'TRADER' SERVICE SHEET 168

PILOT U650, CU650, RGU650 AND RGAU650

FOUR wave bands are covered by the Pilot U650 5-valve (plus rectifier) A.C. superhet, the two short wave ranges being 16-52 metres (referred to below as S.W.1) and 48-150 metres (S.W.2). A jack is provided for a gramophone pick-up and provision is also made for an extension speaker.

An identical chassis is fitted in the CU650 console receiver, the RGU650 radio-gramophone and the RGAU650 automatic radio-gramophone, but this *Service Sheet* was prepared on a table model.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1** (S.W.1), **L3** (S.W.2), **L5** (M.W.) and **L7** (L.W.) to single tuned circuits **L2, C35** (S.W.1), **L4, C35** (S.W.2), **L6, C35** (M.W.) and **L8, C35** (L.W.), which precede variable-mu pentode signal-frequency amplifier (**V1, Pilot 6D6**).

Tuned-secondary transformer couplings by **L9, L10, C40** (S.W.1), **L11, L12, C40** (S.W.2), **L13, L14, C40** (M.W.), and **L15, L16, C40** (L.W.) between **V1** and heptode frequency changer valve (**V2, Pilot 6A7**). Oscillator grid coils **L17** (S.W.1), **L19** (S.W.2), **L21** (M.W.) and **L23** (L.W.) are tuned by **C41**; parallel trimming by **C42** (S.W.1), **C43** (S.W.2), **C44** (M.W.) and **C46** (L.W.); series tracking by **C11** (S.W.1), **C12** (S.W.2), **C45** (M.W.) and **C47** (L.W.); anode reaction coils **L18** (S.W.1), **L20** (S.W.2), **L22** (M.W.) and **L24** (L.W.).

Single variable-mu pentode intermediate frequency amplifier (**V3, Pilot 6D6**) operating with fixed G.B. and special triple-tuned transformer couplings **C48, L25, L26, C49, L27, C50,** and **C51, L28, L29, C52, L30, C53.**

Intermediate frequency 456 KC/S.

Diode second detector is part of double diode triode valve (**V4, Pilot 75**). Audio-frequency component in rectified output is developed across load resistances **R18, R19** and passed via coupling condenser **C19** and manual volume control **R16** to C.G. of triode section which operates as L.F. amplifier. Provision for connection of gramophone pick-up by jack.

D.C. potential developed across **V4** diode load resistances is fed back through decoupling circuits as G.B. to H.F. and F.C. valves, giving automatic volume control. Delay voltage is obtained from drop along **V4** cathode resistance **R20.**

Cathode ray tuning indicator (**T.I., 6G5**) is operated by means of D.C. potential developed across section of **V4** diode load.

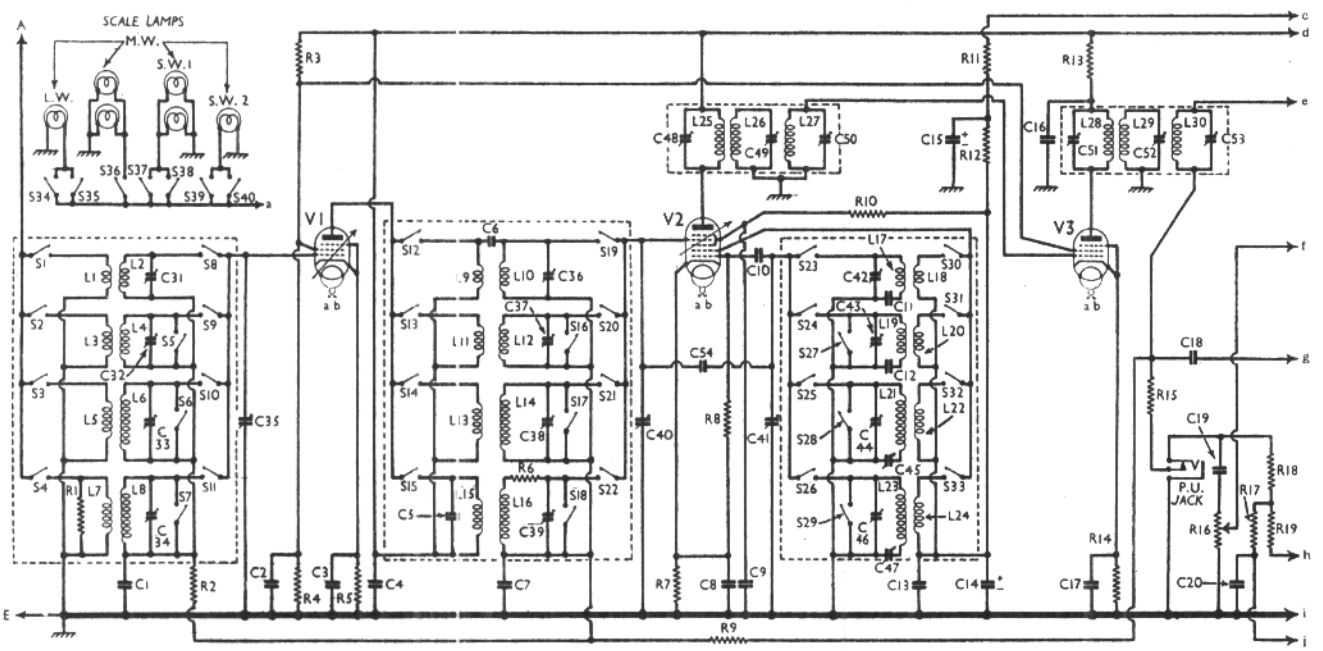
Resistance capacity coupling by **R22, C24** and **R23** between **V4** triode and pentode output valve (**V5 Pilot 42**). Variable tone control in anode circuit by R.C. filter **R24, C25**; fixed tone correction by condenser **C26.** Provision for connection of high-impedance external speaker across primary of internal speaker transformer **T1.** Isolation from H.T. supply by coupling condensers **C29, C30.**

H.T. current is supplied by full-wave rectifying valve (**V6, Pilot 80**). Smoothing by speaker field coil **L33** and dry electrolytic condensers **C23** and **C28.**

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	Aerial L.W. coupling shunt	50,000
R2	V1 C.G. decoupling	100,000
R3	V1 and V3 S.G.'s H.T. potential divider	30,000
R4		40,000
R5	V1 fixed G.B. resistance	400
R6	H.F. trans. L.W. sec. series	250
R7	V2 fixed G.B. resistance	400
R8	V2 osc. C.G. resistance	50,000
R9	A.V.C. line decoupling	1,000,000
R10	V2 S.G.'s H.T. feed	30,000
R11	V2 osc. anode and S.G.'s decoupling	10,000
R12		10,000
R13	V3 anode decoupling	4,000
R14	V3 G.B. resistance	600
R15	I.F. stopper	50,000
R16	Manual volume control	1,000,000
R17	T.I. feed decoupling	1,000,000
R18	V4 diode load	100,000
R19		200,000
R20	V4 G.B. resistance	2,000
R21	V4 anode decoupling	100,000
R22	V4 anode load	250,000
R23	V5 C.G. resistance	500,000
R24	Variable tone control	100,000

	CONDENSERS	Values (μF)
C1	V1 C.G. decoupling	0·05
C2	V1 and V2 S.G.'s by-pass	0·1
C3	V1 cathode by-pass	0·1
C4	V1 anode decoupling	0·25
C5	L.W. H.F. trans. pri. trimmer	0·00025
C6	S.W. H.F. trans. cap. coupling	0·00001
C7	V2 tetrode C.G. decoupling	0·05
C8	V2 cathode by-pass	0·1
C9	V2 S.G.'s by-pass	0·05
C10	V2 osc. C.G. condenser	0·00005
C11	Osc. S.W. 1 series tracker	0·00287
C12	Osc. S.W.2 series tracker	0·00137
C13	V1 osc. anode and S.G.'s decoupling	0·05
C14*		2·0
C15*		2·0
C16	V3 anode decoupling	0·05
C17	V3 cathode by-pass	0·1
C18	I.F. by-pass	0·00025
C19	Coupling to V4 triode	0·01
C20	T.I. feed decoupling	0·05
C21	4V triode anode decoupling	0·1
C22*	V4 cathode by-pass	10·0
C23*	H.T. smoothing	8·0
C24	V4 to V5 L.F. coupling	0·01
C25†	Part of T.C. filter	0·05
C26	Fixed tone corrector	0·005
C27*	V5 cathode by-pass	10·0
C28*	H.T. smoothing	8·0
C29	Ext. L.S. coupling	0·05
C30		0·05
C31‡	Aerial S.W.1 trimmer	—
C32‡	Aerial S.W.2 trimmer	—
C33‡	Aerial M.W. trimmer	—
C34‡	Aerial L.W. trimmer	—
C35†	Aerial circuit tuning	0·00045

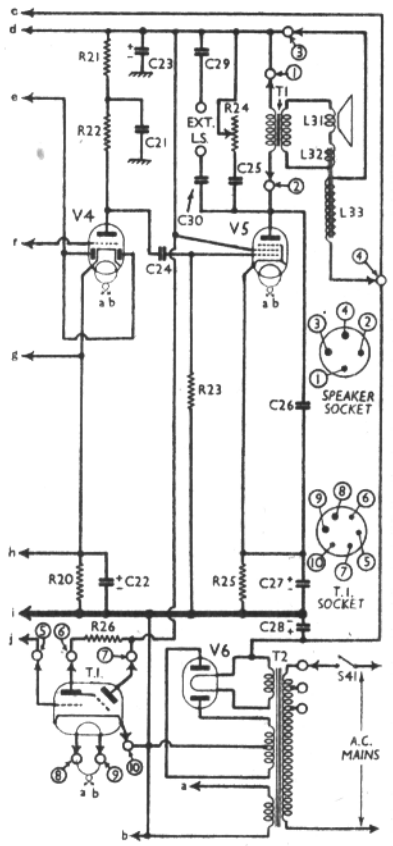


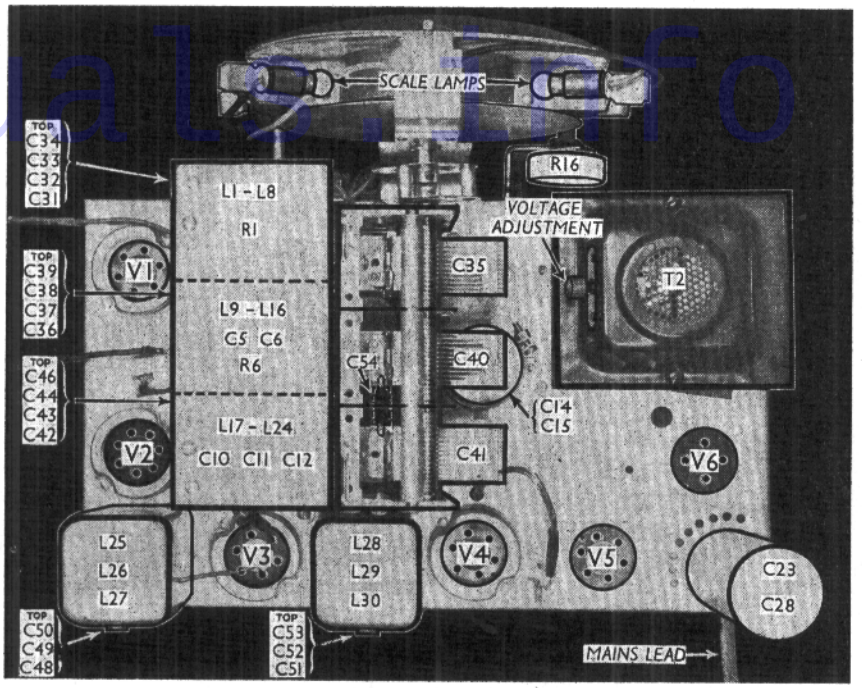
Circuit diagram of the Pilot U650 4-band A.C. superhet. The console and two radiogram models have similar chassis. Note the cathode ray tuning indicator. This and the speaker are connected to the chassis by valve-base type plugs. The connections are indicated by numbered circles in the circuit, and diagrams of the undersides of the sockets are, inset, above, and similarly numbered.

CONDENSERS (*Continued*)		Values (μF)
C36‡	H.F. trans. sec. S.W.1 trimmer	—
C37‡	H.F. trans. sec. S.W.2 trimmer	—
C38‡	H.F. trans. sec. M.W. trimmer	—
C39‡	H.F. trans. sec. L.W. trimmer	—
C40†	H.F. trans. sec. tuning	0·00045
C41†	Oscillator circuit tuning	0·00045
C42‡	Osc. circuit S.W.1 trimmer	—
C43‡	Osc. circuit S.W.2 trimmer	—
C44‡	Osc. circuit M.W. trimmer	—
C45‡	Osc. M.W. series tracker	0.0005
C46‡	Osc. circuit L.W. trimmer	—
C47‡	Osc. L.W. series tracker	0·00015
C48‡	1st I.F. trans. pri. tuning	—
C49†	Absorption coil tuning	—
C50‡	1st I.F. trans. sec. tuning	—
C51‡	2nd I.F. trans. pri. tuning	—
C52‡	Absorption coil tuning	—
C53‡	2nd I.F. trans. sec. tuning	—
C54	Neutralising condenser	—

* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial S.W.1 coupling coil	1·0
L2	Aerial S.W.1 tuning coil	0·05
L3	Aerial S.W.2 coupling coil	3·0
L4	Aerial S.W.2 tuning coil	0·8
L5	Aerial M.W. coupling coil	19·5
L6	Aerial M.W. tuning coil	3·0
L7	Aerial L.W. coupling coil	115·0
L8	Aerial L.W. tuning coil	18·0
L9	H.F. trans. S.W.1 pri.	3·5
L10	H.F. trans. S.W.1 sec.	0·05
L11	H.F. trans. S.W.2 pri.	10·0
L12	H.F. trans. S.W.2 sec.	0·8
L13	H.F. trans. M.W. pri.	90·0
L14	H.F. trans. M.W. sec.	2·6
L15	H.F. trans. L.W. pri.	120·0
L16	H.F. trans. L.W. sec.	18·0
L17	Osc. S.W.1 tuning coil	0·05
L18	Osc. S.W.1 reaction coil	0·6
L19	Osc. S.W.2 tuning coil	0·7
L20	Osc. S.W.2 reaction coil	1·3





Plan view of the chassis. The trimmers in the coil units are numbered from top to bottom in each case. Note the extra components in the main coil unit. C54 is a very small condenser beneath C40 and C41.

OTHER COMPONENTS (*Continued*)		Approx. Values (ohms)
L21	Osc. M.W. tuning coil	5·5
L22	Osc. M.W. reaction coil	2·0
L23	Osc. L.W. tuning coil	14·0
L24	Osc. L.W. reaction coil	3·7
L25	1st I.F. trans. Pri. coil	8·3
L26	1st I.F. trans. Absorption coil	
L27	1st I.F. trans. Sec. coil	8·5
L28	2nd I.F. trans. Pri. coil	13·0
L29	2nd I.F. trans. Absorption coil	12·2
L30	2nd I.F. trans. Sec. coil	8·5
L31	Speaker speech coil	8·5
L32	Hum neutralising coil	1·7
L33	Speaker field coil	0·2
T1	Speaker input trans. Pri.	1400·0
	Speaker input trans. Sec.	750·0
T2	Mains trans. Pri. total	0·3
	Mains trans. Heat. sec.	17·5
	Mains trans. Rect. fil. sec.	0·1
	Mains trans. H.T.sec. total	0·05
T.I.	Cathode ray tuning indicator	330·0
S1-33	Waveband switches	—
S34-40	Scale lamp switches	—
S41	Mains switch, ganged R24	—

DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, first remove the tuning knob (recessed grub screw) and the other three knobs (pull off). Now remove the four bolts (with washers and spring washers) holding the chassis to the bottom of the cabinet when it can be withdrawn to the extent of the speaker and tuning indicator leads, which is sufficient for normal purposes. *When replacing*, do not forget to replace the felt washers on the control spindles.

Removing Speaker.—To remove the speaker from the cabinet, remove the nuts and fibre washers from the four bolts holding it to the sub-baffle. *When replacing* see that the transformer is on the right.

Removing Tuning Indicator.—If it is desired to obtain access to the tuning indicator holder, remove the speaker as described above when the cradle carrying the indicator can be removed. *When replacing*, see that the leads are brought out to the right.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 220 V, using the 225 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the medium band and the volume control was at maximum, but there was no signal input the aerial and earth leads being connected together.

Voltages were measured on the 1,200 V scale of an Avometer, with chassis as negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 6D6	260	6·5	100	1·5
V2 6A7*	260	2·1	100	3·1
V3 6D6	235	5·1	100	2·0
V4 75	75	0·5	—	—
V5 42	230	37·0	260	5·9
V6 80	310†	—	—	—

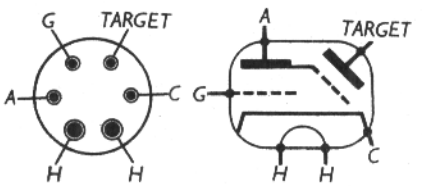
*Oscillator anode (G2) 180 V, 4.7 m.A
† Each anode, A.C.

GENERAL NOTES

Switches.—S1-S33 are the waveband switches, and **S34-S40** the scale lamp switches, ganged together in four rotary units beneath the chassis. These are indicated in our under-chassis view by numbers in circles. The arrows show the directions in which the units are viewed in the diagrams on page VIII.

The table (p. VIII) gives the switch positions for the various control settings. The vertical columns, from left to right, indicate the control settings as the knob is turned clockwise from fully anti-clockwise.

S41 is the Q.M.B. mains switch, ganged with the tone control **R24.** A jack switch, not separately numbered, is used for connection of a pick-up.



Connections of the tuning indicator, looking at the underside of the base, with its electrode diagram on the right.

Coils.—L1-L24 are in the coil and switch unit, in three separately screened sections. This unit also contains the associated trimmers, indicated at the side of our plan chassis view.

Continued overleaf

PILOT U650—*Continued*

The I.F. transformers (each containing three coils) are in two separate screened units on the chassis deck.

Scale Lamps.—These are American-type 6·8 V bulbs with small centre-contact bayonet caps. There are six in all, switched by **S34-S40.**

External Speaker.—Sockets are provided at the rear of the chassis for a high resistance external speaker. It is fed via two fixed condensers.

Tuning Indicator.—This is of the cathode ray type. A separate electrode diagram, and the connections of the pins, looking at the underside of the base, are given on page VII.

Internal Speaker and T.I. Connectors.—Valve-holders are fitted at the back and front of the chassis for the speaker and T.I. plugs. Diagrams, numbered to agree with the connections shown in the circuit, are included at the bottom of the circuit diagram.

Condensers C23, C28.—These are two 8μF dry electrolytics in a single tubular unit. The case is isolated, and the black lead is the common negative. There are two red leads for the positives, that connected to one of the heater sockets of **V6** belonging to **C28.**

Condensers C14, C15.—These are two 2μF dry electrolytics in a tubular unit, the case being isolated. The black lead is the common negative, the green the positive of **C14** and the red of **C15.**

Condenser C54.—This small neutralising condenser is situated beneath **C40** and **C41** in the gang condenser unit. It is formed of the capacity between two tags riveted to a strip of insulating material.

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set to M.W., and turn gang to maximum. Connect signal generator between top cap of **V3** via a 0·1μF condenser, and chassis. Feed in a 456 KC/S signal, and adjust **C53, C52** and **C51** for maximum output. Transfer the signal generator high potential lead (via the condenser) to the top cap of **V2** and adjust **C50, C49** and **C48** for maximum output. Keep the input low in all cases. Finally, repeat these adjustments.

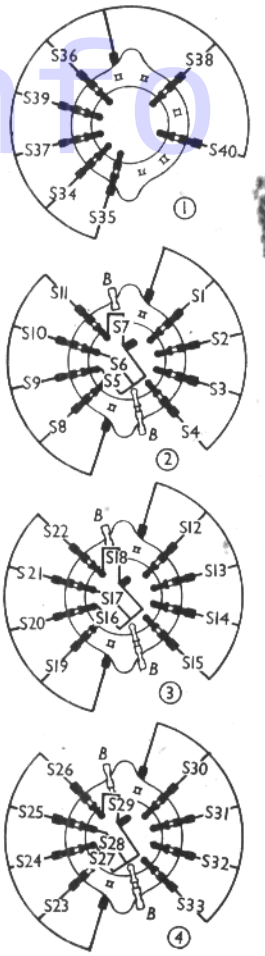
M.W.—Connect signal generator to **A** and **E** leads. Switch set to M.W., and tune to 1,500 KC/S on scale. Feed in a 1,500 KC/S signal, and adjust **C44** for maximum output. Next adjust **C38,** and then **C33.** Feed in a 600 KC/S signal, tune the signal in, then adjust **C45,** while rocking the gang for optimum output. Repeat the adjustment of **C44, C38** and **C33.**

S.W.2.—Switch set to S.W.2 band, set pointer to 49 m. on scale, feed in a 49 m. signal, and adjust **C43, C37** and **C32** for maximum output.

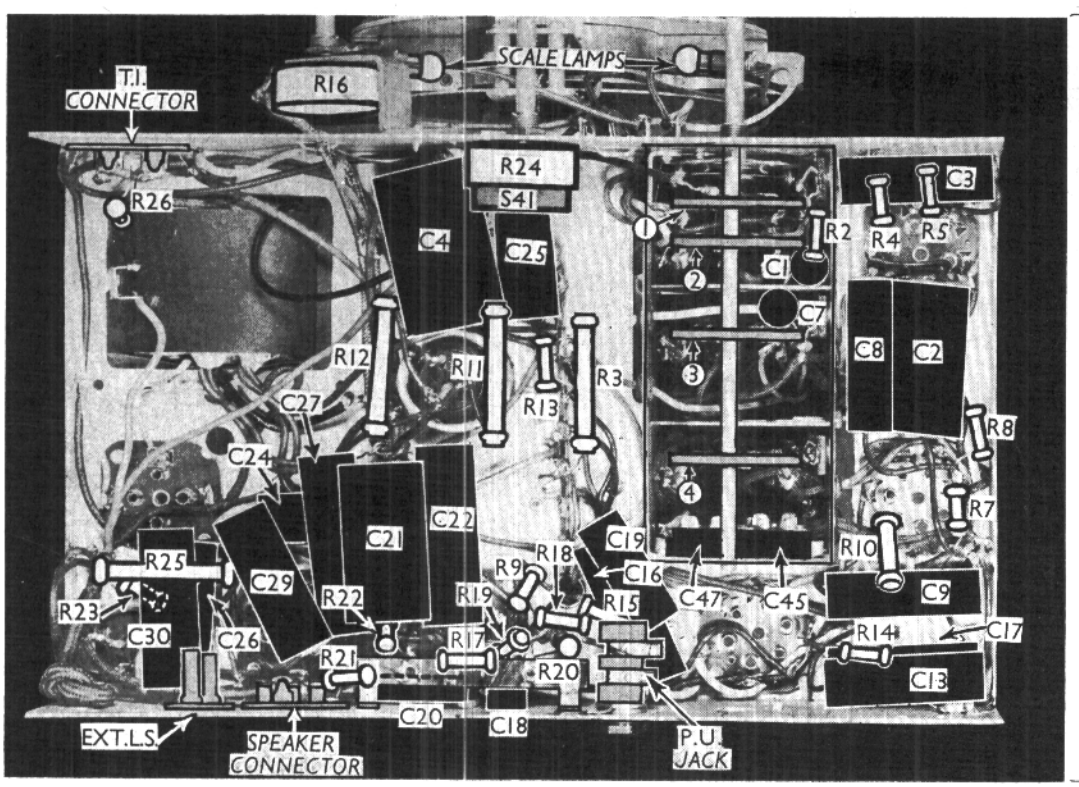
S.W.1.—Switch set to S.W.1 band, set pointer to 16·6 m., feed in a 16·6 m. signal and adjust **C42** for maximum output. Next adjust **C36,** rocking the gang meanwhile. Finally adjust **C31.**

L.W.—Proceed as for M.W., except that **C46, C39** and **C34** are adjusted at 750 m. and **C47** at 2,000 m.

Switch	L.W.	M.W.	S.W.2	S.W.1
S1	O	O	O	C
S2	O	O	C	O
S3	O	C	O	O
S4	C	O	O	O
S5	O	O	O	C
S6	O	O	C	C
S7	O	C	C	O
S8	O	O	O	C
S9	O	O	C	O
S10	O	C	O	O
S11	C	O	O	O
S12	O	O	O	C
S13	O	O	C	O
S14	O	C	O	O
S15	C	O	O	O
S16	O	O	O	C
S17	O	O	C	C
S18	O	C	C	O
S19	O	O	O	C
S20	O	O	C	O
S21	O	C	O	O
S22	C	O	O	O
S23	O	O	O	C
S24	O	O	C	O
S25	O	C	O	O
S26	C	O	O	O
S27	O	O	O	C
S28	O	O	C	C
S29	O	C	C	O
S30	O	O	O	C
S31	O	O	C	O
S32	O	C	O	O
S33	C	O	O	O
S34	C	O	O	O
S35	O	C	O	O
S36	O	C	O	O
S37	O	O	O	C
S38	O	C	O	C
S39	O	O	C	O
S40	O	C	O	O



Diagrams of the switch units, looking in the directions of the arrows in the under-chassis view. Note the three extra switches in units 2, 3 and 4, the common contact in each case being fixed to the rotating portion of the unit.



Under-chassis view. The numbers in circles refer to the switch units, diagrams of which are given above. The speaker and tuning indicator plug into connectors which are indicated. A jack is used for pick-up connection and switching.