V1 osc. C.G. ...	45pF	F4
C11	M.W. osc. tracker...	556pF	F3
C12	L.W. osc. tracker...	390pF	F3
C13	L.W. osc. trim. ...	180pF	F3
C14	Osc. anode decoup.	0·05μF	F4
C15	A.G.C. decoupling	0·05μF	F4
C16	V2 S.G. decoup. ...	0·05μF	F4
C17	V2 cath. by-pass...	0·05μF	E4
C18	V2 anode decoup....	0·05μF	E4
C19, C20	2nd I.F. trans. tuning	110pF	B2
		110pF	B2
C21	I.F. by-pass ...	100pF	E4
C22	A.F. coupling ...	0·01μF	E3
C23, C24, C25	Part tone control...	300pF	E3
		500pF	E3
		33pF	E3
C26	V3 cath. by-pass...	50μF	D3
C27	A.G.C. feed ...	47pF	E4
C28	I.F. by-pass ...	500pF	E3
C29, C30	A.F. coupling ...	0·01μF	E3
		0·01μF	E4
C31*, C32*, C33*	H.T. smoothing ...	8μF	D4
		50μF	B2
		50μF	B2
C34*	Cath. by-pass ...	50μF	D3
C35	Tone corrector ...	0·001μF	—
C36†	Aerial tuning ...	528pF	A1
C37†	Oscillator tuning ...	528pF	A1
C38‡	S.W. osc. trim. ...	40pF	G3
C39‡	M.W. osc. trim. ...	40pF	G3
C40‡	L.W. osc. trim. ...	40pF	F3

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTORS	Values	Locations
R1	V1 C.G.	470kΩ	F4
R2	A.G.C. decoupling	1MΩ	E4
R3	V1 G.B.	220Ω	F3
R4	V1 osc. C.G. ...	47kΩ	F4
R5	Osc. stabilizer .	47Ω	G3
R6	V1 H.T. feed	15kΩ	F4
R7	A.G.C. decoupling	1·5MΩ	E4
R8	V2 C.G. stopper ...	220Ω	F4
R9	V2 S.G. feed ...	47kΩ	E4
R10	V2 anode feed ...	10kΩ	E4
R11	V2 G.B.	330Ω	E4
R12	Diode load ...	330kΩ	E4
R13	I.F. filter	100kΩ	E4
R14	Part tone control...	1MΩ	E3
R15	Tone control ...	2·2MΩ	D3
R16	P.U. isolator ...	560kΩ	G4
R17	Volume control ...	2·2MΩ	E3
R18	V3 G.B.	3.3kΩ	E3
R19	V3 anode load ...	68kΩ	D4
R20	A.G.C. diode load ...	1MΩ	E3
R21	V4 anode load ...	68kΩ	D4
R22	V4 G.B.	2·2kΩ	E4
R23, R24	V4, V5 C.G. ...	470kΩ	E4
		33kΩ	E4
R25	H.T. smoothing ...	10kΩ	D4
R26	V6 C.G.	470kΩ	D4
R27, R28	V5, V6 C.G. stoppers	47kΩ	E3
		47kΩ	E4
R29	V5, V6 G.B. ...	120Ω	E4
R30	H.T. smoothing ...	1·5kΩ	D4
R31, R32, R33	Negative feed-back	12Ω	E3
		220Ω	E3
		22Ω	E3





R15 in the diode output ing of switch **S23.** The between the chassis and

If the component numbers given in the accompanying tables are used when ordering replacement parts, dealers are advised to mention the fact on the order, as these numbers may differ from those used in the manufacturers' diagram.

OTHER COMPONENTS			Approx. Values (ohm)	Locations
L1	Aerial coupling coils		—	G4
L2			0·6	G4
L3			32·0	F4
L4	Aerial tuning coils		—	G4
L5			4·0	G4
L6			16·0	F4
L7	Osc. tuning coils ...		—	F3
L8			3·2	F3
L9			4·0	F3
L10	Osc. reaction coils...		—	F3
L11			0·6	F3
L12			1·5	F3
L13	1st I.F. trans.	Pri.	12·5	B2
L14		Sec.	12·5	B2
L15	2nd I.F. trans.	Pri.	12·5	B2
L16		Sec.	12·5	B2
L17	Speech coil ...		2·5	—
T1	Pri., total		145·0	—
	Sec.		—	—
T2	Pri., total		27·0	—
	H.T. sec., total ...		280·0	C1
	Htr. sec.		—	—
S1-S23	Waveband switches		—	G4
S24	Speaker switch ...		—	—
S25	Mains sw., g'd R17		—	E3

DISMANTLING

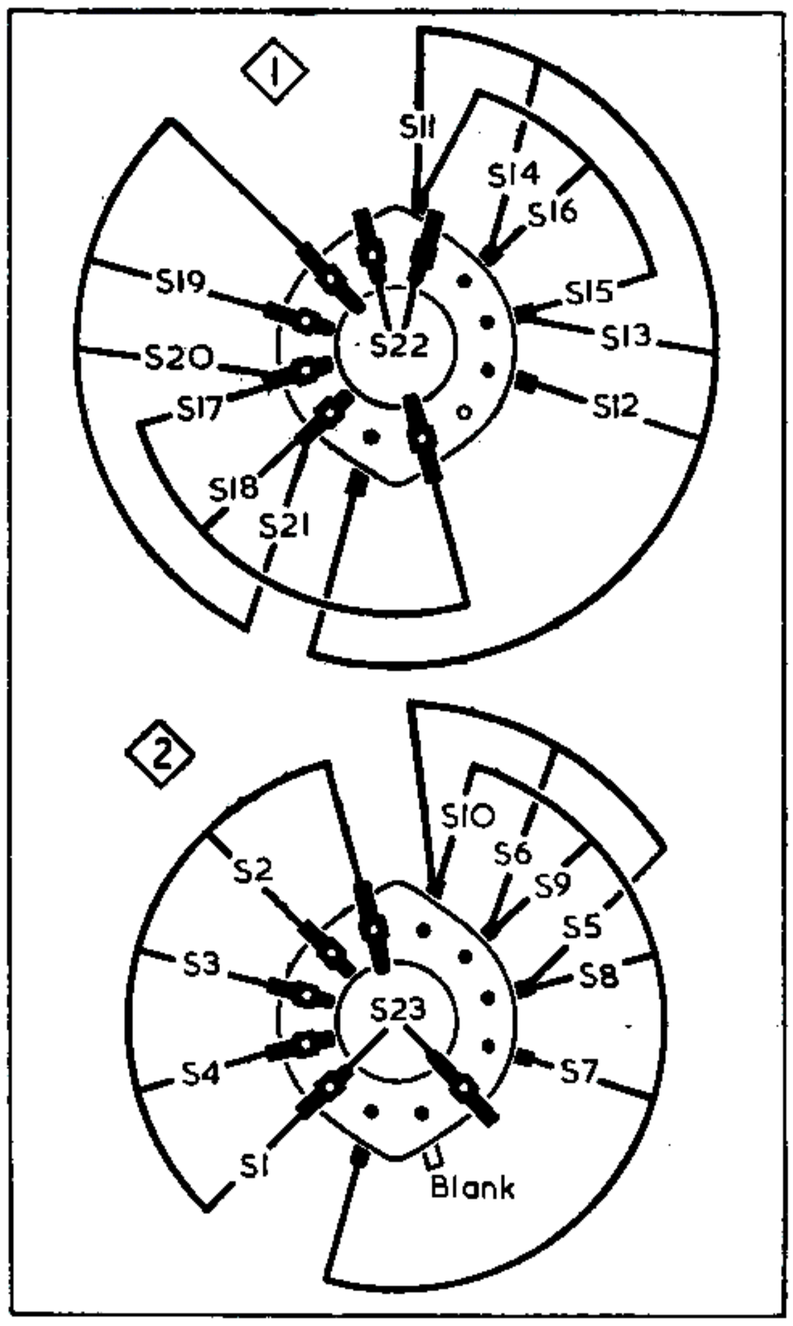
Removing Chassis.— Set tuning control so that the cursor is in the middle of the scale and lift the drive cord off the cursor carriage;
remove four control knobs (pull off);
disconnect speaker and scale lamp plug from chassis;
remove two screws securing rear edges of chassis to cabinet and withdraw chassis.

When replacing, check that the pegs projecting from the front of the chassis locate correctly in the grommets in the front of the cabinet. Check that with the gang at maximum capacitance the cursor coincides with the datum line on the tuning scale.

GENERAL NOTES

Switches.—**S1-S21** are the waveband switches, and **S22, S23** the radio/gram change-over switches, ganged in two rotary units beneath the chassis. These units are indicated in our underside view of the chassis by arrows and the numbers **1** and **2** in diamond surrounds. They are shown in detail in the diagrams in col. 2,

Waveband Switch Diagrams and Table



Diagrams of the waveband switch units, drawn as seen when viewed from the rear of an inverted chassis. On the right of the diagrams, in the next column, is the associated table.

Switches	S.W.	M.W.	L.W.	Gram
S1	—	—	—	C
S2	C	—	—	—
S3	—	C	—	—
S4	—	—	C	—
S5	C	—	—	—
S6	C	C	—	—
S7	C	—	—	—
S8	—	C	—	—
S9	—	—	C	—
S10	—	—	—	C
S11	—	—	—	C
S12	C	—	—	—
S13	—	C	—	—
S14	—	—	C	—
S15	C	—	—	—
S16	C	C	—	—
S17	C	—	—	—
S18	C	C	—	—
S19	C	—	—	—
S20	—	C	—	—
S21	—	—	C	—
S22	—	—	—	C
S23	—	—	—	C

where they are drawn as seen from the rear of an inverted chassis.

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

S24 is the internal speaker switch, associated with the external speaker sockets on a panel at the rear of the cabinet.

S25 is the Q.M.B. mains switch, ganged with the volume control **R17.**

Scale Lamps.—These are two M.E.S.-type lamps, with spherical bulbs, rated at 6.5 V, 0.3 A. They are mounted in the cabinet, not on the chassis, and are connected to chassis via the octal connecting plug.

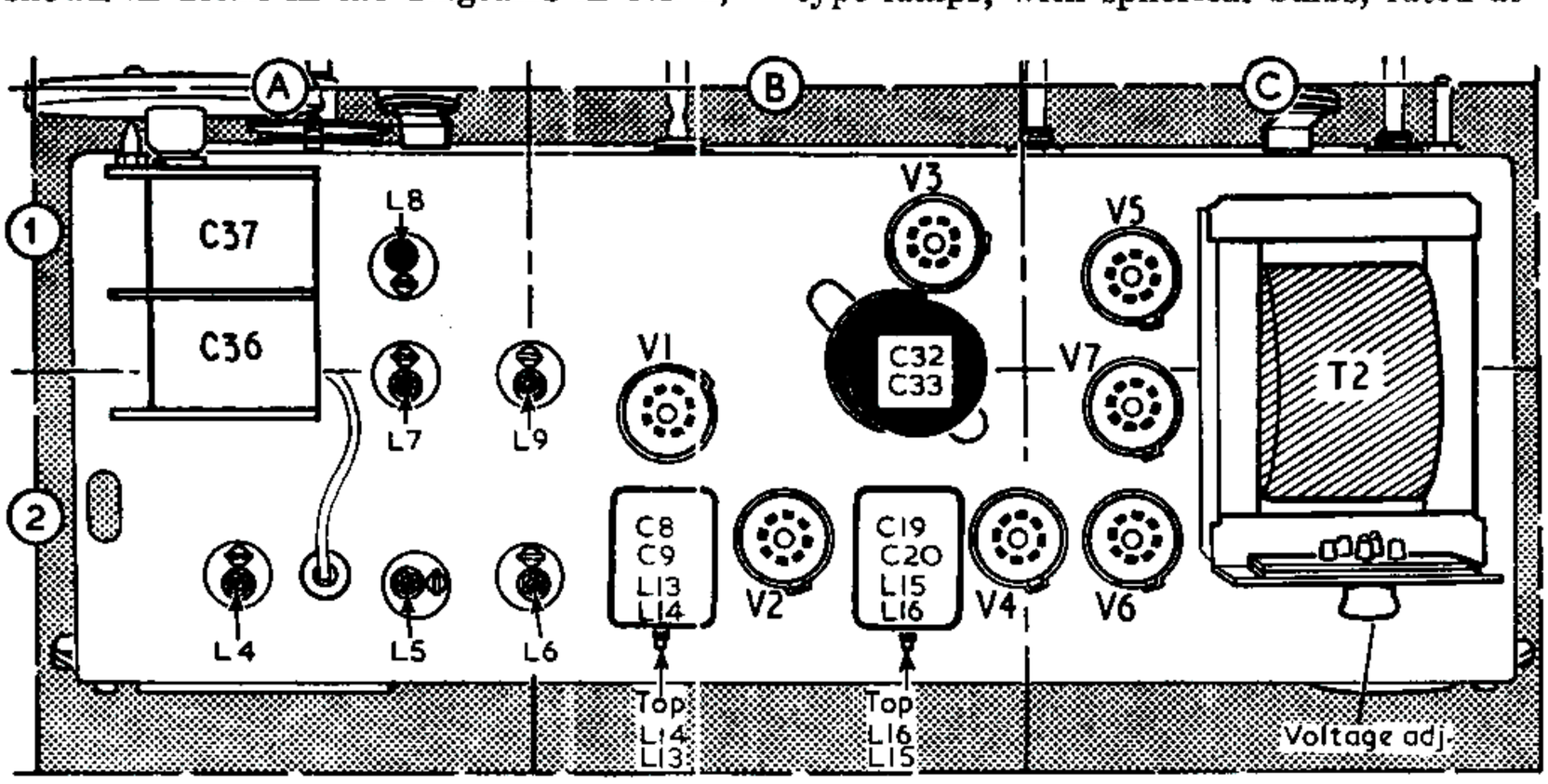
External Speaker.—Two sockets are provided on a panel at the rear of the cabinet for the connection of a low impedance (about 2-3Ω) external speaker. **S25** permits the internal speaker to be muted when it is in use. The makers stipulate that the external leads must not be earthed.

Gramophone Pick-up.—The makers recommend the use of a good quality pick-up of high impedance. It may have a magnetic or crystal movement, but the latter is preferable, and should be terminated by the network recommended by its makers.

The type specifically mentioned is the Cosmocord GP19 standard and GP19 L.P., and its connecting leads should be shunted by a terminating network consisting of a 0.003μF capacitor and a 330kΩ resistor connected in parallel.

External Connections.—The speaker, output transformer and scale lamps are mounted in the cabinet, external to the chassis, and connections between the two are effected by means of a standard octal plug and socket. The socket is indicated in our underside view of the chassis at location D3.

Pins 3 and 4 are used for the scale lamp connections, and pins 1, 2, 6, 7 and 8 for the speaker and transformer. Pin 5 is unused. The points where the interconnections occur are indicated in our circuit diagram by arrowheads and open circles.

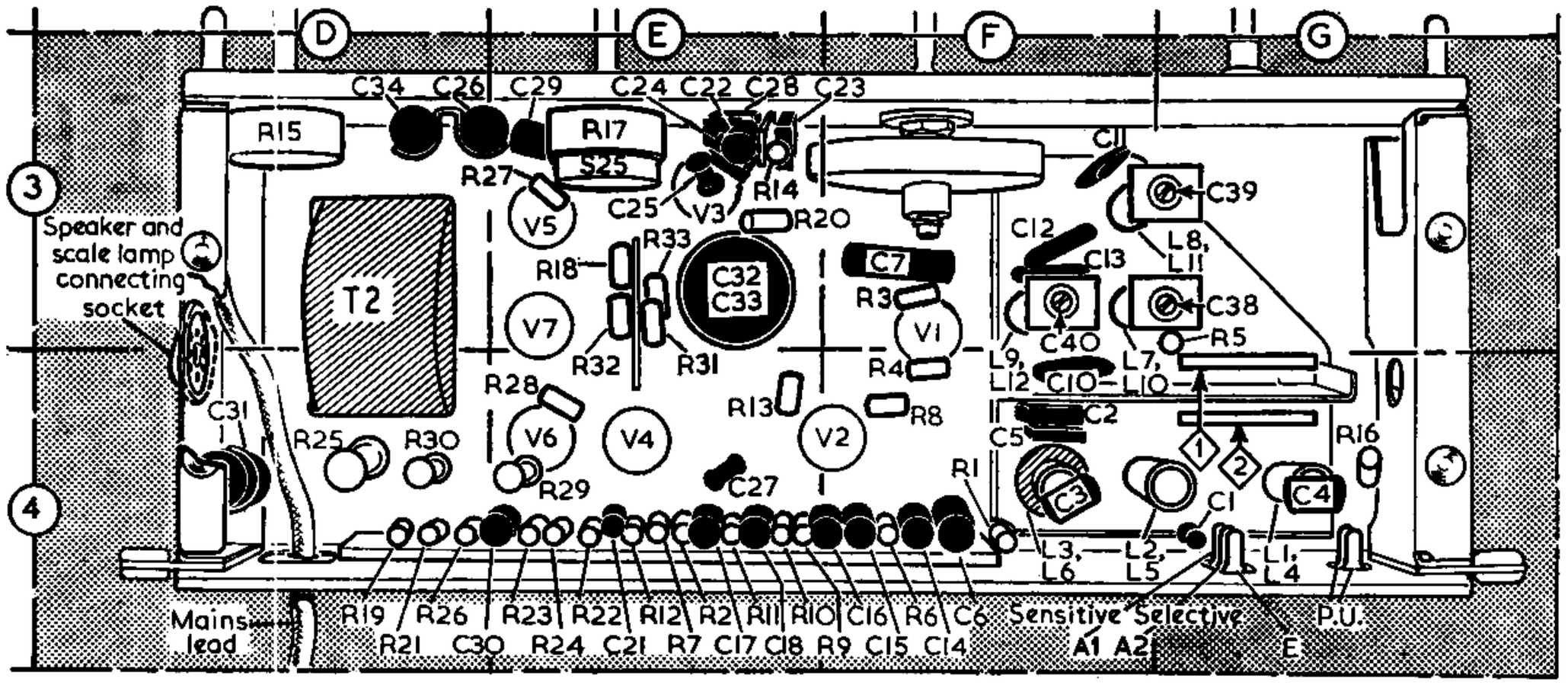


Plan view of the chassis. The core adjustments for alignment are indicated here, but all the capacitative trimmer adjustments are below the deck.

CIRCUIT ALIGNMENT

Remove the chassis from its cabinet, and, with the octal speaker plug still connected, stand it on the bench so that the adjustments above and below chassis are accessible. The receiver should be allowed to warm up for 15 minutes before carrying out the following alignment procedure.

I.F. Stages.—Switch receiver to M.W. and tune to the highest wavelength end of the band. Connect output of signal generator to control grid (pin 6) of **V2** and chassis. Feed in a 465kc/s signal



and adjust the cores of **L16** and **L15** (location reference B2) for maximum output. Transfer "live" signal generator output lead to control grid (pin 6) of **V1** and adjust the cores of **L14** and **L13** (B2) for maximum output. Do not readjust **L15, L16.**

R.F. and Oscillator Stages.—As the tuning scale remains fixed in the cabinet when the chassis is withdrawn, reference must be made the substitute scale printed on the back of the tuning drive drum. Check that with the gang at maximum capacitance, the cursor coincides with the datum line on the main tuning scale, or the metal pointer fixed to the top of the gang coincides with the datum line on the substitute tuning scale. Transfer the signal generator leads, via a 200pF capacitor for M.W. and L.W. and a 400Ω non-inductive resistor for S.W., to the aerial **A1** (sensitive position) and **E** sockets.

L.W.—Switch receiver to L.W., tune to 2,000m, feed in a 2,000m (150 kc/s) signal and adjust the cores of **L9** (A2) and **L6** (A2) for maximum output. Tune receiver to 1,000m, feed in a 1,000m (300 kc/s) signal and adjust **C40** (F3) for maximum output. Repeat these adjustments.

M.W.—Switch receiver to M.W., tune to 500m, feed in a 500m (600 kc/s) signal and adjust the cores of **L8** (A1) and **L5** (A2) for maximum output. Tune receiver to 200m, feed in a 200m (1,500 kc/s) signal and adjust **C39** (G3) for maximum output. Repeat these adjustments.

S.W.—Switch receiver to S.W., tune to 50m, feed in a 50m (6 Mc/s) signal and adjust the cores of **L7** (A2) and **L4** (A2) for maximum output. Tune receiver to 25m, feed in a 25m (12 Mc/s) signal and adjust **C38** (G3) for maximum output. Repeat these adjustments.

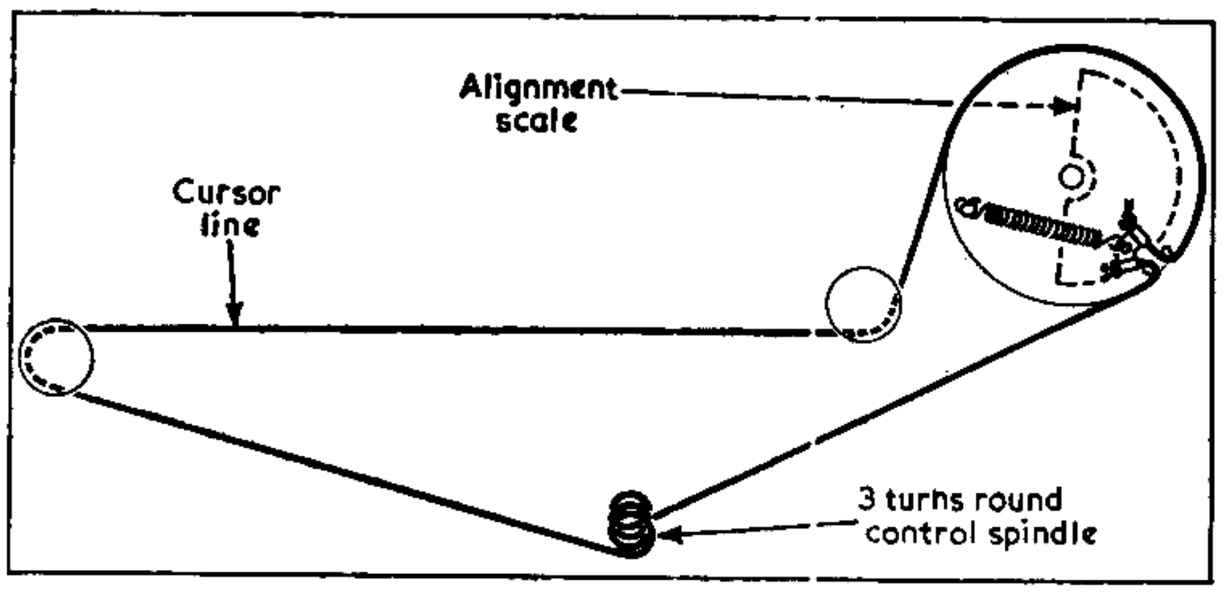
DRIVE CORD REPLACEMENT

About three feet of nylon braided glass yarn is required for a new tuning drive cord, which should be run as shown in the accompanying sketch, where the system is drawn as seen from the front with the gang at maximum capacitance.

The ends of the cord are clamped in in a special anchor plate, which has a hole in which to hook the tension spring, and it is possible to make the cord up complete before fitting, and then thread it through the opening in the drive drum groove and loop it round the pulleys and control spindle. The makers state that the length of the cord when made up in this way is 32¼in.

The cord is fitted with a wedge-shaped driving clip to engage with the cursor carriage. This can be slipped on afterwards, but its cord grips should not be finally clenched until the chassis is in the cabinet, when with the gang at maximum capacitance the cursor should be adjusted to cover the datum line on the right-hand side of the scales.

The alignment scale, which is cemented on the rear face of the drive drum, should be so positioned that its calibration point 25 is level with the gap in the drive drum groove.



Sketch showing the tuning drive system, drawn as seen from the front when the gang is at maximum capacitance.

VALVE ANALYSIS

Valve voltages and currents given in the table below are derived from the manufacturers' information and are the average figures taken from a number of receivers operating from 230 V A.C. mains. The receivers were switched to M.W., but there was no signal input.

Voltage readings were measured on the 1,000 V and 10 V ranges of a Model 7 Avometer. Chassis was the negative connection in every case.

Valve	Anode		Screen		Cath.
	V	mA	V	mA	V
V1 ECH42	120	2·0	55	2·0	1·5
	Oscillator				
	55	2·3			
V2 EF41	80	4·4	60	1·3	1·3
V3 EBC41	90	0·3	—	—	1·0
V4 EBC41	80	1·0	—	—	0·8
V5 EL41	258	27·0	231	3·5	6·5
V6 EL41	258	27·0	231	3·5	6·5
V7 EZ40	242*	—	—	—	260·0

* A.C. voltage reading.

Printed in England by Cornwall Press Ltd., Paris Garden, London, S.E.1.