ULTRA "22" A.C. MAINS SUPERHET

Circuit.—The combined first detector oscillator valve A.C./T.P. met. (V1) is a triode pentode with a nine-pin base. The pentode section is preceded by a band-pass aerial tuner and bias is partly fixed by cathode resistance and partly obtained from the A.V.C. line.

The oscillator element is operated with the tuned coil in the anode lead coupled to a coil in the common cathode lead. The pentode section is coupled to the next valve by a band-pass I.F. transformer (frequency 456 k.c.).

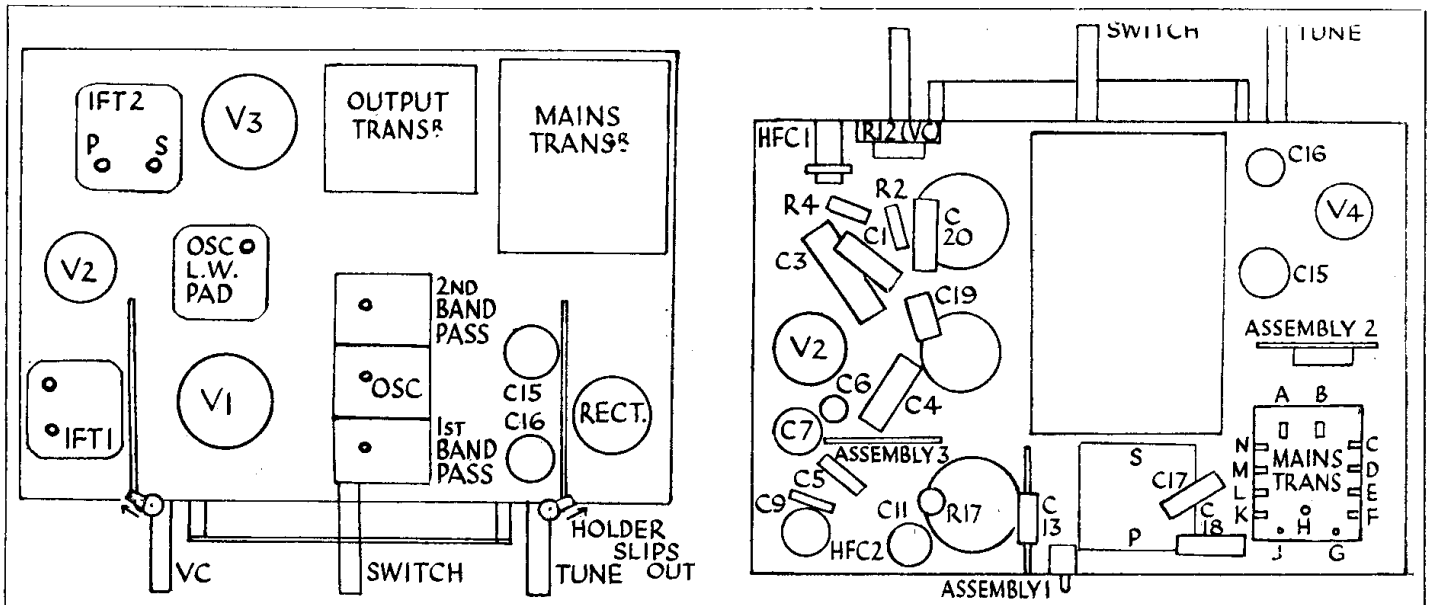
The I.F. valve A.C./VP1 (V2) (seven-pin) is biased by cathode resistance and from the A.V.C. line. Coupling to the next valve is by another band-pass I.F. transformer.

The combined second detector and pentode output valve A.C.2 Pen. D.D. (V3) (seven-pin) employs one diode anode for L.F. purposes and the other for A.V.C.

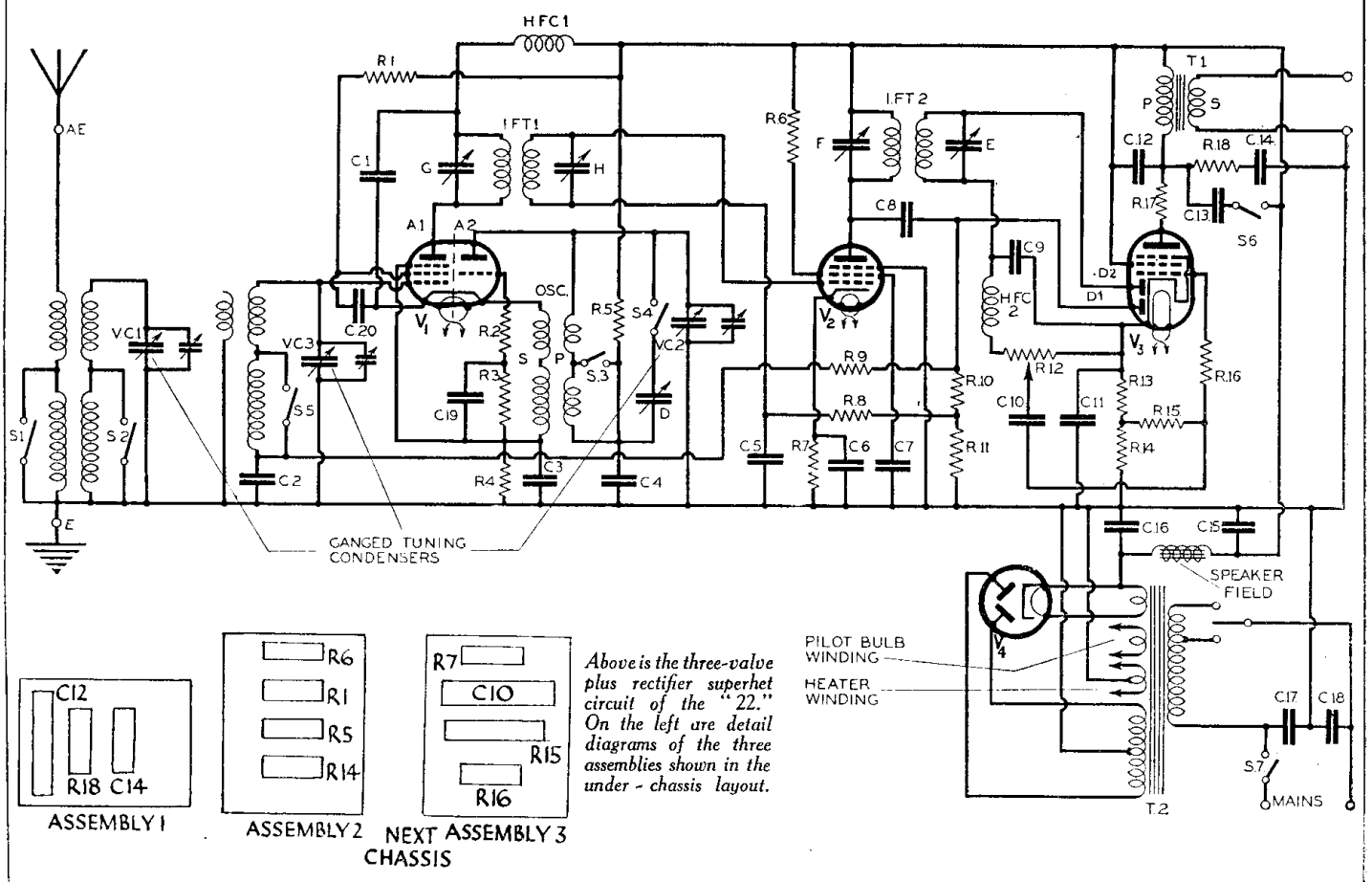
The L.F. impulses from the first are fed through an H.F. choke to the load resistance which forms the volume control. The feed to the grid is through an L.F. coupling condenser C10.

The A.V.C. diode anode is coupled to the anode of V2 by a condenser and the bias potentiometer is formed by R10 and R11. Full A.V.C. potential is applied to V1 and only three-quarters to V2.

The pentode circuit has a grid stopper R16 and an anode stabilising resistance R17,



Left and right, respectively, are shown the above and below "deck" layouts of the "22" receiver by Ultra Electric, Ltd.



Above is the three-valve plus rectifier superhet circuit of the "22." On the left are detail diagrams of the three assemblies shown in the under-chassis layout.

ULTRA 22

Three-valve, plus rectifier, two waveband superhet for 200/250 v AC mains. Table models 40/100 cycles, radiograms 50/60 cycles. Provision for extra speaker with means of switching off the parent speaker. Marketed in 1934 by Ultra Electric, Ltd., London.

Circuit.—The circuits for the radiogram and table models are similar except for the PU circuit. There is no provision for PU on the table model and the components which have been specially noted in the component tables are not incorporated in the table model chassis. In the latter case L13 is returned direct to the top of C5.

This review is based on the radiogram chassis.

Coils L1 (MW) and L2 (LW) couple the aerial input to the inductively-coupled band-pass filter, the primary coils of which are L3 and L4. The secondary windings, L6 and L7, are loaded by L5 which simulates the aerial coupling load on the primary coils.

The secondary coils feed straight into the control grid of the triode-pentode frequency-changer V1 which has cathode coupling for the oscillator triode section. L8 and L9 are the cathode injector coils which are coupled to the tuned anode coils L10 (MW) and L11 (LW).

R2 is a grid stopper in the triode section grid circuit while R3 and C19 are the grid leak and condenser. V1 derives standing bias from R4 decoupled by C3. The control grid of V1 is returned to the AVC line with R9 and C2 as decoupling components for the grid circuit.

The screen of V1 is fed through R1 which is decoupled by C20 while the oscillator anode feed resistance is R5 decoupled by C4. The anode circuit of V1 is decoupled by an HF choke L14 and condenser C1.

The IF signal is transferred to V2 by the IF transformer comprising L12 and L13. V2 is a variable-mu HF pentode which operates as an IF amplifier on radio and a LF amplifier on gram. Standing bias is provided by R7 decoupled by C6 which is not changed on radio or gram. V2 anode circuit is decoupled by R19, C22 and the screen is fed *via* R6 which is decoupled by C7.

The "earthy" side of L13 is returned to the AVC line *via* the gram volume control R21 which is ganged to the radio volume control R12. Thus the output of the PU is transferred to the grid circuit of V2 and the LF output of the anode circuit is coupled by R20 and C24 to the output valve V3.

On gram S8 contacts on the wave-change switch are closed and connect the LF output of V2 to the grid of V3 through C10, while S9 contacts are opened which disconnects the radio volume control.

The IF output of V2 is transferred to the second IF transformer L15, L16 to the signal diode of the double-diode pentode output valve. The signal diode load is the volume control R12 which has L17 and C9 in series with it as an IF filter. The volume control feeds the grid of the pentode section of V3 through C10 and the grid stopper R16.

The AVC diode is fed from L15 through C8, the AVC load resistance being R10 and R11. The full AVC voltage is applied to V1 and a lower voltage from the junction of R10 and R11 to V2. Delay volts are obtained from resistances R13, R14 in the cathode circuit of V3, while part of the available potential is applied as bias for the pentode section by connecting the grid through R15 to the junction of R13, R14.

The LF bias is then obtained by the potential developed across R13, the top end of which is connected to the cathode.

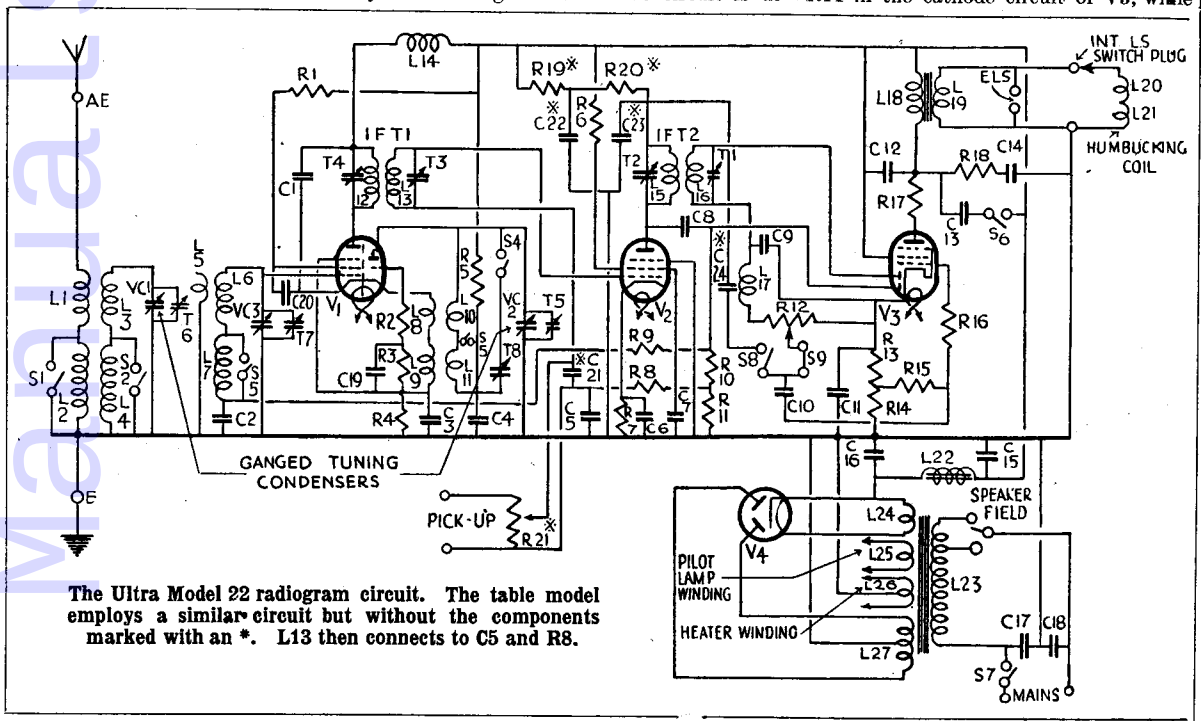
The output of V3 is coupled by the matching transformer L18, L19 to the low-impedance energised loudspeaker. The anode circuit of V3 incorporates an oscillation prevention resistance R17. A permanent degree of tone correction is effected by C12 and by R18 and C14. C13 shorts the latter components when the tone control switch S6 mounted on the back of the chassis, is switched to the bass position.

Extra loudspeaker sockets are provided in some models with a plug and socket arrangement for disconnecting the parent speaker when desired. In other chassis the secondary of the output transformer is connected to two sockets to which either the parent speaker or an external speaker may be connected. The latter should have a speech coil DC resistance of 3 to 6 ohms.

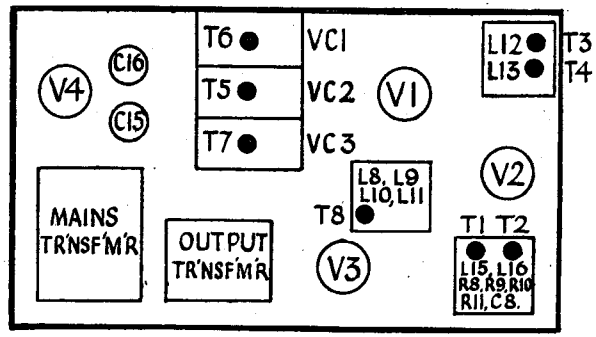
The HT supply circuit is quite standard and comprises a full wave rectifier V4 with smoothing carried out by the field of the speaker L22 and condensers C15 and C16. The mains input is HF filtered by C17 and C18.

The pilot lamp is fed from a separate 4-volt LT winding.

The mains on-off switch, S7 is a separate component mounted on the side of the radiogram cabinet, but on the table models S7 is ganged with the volume control.



The Ultra Model 22 radiogram circuit. The table model employs a similar circuit but without the components marked with an *. L13 then connects to C5 and R8.



All trimmers of the Ultra 22 are adjustable from the top. This lay-out shows their positions.

GANGING.

IF Circuits.—Feed a 456 kc signal to the control grid of V1 with the volume control at maximum. Adjust T1, T2, T3, and T4 in that order for maximum reading on output meter, keeping the input below AVC level.

MW Band.—Check calibration by turning gang to maximum capacity and adjusting the pointer so that it coincides with the dot to the left of the 12 o'clock position on the tuning scale. Switch to MW. Inject and tune in 200 metres signal and adjust T5, T6, and T7 in that order for maximum output.

LW Band.—Switch to L2. Inject and tune in a 1,500 metre signal and adjust T8 for maximum reading on output meter.

There are no tracking adjustments for the other readings of the wavebands.

VALVE READINGS

V	Type	Electrode	Volts	Ma
1	AC/TP	Anode	274	7.5
	met	Osc. Anode	110	2
		Screen	200	2
2	AC/VP1	Anode	274	10
		Screen	195	2.5
3	AC2	Anode	260	38
	PenDD	Screen	274	6

Pilot lamps, 4.5v, .3 amp, MES.

RESISTANCES

R.	Ohms	R.	Ohms
1	25,000	12	500,000
2	1,000	13	138
3	50,000	14	138
4	480	15	1 meg.
5	80,000	16	1,000
6	30,000	17	60
7	165	18	15,000
8	1 meg	19*	10,000
9	1 meg	20*	3,000
10	250,000	21*	50,000
11	750,000		

* Not used on Table Model

CONDENSERS

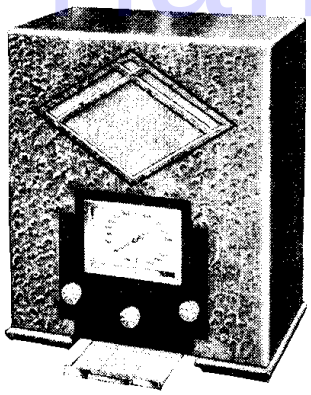
C	Mfds	C	Mfds
1	.1	13	.01
2	.05	14	.01
3	.5	15	16
4	.1	16	8
4	.1	17	.01
5	.05	18	.01
6	.1	19	.0002
7	.5	20	.1
8	.0002	21*	.0002
9	.0002	22*†	.5
10	.01	23*	.002
11	50	24*	.1
12	.001		

* Not used on Table Model.
† A 2 mfd electrolytic may be used in cases bad hum.

WINDINGS

L	Ohms	L	Ohms
1	1.5	15	5.6
2	48.5	16	5.6
3	4.5	17	500
4	11	18	400
5	1.5	19	.25
6	4.7	20	4.5
7	11.5	21	—
8, 9	1.2	22	1500
		23	30
10	8.5	24	.16
11	4.0	25	.3
12	5.6	26	.12
13	5.6	27	660
14	55		

ULTRA "22" A.C. MAINS SUPERHET (Cont.)



"Clock-face" tuning and a three-valve superhet circuit are distinguishing characteristics of the model "22" produced by Ultra Electric, Ltd.

and is provided with optional tone control by means of a condenser in series with a resistance and a condenser across the resistance, the latter connected into the circuit by the switch.

Mains equipment consists of transformer, full wave indirectly heated rectifier UU60/250, with the L.S. field in the positive H.T. lead for smoothing in conjunction with a 16 mfd. and an 8 mfd. electrolytic condenser.

VALVE READINGS

V.	Type.	Electrode.	Volts.	M.A.
1	AC/TP met.	anode ...	274	7.5
		aux. grid	200	2
		osc. anode*	110	2
2	AC/VP1 ...	anode ...	274	10
		aux. grid	195	2.5
3	AC2PenDD	anode ...	260	38
		aux. grid	274	6

* Measured across C4.

The mains leads are fitted with H.F. by-pass condensers.

Special Notes.—The valve connections, looking from underneath and counting clockwise from the two filament pins which are close together at one end are :—

Pentode grid at top.

V1, nine-pin (triode pentode) : H, H, cathode, osc. anode, osc. grid, metallising, aux. grid, pentode anode, suppressor grid.

V2, seven-pin (H.F. pentode) : H, H, cathode, aux. grid, metallising, grid, suppressor grid. Anode is at the top.

V3, seven-pin : H, H, cathode, aux. grid, diode anode 2, pentode anode, diode anode 1. Grid is at top.

Removing the Chassis.—Undo the knobs (grub screws). Remove four holding screws underneath. Remove two screws from wooden block in top of cabinet and lift the chassis out.

Quick Tests.—Between the following terminals of panel on L.S. and chassis (looking from behind and counting from the left) :—

(1), red, H.T.+ unsmoothed, 365 volts.

(5), green with black tracer, H.T smoothed 274 volts.

The output transformer terminals are inside the chassis.

CONDENSERS

C.	Purpose.	Mfd.
1	Decoupling V1 anode	.1
2	Decoupling V1 grid	.05
3	V1 cathode by-pass from osc. coil	.5
4	Decoupling V1 osc. anode ...	.1
5	Decoupling A.V.C. to V2 ...	.05
6	V2 cathode by-pass	.1
7	V2 aux. grid	.5
8	I.F. feed to A.V.C. diode anode	.0002
9	H.F. by-pass from diode ...	.0002
10	L.F. coupling diode anode to grid	.01
11	V3 cathode by-pass	50 el.
12	By-pass V3 anode to aux. grid	.001
13	Tone correction circuit	.01
14	Tone correction circuit	.01
15	H.T. smoothing	16 el.
16	H.T. smoothing	8 el.
17	H.F. by-pass from mains lead ...	.01
18	H.F. by-pass from mains lead ...	.01
19	V1 osc. grid condenser	.0002
20	V1 aux. grid	.1

General Notes.—The layout is easily followed except for the three resistance and condenser assemblies. These are given in the special diagram.

Mains transformer connections (see layout diagram) :—

A and B : Pilot lamp winding (blue with black).

C and N : Rectifier heater (green).
D : To mains lead (yellow).
E : 200-220 mains tap (pink).
F : 230-250 mains tap (dark green).
G and J : Set heaters.
H : Centre taps to chassis.
K (yellow) and M (blue) : Rectifier anodes.
L : Chassis.

To reach the switch and the band-pass coils it is necessary to remove the screen cover by undoing the four screws on the flanges.

The following components are inside the case of the second I.F. transformer : R8, R9, R10, R11, and C8.

Replacing the Chassis.—Lay chassis inside cabinet, replace wooden block above speaker and insert the four holding screws. Replace the knobs.

RESISTANCES

R.	Purpose.	Ohms.
1	Voltage dropping to V1 aux. grid	25,000
2	Harmonic suppressor in osc. grid	1,000
3	Osc. grid leak	50,000
4	V1 cathode bias	480
5	Voltage dropping to osc. anode...	80,000
6	Voltage dropping to V2 aux. grid	30,000
7	V2 cathode bias	165
8	Decoupling A.V.C. to V2 ...	1 meg.
9	Decoupling A.V.C. to V1 ...	1 meg.
10	A.V.C. potentiometer	250,000
11	A.V.C. potentiometer	750,000
12	Diode load, var. V.C.	500,000
13	V3 cathode bias	138
14	Part of A.V.C. delay ftr. ...	138
15	V3 grid return bias resistance ...	1 meg.
16	V3 grid stopper	1,000
17	V3 anode stabiliser	60
18	Tone correction circuit V3 anode	15,000
—	L.S. field	1,500
—	P. of output transformer ...	400

LANCASTRIA SUPERHET BY FERRANTI

The 1934-5 model Lancastria by Ferranti, Ltd., is a three-valve A.C. superhet utilising a heptode and a combined double-diode pentode.

Circuit.—The combined detector oscillator, VHT4 met. (V1), a heptode, is preceded by a band-pass aerial tuner with second channel suppressor circuit. Switching for local reception connects the resistance, R1, across the aerial input. Bias for the detector section is partly fixed by cathode resistance and partly controlled from the A.V.C. line.

The oscillator operates with the tuned coil in the grid circuit. Coupling to the I.F. valve is by band-pass I.F. transformer (frequency 125 K.C.).

The I.F. valve, VPT4 met. (V2), is biased also by cathode resistance and by A.V.C. The tuning indicator is connected in to the H.T. lead to the anode and coupling to the second detector is by another band-pass I.F. transformer.

In the combined second detector and pentode output valve, a PT4D (or Mazda AC2Pen DD) (V3) there is one diode anode for rectification and L.F. purposes. This is coupled to the grid of the pentode section by resistance-capacity filter with the grid leak forming the manual volume control.

VALVE READINGS

No signal.

Valve	Type.	Electrode.	Volts.	Ma.
1	V.H.T4	anode ..	200	3
		screen ..	100	
		osc. anode..	100	1.5
2	V.P.T4 ..	anode ..	200	5
		aux. grid ..	100	
3	P.T.4D or A.C.2 Pen D.D.	anode ..	240	28
		aux. grid...	250	8

The other diode anode is used for A.V.C., a delay being obtained by the initial bias on V1 and V2.

The pentode anode circuit has a stabilising resistance, R13, and tone control is provided by a condenser in series with a variable resistance. As usual, the internal speaker is provided with a switch so that the speech coil can be disconnected when an external speaker is needed.

Mains equipment consists of transformer, full wave rectifier and the L.S. field in the negative lead for smoothing, with two 8 mfd. electrolytic condensers.

Special Notes.—The indicators for tone, volume and wave-change switch are operated by cords, attached at one end to collars which are fixed to the spindles by grub screws, and passing once round the spindle to the lever arm of their respective pointers.

Before placing the chassis inside the cabinet again it is advisable to see that the pointers are in their correct positions.

The grid connection of the double diode pentode is at the top of the bulb. The base connections (counting clockwise from the two heater pins which are close together at one end and looking from underneath) are :—H, H, cathode, aux. grid, diode anode 1, anode diode anode 2.

The heptode valve connections are H. H.

(*Continued on pages* 118-119.)