NUMBER 126 'TRADER' SERVICE SHEETS

ULTRA 102

(AND 97 RADIO-GRAMOPHONE)

A 3-VALVE (plus rectifier) superhet chassis is fitted in the Ultra 102 A.C./D.C. receiver, which is suitable for mains of 195-255 V (40-100 c.p.s. in the case of A.C.). The valve arrangement consists of a triode-pentode frequency changer, a variable-mu pentode I.F. amplifier and a double diode output pentode. Provision is made for an extension speaker and a plug and socket device allows the internal speaker to be cut out, if desired.

The chassis of the 97 radio-gramophone is somewhat similar, except for the addition of the pick-up circuit. The differences are explained under "General Notes."

CIRCUIT DESCRIPTION

Aerial input via blocking condenser **C1** and coupling coils **L1, L2** to inductively coupled band-pass filter. Primary **L3, L4** tuned by **C19**; secondary **L6, L7** tuned by **C21.**

First valve is a triode-pentode (**V1, Mazda metallised TP2620**) operating as frequency changer with cathode injection. Triode section forms separate oscillator with anode coils **L10, L11** tuned by **C24** and coupling coils **L8, L9** in common cathode circuit. Tracking by specially-shaped condenser plates and additional fixed condenser **C8** (L.W.).

Second valve, a variable-mu H.F. pentode (**V2, Mazda metallised VP1321**) operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **L12, L13** and **L14, L15.**

Intermediate frequency 456 KC/S.

Diode second detector forms part of double diode output pentode (**V3, Mazda Pen./DD./4020**). Audio frequency component in rectified output is developed across load resistance **R12,** and passed via coupling condenser **C11,** I.F. stopper **R9,** manual volume control **R10,** and I.F. stopper **R11** to control grid of pentode section. Tone correction in anode circuit by fixed condenser **C13.** Provision for connection of external low-impedance speaker across secondary of output transformer **T1.** Plug and socket enable internal speaker speech coil circuit to be broken.

Second diode of **V3** fed from **V2** anode via condenser **C15** provides D.C. potential which is developed across load resistance **R16, R17** and fed back through decoupling circuits as G.B. to F.C. and I.F. valves giving automatic volume control. Delay voltage is obtained from drop along **V3** cathode resistances **R13, R14.**

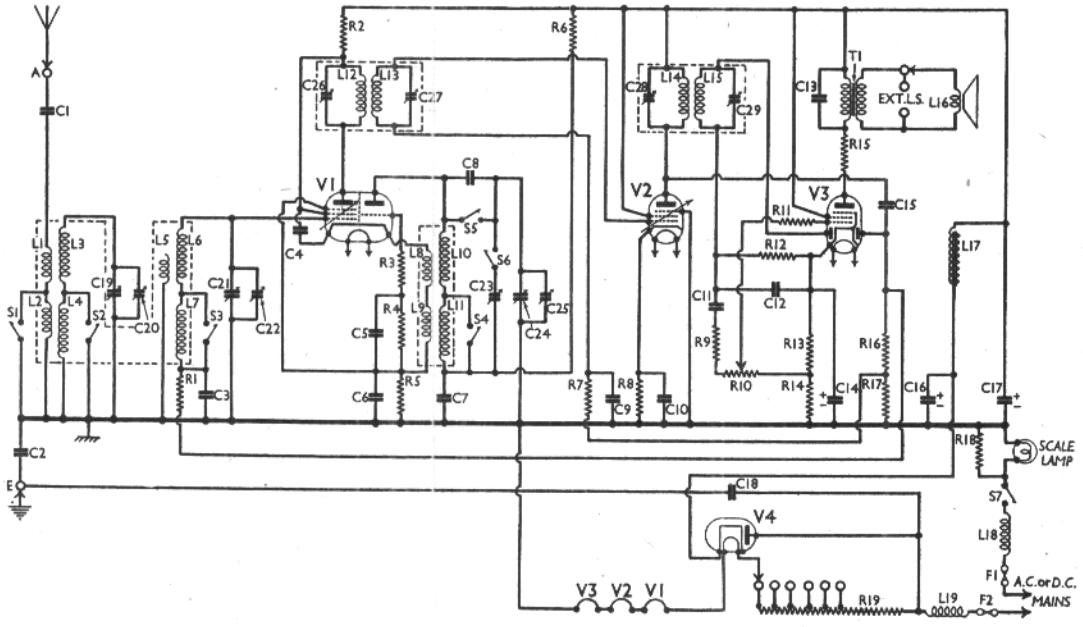
When the receiver is used with A.C. mains, H.T. current is supplied by a half-wave rectifying valve (**V4, Mazda U4020**) which, with D.C. supplies, behaves as a resistance of low value. Smoothing is effected by an iron-cored choke **L17** and dry electrolytic condensers **C16, C17.**

The valve heaters are connected in series, together with a tapped ballast resistance **R19** across the mains input circuit which includes fuses **F1, F2,** filter chokes **L18, L19,** and the scale lamp with its shunt resistance **R18.**

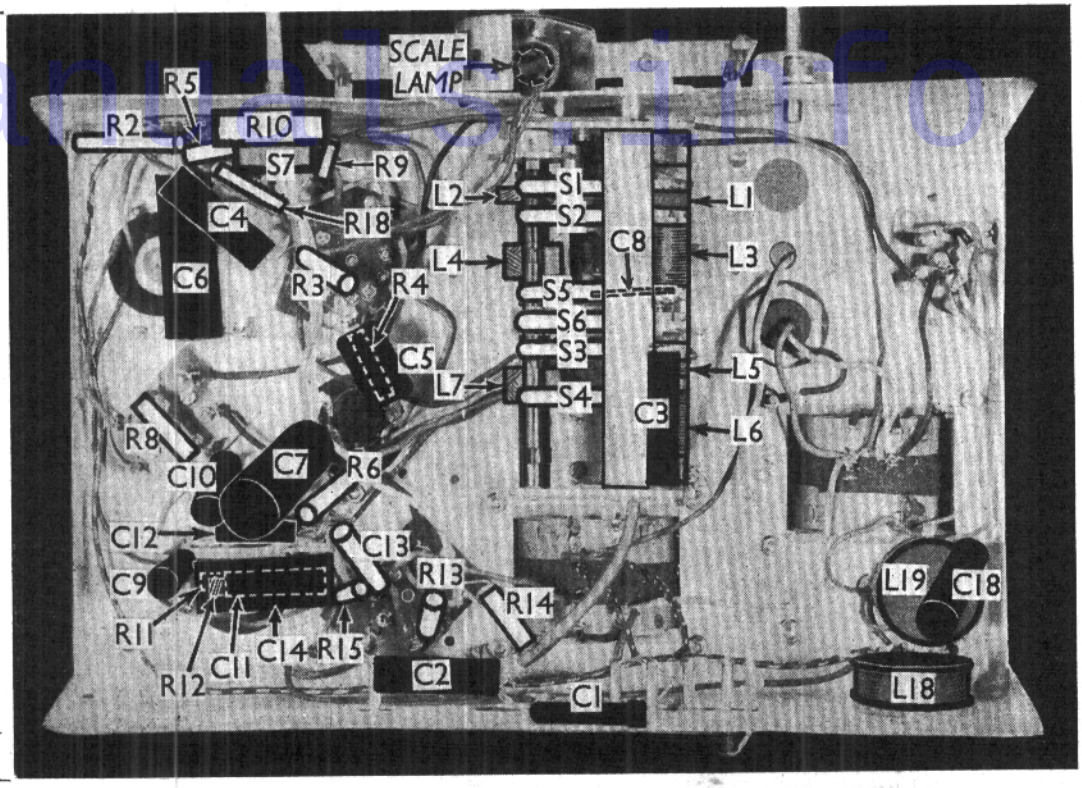
COMPONENTS AND VALUES

	Resistances	Values (ohms)
R1	V1 pentode C.G. decoupling	1,000,000
R2	V1 pent. A and S.G. decoupling	7,000
R3	V1 osc. harmonic suppressor	1,000
R4	V1 osc. C.G. resistance	50,000
R5	V1 cathode resistance	660
R6	V1 osc. anode decoupling	50,000
R7	V2 C.G. decoupling	1,000,000
R8	V2 fixed G.B. resistance	30
R9	I.F. stopper	10,000
R10	Manual volume control	1,000,000
R11	V3 C.G. I.F. stopper	1,000
R12	V3 signal diode load	500,000
R13	V3 G.B. and A.V.C. delay voltage resistances	110
R14		110
R15	V3 anode circuit stabiliser	60
R16	V3 A.V.C. diode load	250,000
R17		750,000
R18	Scale lamp shunt	80
R19	Heater circuit ballast, total	625

	Condensers	Values (μF)
C1	Aerial isolating condnser	0·004
C2	Earth blocking condenser	0·1
C3	V1 pentode C.G. decoupling	0·05
C4	V1 pent. A and S.G. decoupling	0·1
C5	V1 osc. C.G. condenser	0·0002
C6	V1 cathode by-pass	0·5
C7	V1 osc. anode decoupling	0·5
C8	Oscillator L.W. tracker	0·0003
C9	V2 C.G. decoupling	0·05
C10	V2 cathode by-pass	0·1
C11	L.F. coupling to V3 pentode	0·01
C12	I.F. by-pass	0·0002
C13	Tone corrector	0·01



Circuit diagram of the Ultra 102 universal superhet. The 97 radio-gramophone has a basically similar circuit, but with certain additions described in "General Notes."



Under-chassis view. The cover over the switch and coil unit has been removed. In case the positions of the components on the paxolin panel towards the bottom left of the illustration are not clear, they are described in "General Notes." R4 is beneath C5.

Condensers (continued)		Values (μF)
C14*	V3 cathode by-pass	50·0
C15	Coupling to V3 A.V.C. diode	0·0002
C16*	H.T. smoothing	8·0
C17*	H.T. smoothing	16·0
C18	V4 anode by-pass	0·1
C19†	Band-pass primary tuning	—
C20‡	Band-pass primary trimmer	—
C21†	Band-pass secondary tuning	—
C22‡	Band-pass secondary trimmer	—
C23‡	Oscillator L.W. trimmer	—
C24†	Oscillator tuning	—
C25‡	Oscillator trimmer	—
C26‡	1st I.F. trans. pri. tuning	—
C27‡	1st I.F. trans. sec. tuning	—
C28‡	2nd I.F. trans. pri. tuning	—
C29‡	2nd I.F. trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

Other Components		Approx. Values (ohms)
L1	Aerial coupling coils	1·5
L2	Aerial coupling coils	65·0
L3	Band-pass primary coils	4·7
L4	Band-pass primary coils	11·3
L5	L6 loading coil	1·3
L6	Band-pass secondary coils	4·7
L7	Band-pass secondary coils	11·3
L8	Oscillator coupling coils, total	0·8
L9	Oscillator coupling coils, total	
L10	Oscillator tuning coils	9·2
L11	Oscillator tuning coils	9·8
L12	1st I.F. trans. Pri.	6·0
L13	1st I.F. trans. Sec.	6·0
L14	2nd I.F. trans. Pri.	6·0
L15	2nd I.F. trans. Sec.	6·0
L16	Speaker speech coil	2·0
L17	H.T. smoothing choke	500·0
L18	Mains filter chokes	1·0
L19	Mains filter chokes	1·0
T1	Output transformer Pri.	380·0
T1	Output transformer Sec.	0·2
S1-S6	Waveband switches	—
S7	Mains switch, ganged R10	—
F1,F2	Mains circuit fuses, 0·5 A	—

DISMANTLING THE SET

A detachable bottom is fitted to the cabinet and upon removal (four countersunk-head wood screws) gives access to most of the under-chassis components.

Removing Chassis.—If it should prove necessary to remove the chassis from the cabinet, remove the back (six countersunk-head wood screws) and the three control knobs (recessed grub screws). Now remove the three bolts (with washers) holding the chassis to the bottom of the cabinet and free the speaker leads from the electrolytic condenser round which they are coiled. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

When replacing, replace the speaker leads round the electrolytic condenser and cover the heads of the chassis fixing bolts with wax.

To free the chassis entirely unsolder the leads from the speaker terminal panel.

Removing Speaker.—To remove the speaker from the cabinet, remove the nuts and lock washers from the three bolts holding the clamps, and remove the clamps. *When replacing*, see that the speaker terminal panel is at the bottom.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on A.C. mains of 230 V, using the 225-235 V tapping on the mains resistance. The volume control was at maximum and the receiver was tuned to the lowest wavelength on the medium band, but 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 TP2620*	165	3·8	165	1·7
V2 VP1321	210	14·0	210	3·7
V3 Pen/DD/4020	190	40·0	210	8·3
V4 U4020†	—	—	—	—

*Osc. anode 82 V, 2.3 mA.
†Cathode to chassis, 245 V D.C.

GENERAL NOTES

Switches.—**S1-S6** are the waveband switches in a single unit beneath the chassis. The cover over this and the signal frequency coils has been removed in our under-chassis view. All the switches, except **S6** should be *closed* on the M.W. band and *open* on the L.W. band. **S6** closes on the L.W. band and opens on the M.W. band.

S7 is the Q.M.B. mains switch, ganged with the volume control **R10.**

Coils.—**L1-L7** are mounted beneath the chassis, between the switch unit and chassis. A screening cover fits over the whole assembly. Note that **L1** and **L5** are wound over **L3** and **L6** respectively.

L8-L11, the oscillator coils, are in a screened unit on the chassis deck, which also contains the trimmer **C23.** The I.F. transformers **L12, L13** and **L14, L15** are in two further screened units on the chassis deck, which contain the I.F. trimmers. In addition, the **L14, L15** unit contains **R1, R7, R16, R17** and **C15.**

The filter chokes **L18** and **L19** are beneath the chassis.

(*Continued overleaf*)

ULTRA 102 and 97 (*continued*)

Scale Lamp.—This is an Osram M.E.S. type, rated at 4·5 V, 0·3 A. It is in series with the valve heaters, but is shunted by **R18.** Should the lamp fail, the receiver will continue to operate, though with slightly lower heater voltages.

Fuses F1, F2.—These are two Bulgin 1¼ in. glass tubular types, rated at 0·5 A each. They are mounted in clips behind the mains connector.

External Speaker.—There is provision for the connection of a low resistance (about 2 O) external speaker to two sockets at the rear of the chassis. An Ultra 30 (chassis model) or Ultra 45 (cabinet model) is recommended. A plug and socket arrangement is also provided at the rear of the chassis, to silence the internal speaker when desired. It does this by breaking one of the connections from the secondary of **T1** to the internal speaker speech coil **L16.**

Condensers C16, C17.—These are two dry electrolytics in a tubular metal case on the chassis deck. There is a common negative (black lead), while the yellow lead is the positive of **C16** and the red the positive of **C17.**

Components C11, C14, R11, R12.—These are mounted on a vertical paxolin panel, on the side facing the back of the chassis. As their positions may not be quite clear in the under-chassis view, it should be noted that the large tubular condenser **C14** is at the top, then come **C11, R12** and **R11,** in that order.

Components R1, R7, R16, R17, C15.—These are all inside the second I.F. transformer unit, and the resistances may be identified by their colour coding. It will be noted that both **R1** and **R7** are 1 MO resistances, and of the two **R1** is mounted vertically and **R7** horizontally.

Radiogram Modifications.—In the model 97 radio-gramophone chassis there are six condensers, three fixed resistances and two switches additional to those shown in the 102 circuit diagram and chassis pictures. The pick-up feeds into the I.F. amplifier valve **V2** which, on gramophone, operates as a triode L.F. amplifier R.C. coupled to the output pentode **V3.** Pick-up isolation is effected by means of a 0·5 μF earth blocking condenser and a 0·1 μF coupling condenser, which feeds the control grid of **V2** via the secondary winding of the first I.F. transformer. The screening grid of **V2** is used as the triode anode and has a 10,000 O load resistance and a 15,000 O decoupling resistance working in conjunction with a 2·0 μF by-pass condenser. A 0·1 μF condenser couples the S.G. via change-over switches to the manual volume control **R10** in **V3** control grid circuit, and a further 0·002 μF condenser is used as an anode-chassis by-pass. The remaining condenser (0·0002 μF) and resistance (50,000 O) are connected in the control grid return circuit of **V2.**

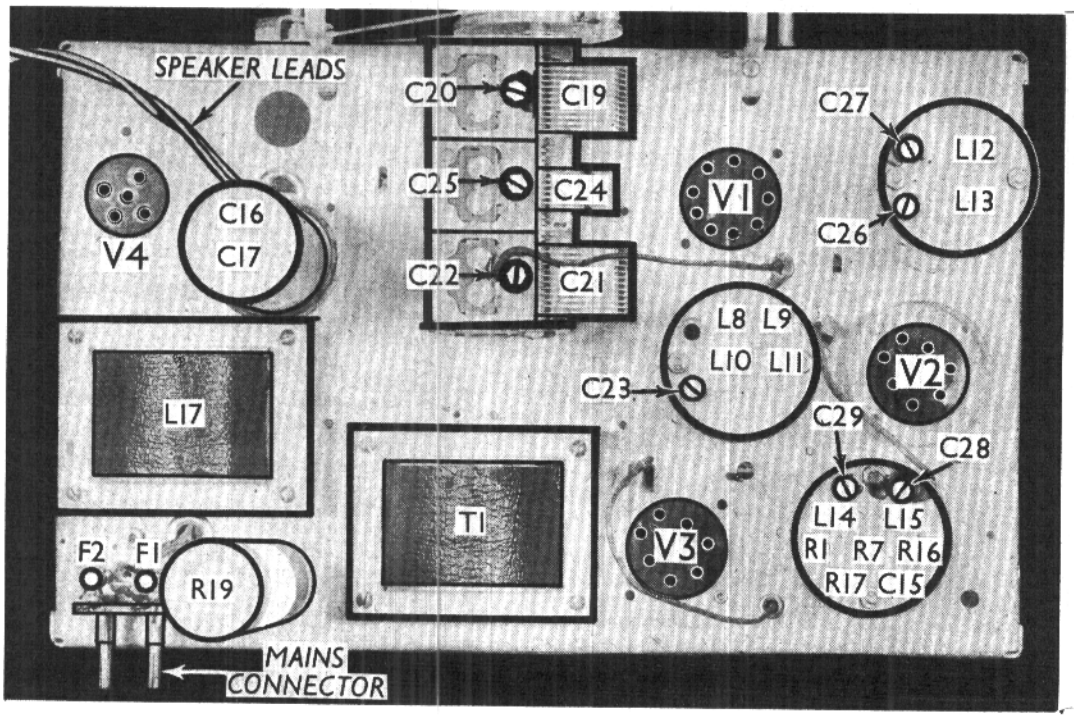
CIRCUIT ALIGNMENT

First adjust the scale pointer to cover the horizontal line above 2,000 m. on the scale when the gang condenser is at maximum.

Line up the I.F. transformers by means of the trimmers **C29, C28, C27, C26,** for maximum output with an input of 456 KC/S from an oscillator. Reduce the input as the circuits come into tune.

Set the signal generator to 200 m., switch set to M.W. and tune until pointer indicates 200 m. on scale. Adjust **C22, C20** and **C25** for maximum output. If a heterodyne whistle occurs just above London Regional station, re-adjust **C20** and **C25** until it disappears.

Feed in a 1,500 m. signal, switch set to L.W., tune to 1,500 m. on the scale, and adjust **C23** for maximum output



Plan view of the chassis. Note that the L14, L15 I.F. transformer contains, in addition to the two trimmers, five other components (See "General Notes.") C16 and C17 are two dry electrolytic condensers in a single tubular metal can. R19 is the adjustable heater circuit ballast resistance