NUMBER 134

'TRADER' SERVICE SHEETS

PHILCO 295

5-VALVE ALL-WAVE BATTERY MODEL

A SHORT-WAVE range of 16-54 metres is covered by the Philco 295 5-valve battery all-wave superhet. It has sockets for a gramophone pick-up and for the Philco all-wave aerial, while a feature of the circuit is the incorporation of a signal frequency amplifier stage.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L2** (S.W.), **L4** (M.W.), **L6** (L.W.) to tuned circuit comprising **C26** and coils **L3** (S.W.), **L5** (M.W.), **L7** (L.W.). Filter circuit **L1, C21** by-passes interference at the intermediate frequency. Provision for connection of special aerial transmission line to terminals marked "Black" and "Red."

First valve (**V1, Philco 1A4E**) is a variable-mu pentode operating as signal frequency amplifier with tuned secondary transformer coupling to heptode frequency changer (**V2, Philco 1C6**). Transformer primaries **L8** (S.W.), **L12** (M.W. and L.W.); secondaries **L9** (S.W.), **L11** (M.W.), **L13** (L.W.) tuned by **C31**. Oscillator grid coils **L14** (S.W.), **L16** (M.W.), **L17** (L.W.) tuned by **C32**; tracking by **C6, C34** (S.W.), **C37** (M.W.), **C39** (L.W.); reaction is applied by small coil **L15** and condenser **C5**.

Third valve, a variable-mu H.F. pentode (**V3, Philco 1A4E**) operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **L18, L19** and **L20, L21**.

Intermediate frequency 451 KC/S.

Diode second detector forms part of double diode triode valve (**V4, Philco 2102**). Audio-frequency component in rectified output is developed across load resistance **R9** and passed via coupling condenser **C12** and manual volume control **R12** to C.G. of triode section which operates as L.F. amplifier. Four-point tone control is effected by means of tapping on volume control and **R11, C13, C14, C15,** which work in conjunction with switches **S35, S36, S37.** Provision for connection of gramophone pick-up across volume control by switch **S34.** I.F. filtering by stopper resistance **R8** and by-pass condensers **C10, C11, C16, C17.**

D.C. potential developed across **R9** is fed back through decoupling circuits as G.B. to H.F., F.C. and I.F. valves, giving automatic volume control.

Parallel fed transformer coupling by **R13, C18** and **T1** to double-pentode quiescent push-pull output stage (**V5, Philco 2103**). Resistance **R16** prevents parasitic oscillations. Fixed tone correction by R.C. filter **R17, C20.** Coupling to speaker by special input transformer **T2.** Provision for connection of low impedance external speaker across secondary winding.

COMPONENTS AND VALUES

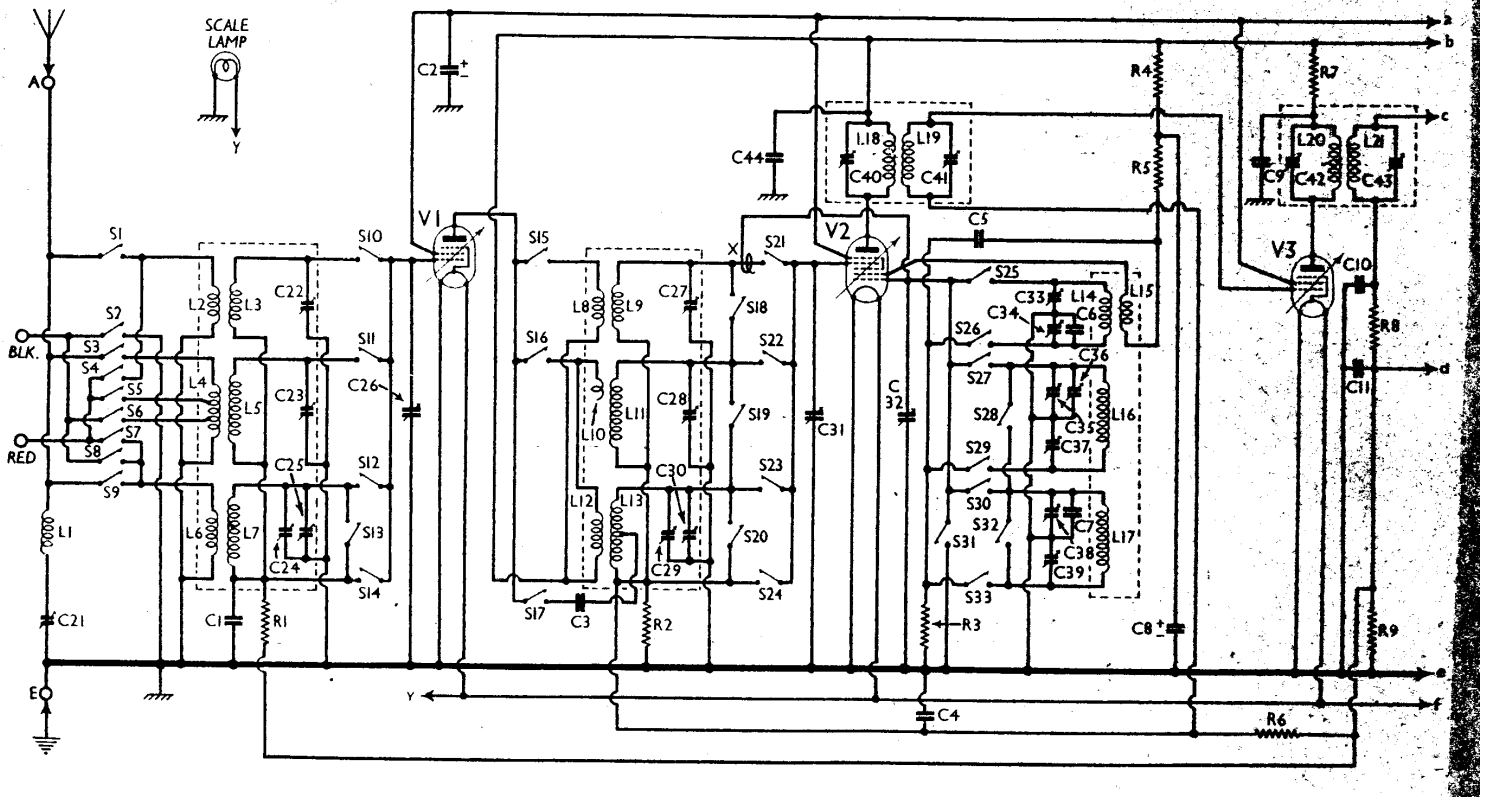
	Resistances	Values (ohms)
R1	V1 C.G. decoupling	2,000,000
R2	V2 tetrode C.G. decoupling	2,000,000
R3	V2 osc. C.G. resistance	32,000
R4	V2 osc. anode decoupling	2,000
R5	V2 osc. anode resistance	10,000
R6	V2 and V3 A.V.C. line decoupling	2,000,000
R7	V3 anode decoupling	1,000
R8	I.F. stopper	51,000
R9	V4 diode load	330,000
R10	Gram. pick-up series resistance	51,000
R11	Part of T.C. circuit	25,000
R12*	Manual volume control	1,000,000
R13	V4 triode anode load	51,000
R14	V1, V2, V3, S.G.'s decoupling	20,000
R15	G.B. battery load	1,000
R16	V5 C.G. circuits stabiliser	240,000
R17	Part V5 imp. limiting filter	25,000

* Tapped at 215,000 O.

	Condensers	Values (μF)
C1	V1 C.G. decoupling	0·05
C2*	V1, V2, V3 S.G.'s decoupling	4·0
C3	H.F. trans. cap. coupling (L.W.)	0·00041
C4	V2, V3 A.V.C. line decoupling	0·05
C5	V2 osc. anode coupling	0·00025
C6	Oscillator fixed tracker (S.W.)	0·00225
C7	Oscillator fixed trimmer (L.W.)	0·00005
C8*	V2 osc. anode decoupling	8·0
C9	V3 anode decoupling	0·09
C10, C11	I.F. by-passes	0·00011
C12	L.F. coupling to vol. cont.	0·01
C13, C14, C15	Parts of tone control circuit	0·001, 0·01, 0·001
C16	V4 triode C.G. I.F. by-pass	0·00011
C17	V4 triode anode I.F. by-pass	0·0008
C18	L.F. coupling to T1	0·09
C19*	H.T. supply reservoir	2·0
C20	Part V5 imp. limiting filter	0·001
C21‡	Aerial I.F. filter tuning	0·000045
C22‡	Aerial S.W. trimmer	—
C23‡	Aerial M.W. trimmer	—
C24‡, C25‡	Aerial L.W. trimmers	—
C26†	Aerial circuit tuning	—
C27‡	H.F. trans. S.W. sec. trimmer	—
C28‡	H.F. trans. M.W. sec. trimmer	—
C29‡, C30‡	H.F. trans. L.W. sec. trimmers	—
C31†	H.F. trans. sec. tuning	—
C32†	Oscillator circuit tuning	—
C33‡	Osc. S.W. trimmer	—
C34‡	Osc. S.W. tracker	0·0006
C35‡, C36‡	Osc. M.W. trimmers	—
C37‡	Osc. M.W. tracker	0·0015
C38‡	Osc. L.W. trimmer	—
C39‡	Osc. L.W. tracker	0·000375
C40‡	1st I.F. trans. pri. tuning	—
C41‡	1st I.F. trans. sec. tuning	—
C42‡	2nd I.F. trans. pri. tuning	—
C43‡	2nd I.F. trans. sec. tuning	—
C44	V2 anode decoupling	0·09

* Electrolytic. † Variable. ‡ Pre-set.

	Other Components	Approx. Values (ohms)
L1	Aerial I.F. filter coil	17·0
L2	Aerial S.W. coupling coil	0·5
L3	Aerial S.W. tuning coil	0·1
L4	Aerial M.W. coupling coil	35·0
L5	Aerial M.W. tuning coil	2·5
L6	Aerial L.W. coupling coil	115·0
L7	Aerial L.W. tuning coil	15·0



PHILCO 295 (*Continued*)

position (bass boost) all switches are *open*, in the third position (top cut 1) **S36** is *closed*, and in the fully clockwise position (top cut 2) both **S36** and **S37** are *closed*.

S33 is a 3-point Q.M.B. switch used for L.T. and H.T. switching. It is ganged with the manual volume control **R12**.

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

Coils.—All tuning coils, with the exception of the I.F. filter coil **L1**, are in five screened units mounted on the chassis deck. **L1** is beneath the chassis, at the rear.

Condensers.—**C2**, **C8** and **C19** are respectively 4, 8 and 2 μF dry electrolytics in a single cylindrical metal can beneath the chassis. The can is the common negative connection, while the positive connections are taken out to colour-coded tags. The blue tag is the positive of **C2**, the yellow tag the positive of **C8**, and the plain tag the positive of **C19**.

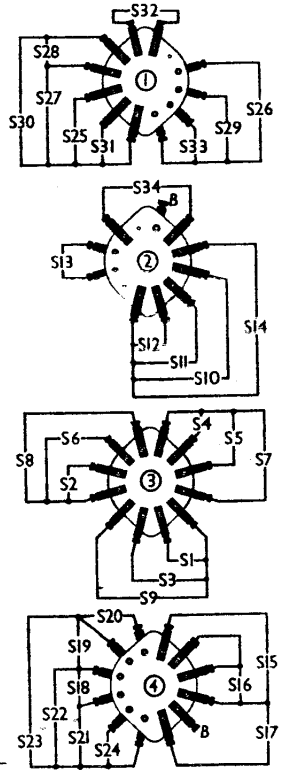
C18 is a mica dielectric condenser in a black moulded case. The centre tag is used only as a bearer.

Scale Lamp.—A Philco 2 V type with a special bayonet cap.

External Speaker.—Soldering tags are provided on the internal speaker input transformer for the connection of a low-impedance (2 O) external speaker.

Battery Leads and Voltages.—The following coding for the battery leads is employed:—White, **L.T.** negative; white-black, L.T. positive; black, **H.T.** negative and G.B. positive; yellow-black, **H.T.** positive 67·5 V; yellow, H.T. positive 165 V; **blue**, G.B. negative 3 V; green, G.B. negative 9 V.

H.T. Battery.—The recommended H.T. battery is a Philco-Siemens Full-o'-Power 165 V combined H.T. and G.B. type, number 1287.



Diagrams of the wave-change and gramophone switches, as seen from the rear of the underside of the chassis. The units are numbered in accordance with the under-chassis view.

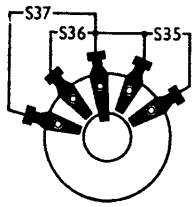


Diagram of the tone control switch unit, seen from the rear of the underside of the chassis.

CIRCUIT ALIGNMENT

I.F. Transformers.—Adjust signal generator to 451 KC/S and feed output between **V2** control grid (top cap) and chassis, first removing normal grid connection. Set wavechange switch control to **M.W.**, gang condenser to minimum capacity, volume control to maximum, and tone control to normal. Adjust I.F. trimmers **C43, C42, C41, C40** in that order to obtain maximum reading on output meter.

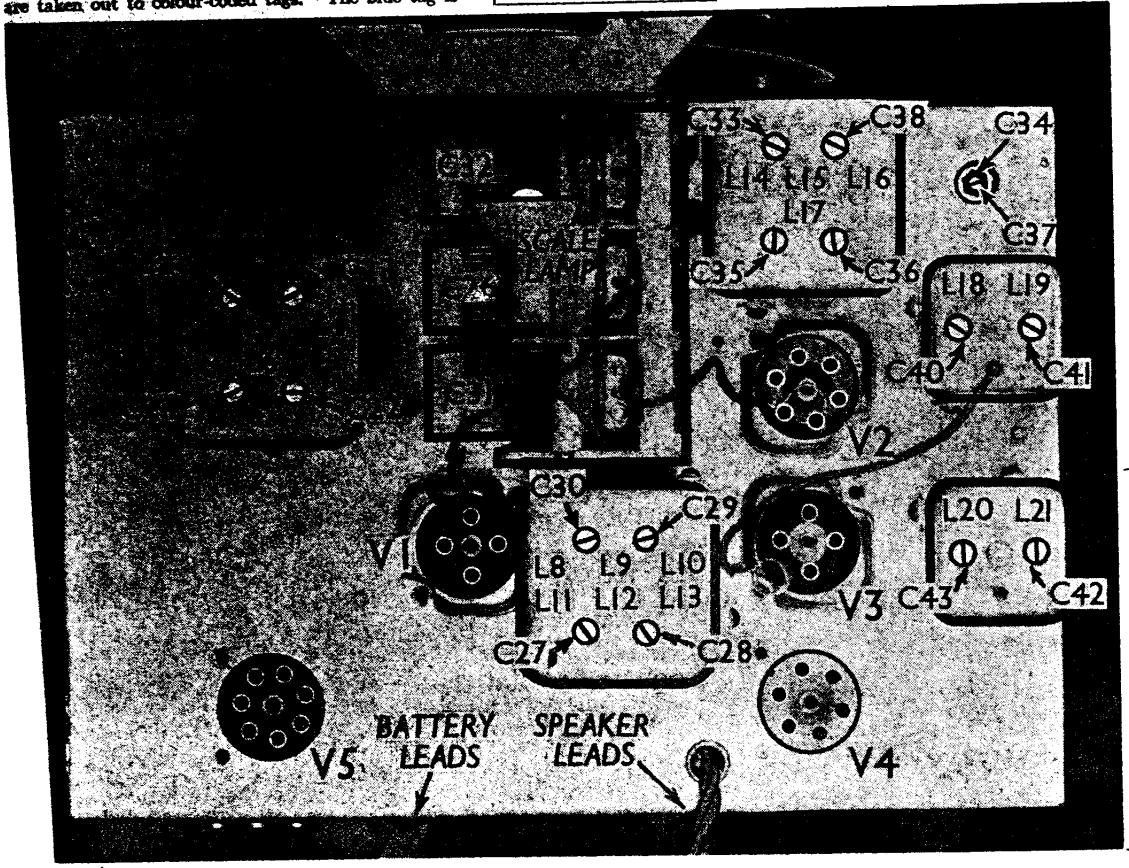
I.F. Filter.—Transfer signal generator lead via a dummy aerial to the aerial socket and replace **V2** grid lead. Feed in 451 KC/S signal and adjust **C21** (screw) for minimum output.

Signal Frequency and Oscillator Circuits.—First set gang condenser to minimum capacity (vanes fully out) and check that indicator reads on index line (above 1,500 KC/S). Set wavechange switch to L.W., gang to 290 KC/S and adjust **C39** (nut) to three-quarters of a turn from tight. Feed in a 290 KC/S signal (aerial socket) and adjust trimmers **C38, C29, C30, C24, C25** for maximum output. There are two trimmers each on the aerial and H.F. coils and these enable very fine adjustments to be made. If **C39** is too tight, violent oscillation may occur. Feed in and tune a 160 KC/S signal. Rock gang and adjust tracker **C39** for maximum output. Re-adjust trimmer at 290 KC/S and tracker at 160 KC/S until no further improvement is obtainable.

Set wavechange switch to M.W. and gang to 1,400 KC/S. Feed in a 1,400 KC/S signal and trim **C35** and **C36** for maximum output. Both should be reasonably tight. Trim **C28** and **C23** for maximum output. Feed in and tune a 600 KC/S signal. Rock gang and adjust tracker **C37** (screw) for maximum output. Re-adjust trimmers at 1,400 KC/S and tracker at 600 KC/S until no further improvement results.

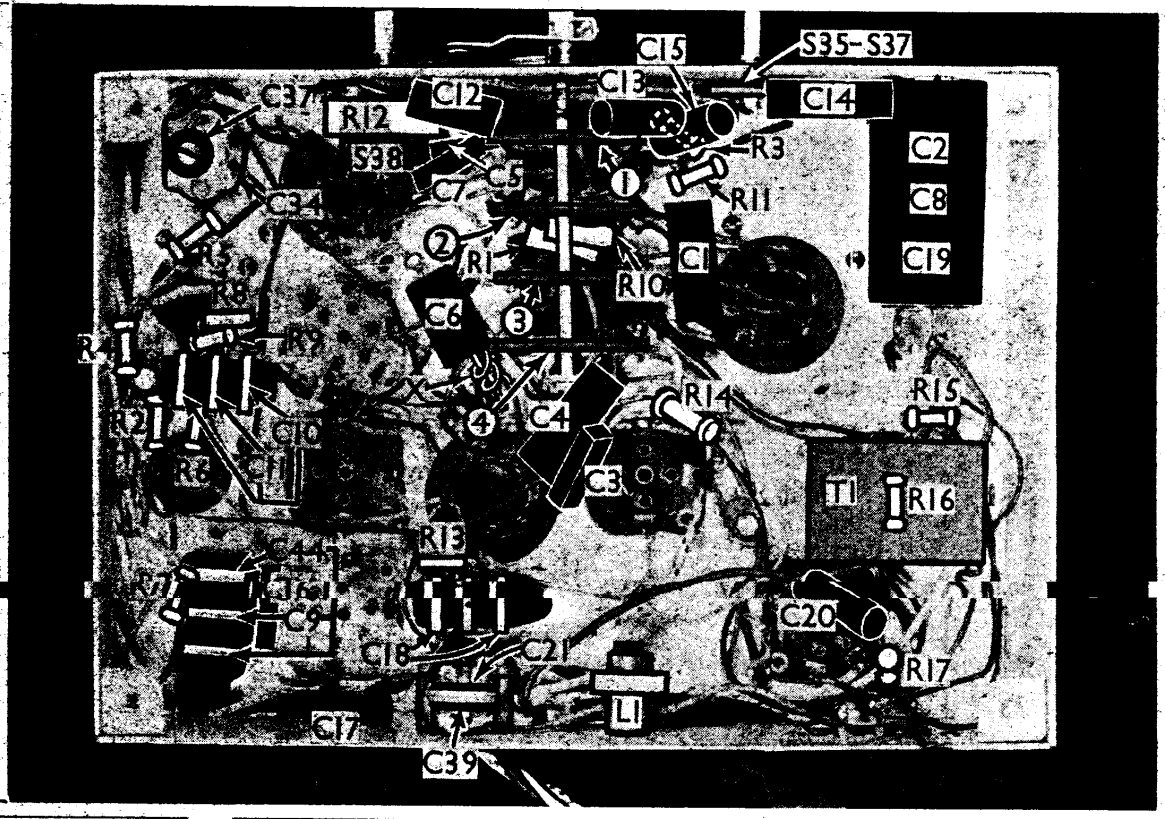
Set wavechange switch to S.W. and gang to 18 MC. Substitute a 400 O resistance for the dummy aerial, and feed in 18 MC signal, adjusting **C33** for maximum output. To avoid adjusting to the image frequency, the signal input should be kept low and **C33** should first be screwed up tight and then slowly unscrewed until the second peak (minimum capacity) is obtained. To overcome the effect of "locking" when trimming the signal frequency circuits a 21 plate variable condenser (approx. 0·00035 μF) is shunted across **C32** section of gang and tuned for the 18 MC signal (about half open). Then trimmers **C27** and **C22** are adjusted for maximum output, after which the shunt capacity is removed and **C33** retrimmed. Check for image frequency, which should be weaker than the fundamental at approximately 17·1 MC. Feed in and tune 6 MC signal. Rock gang and adjust tracker **C34** (nut). Re-adjust trimmers at 18 MC and tracker at 6 MC until no further gain can be obtained.

Finally, check the calibration.



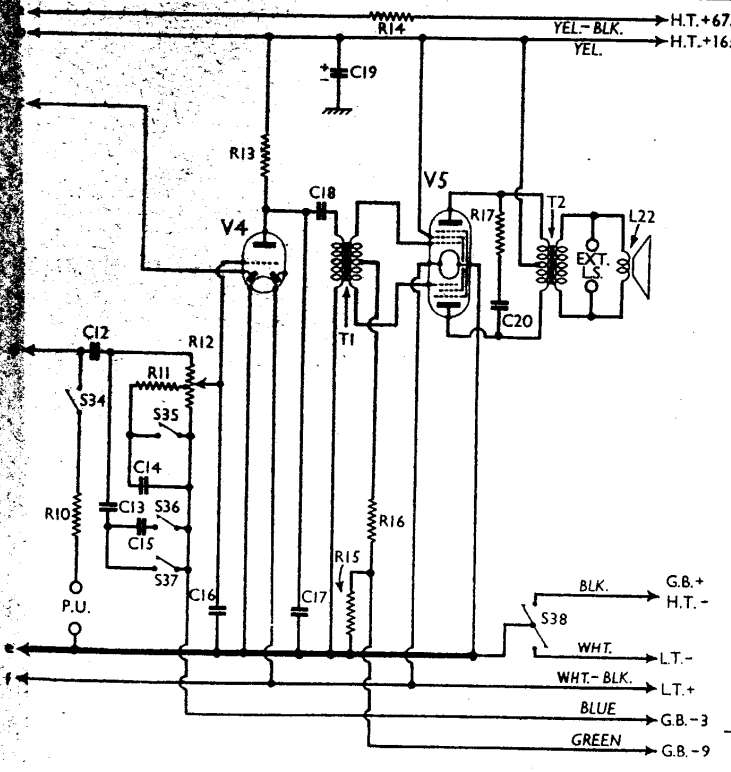
Plan view of the chassis. All trimmers with the exception of C21 and C39 are clearly marked.

Under-chassis view. C34 is beneath C37, and both are adjustable through a hole in the chassis deck. X is a small coupling consisting of 1½ turns of one wire round another. The figures in circles indicate the switch units, and the arrows show the direction in which they were viewed in drawing up the diagrams on page VIII.



	Other Components (continued).	Approx. Values (ohms)
L8	H.F. trans. S.W. primary	5·0
L9	H.F. trans. S.W. secondary	0·1
L10	Small coupling	Very low
L11	H.F. trans. M.W. secondary	2·5
L12	H.F. trans. M.W. and L.W. primary	115·0
L13	H.F. trans. L.W. secondary	15·0
L14	Oscillator S.W. tuning coil	0·1
L15	Osc. anode reaction coil	0·4
L16	Oscillator M.W. tuning coil	2·0
L17	Oscillator L.W. tuning coil	6·0
L18	1st I.F. trans. Pri.	8·0
L19	1st I.F. trans. Sec.	12·0
L20	2nd I.F. trans. Pri.	12·0
L21	2nd I.F. trans. Sec.	8·0

	Other Components (continued).	Approx. Values (ohms)
L22	Speaker speech coil	2·0
T1	Intervalve trans. Pri.	650·0
	Intervalve trans. Sec. total	6,000·0
T2	Speaker input trans. Pri. total	500·0
	Speaker input trans. Sec.	0·2
S1-S33	Waveband and muting switches	—
S34	Gram. pick-up switch	—
S35-S37	Tone control switches	—
S38	L.T. and H.T. switch, ganged R12	—
X	Small coupling	—



On the left, and on the preceding page is the circuit diagram of the Philco 295. The small letters and arrows assist in tracing across from one section of the diagram to the other.

DISMANTLING THE SET

Removing Chassis.—If it is necessary to remove the chassis from the cabinet, first remove the batteries and the back. Now remove the five control knobs (pull off), and the four bolts (with washers) holding the chassis to the bottom of the cabinet. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

When replacing, do not forget the rubber washers between the chassis and the bottom of the cabinet.

To free the chassis entirely, unsolder the leads from the speaker. *When replacing*, connect the leads as follow, numbering the tags from bottom to top:—1, blank; 2, green; 3, green/white; 4, white; 5, blank.

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

VALVE ANALYSIS

Valve voltages and currents given in the table below were measured with a battery reading 165 V, with the volume control at maximum and the receiver tuned to the lowest wavelength on the medium band. There was no signal input.

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

Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 1A4E	165	0·9	25	0·2
V2 1C6*	165	0·3	25	0·6
V3 1A4E	165	0·9	25	0·2
V4 2102	90	1·3	—	—
V5 2103	162†	6·7†	165	3·8

* Osc. anode (G2), 130 V, 2·2 mA.
† Each anode.

GENERAL NOTES

Switches.—S1-S34 are the waveband and gramophone switches in four ganged assemblies beneath the chassis. For the sake of clarity in the circuit diagram the contacts have been separated into single-pole units which are shown in the separate switch diagrams. These show the contact arrangements as seen looking at the underside of the chassis from the rear. The table (p. VIII) gives the switch positions for the various settings of the control knob, O indicating open and C closed.

S35-S37, the tone control switches, are in a separate rotary assembly also shown diagrammatically. Here again, the contacts have been separated into single-pole units. With the control knob in its fully anti-clockwise position (normal) **S35** is *closed*. In the next

(*Continued overleaf*)