

# ULTRA 121 ALL-WAVE SUPERHET FOUR

**CIRCUIT.**—The aerial input passes through an I.F. rejector circuit consisting of a variable-inductance iron-cored coil and a parallel connected condenser, and also, on medium and long waves, through a set of band-pass coils, to the grid of V1, a triode-hexode-frequency changer.

On short waves an H.F. transformer arrangement is substituted for the band-pass coils.

The output of V1 passes through an iron-cored I.F. transformer to the grid of V2, an H.F. pentode, acting as the I.F. amplifier and amplifying the converted signal of 456 kc.

The signal then passes through a further iron-cored I.F. transformer to the demodulating diode of V3, where it is rectified. The other diode of V3, a double diode pentode, provides a D.C. potential which is fed back through a resistance and condenser network to provide A.V.C.

A volume control is incorporated in the demodulating diode network arrangement that feeds the control grid of the pentode section of V3.

A fixed tone compensator in the form of a condenser is connected across the primary of the speaker matching transformer in the anode circuit of V3.

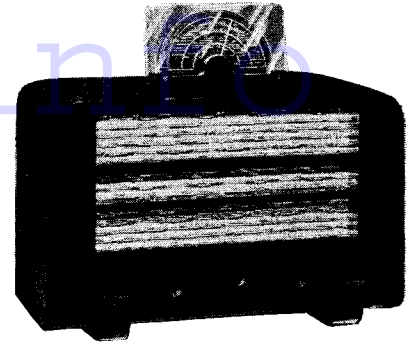
Mains equipment consists of a full-wave rectifying valve, V4, a mains transformer, smoothing choke (speaker field) and electrolytic smoothing condensers.

**Special Notes.**—The dial lights of the receiver are mounted in screw-in holders clamped to supports and are located underneath the wavelength dial. They are rated at 4.5 volts .3 amp.

Sockets are provided for use with an external speaker. There are three sockets for the purpose, the external speaker being plugged into the two sockets furthest away from the wander plug.

If it is desired to render the set speaker inoperative, the removal of the wander plug from its socket effects this operation. Alternatively, both the set and external speaker can be used. A permanent-magnet moving-coil speaker with a low resistance should be used for extension purposes.

A pair of sockets situated above the



An original, very easy to use type of dial is an outstanding feature of the Ultra 121 A.C. mains superhet.

speaker sockets enables a pick-up to be connected.

The receiver is designed for use with a pick-up of the piezo-electric crystal type. The makers state that if an electromagnetic pick-up be used, then a low-resistance type (about 2,000 ohms) should be chosen with an output of approximately 1 volt RMS, and it will be necessary to interpose an 8:1 transformer between the pick-up and the set.

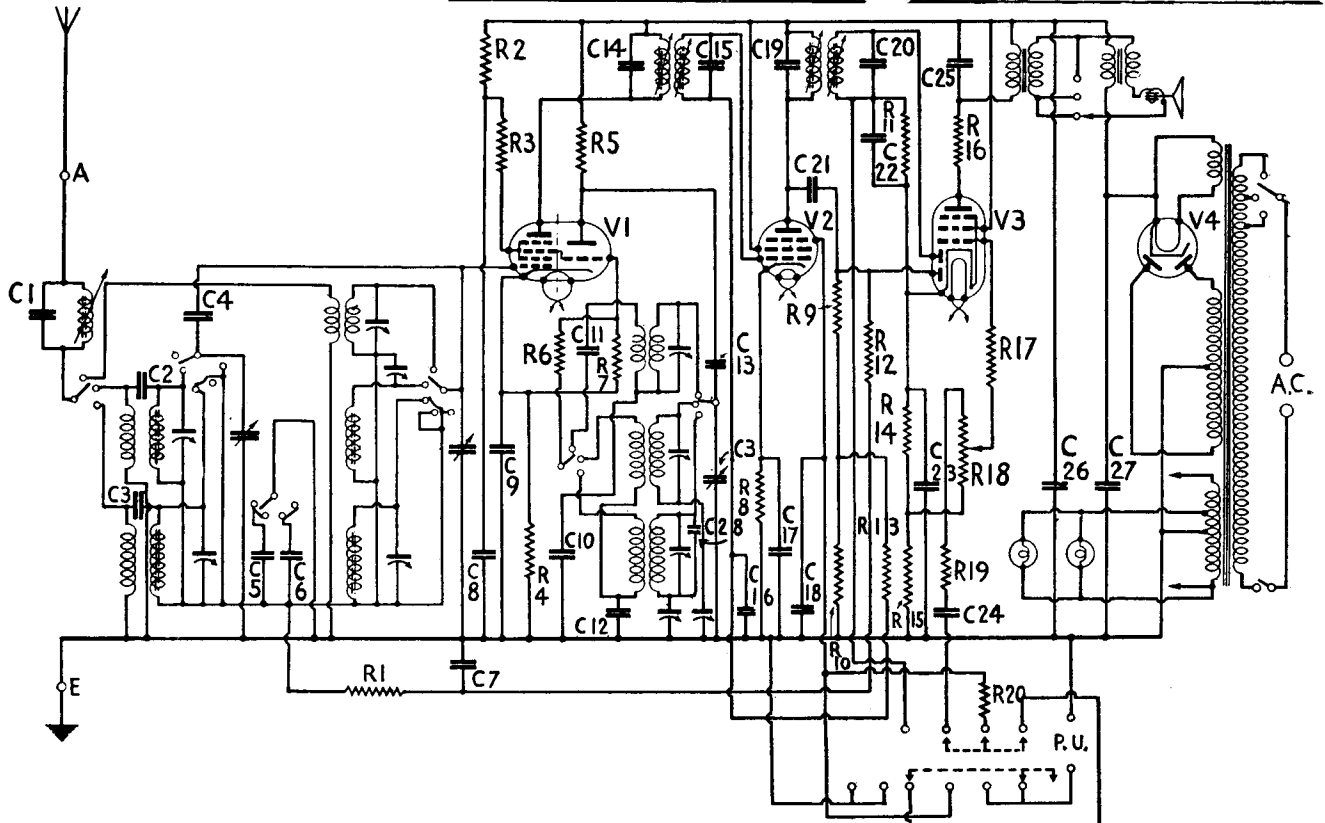
A mains voltage adjustment panel located next to the mains cord outlet

VALVE READINGS					
No signal. Volume maximum, 200 volt A.C. mains.					
V.	Type.	Electrode.	Volts.	Ma.	
1	All Mazda. AC/TH1 met. (7)	Anode ...	250	5.2	
		Osc.anode	35	6	
		Screen ...	140	4	
2	AC/VP2 met. (7)	Anode ...	250	8.5	
		Screen ...	250	5.4	
3	AC2/Pen DD (7)	Anode ...	232	33	
		Screen ...	250	7.8	
4	UU4 (4)	...	Filament	375	—

**QUICK TESTS**

Quick tests are available on this receiver on the tags of the speaker transformer. Volts measured between this and the chassis should be—

Red—375 volts, unsmoothed H.T.  
Black lead with grey—232 volts, smoothed H.T.



An orthodox form of "short" superhet circuit is used in the 121. The switch at bottom right is explained under "Special Notes."

enables the various compensations to be carried out. This takes the form of a centre socket with three sockets (marked with voltages) and a bridging contact.

Resistances R9, R10, R12, R13 and condenser C21 are to be found inside the second I.F. transformer can.

The pentode compensator C25 was connected between the anode of V3 and earth in our chassis, and not across the primary of the speaker transformer as in the circuit.

Interstation noise suppression is provided on medium and long waves. In these positions the switch, shown bottom right in circuit diagram, connects the suppressor grid of V2, via R20, to the top end of R11. This applies a low voltage which blocks V2 to all except substantial signals. On short waves V2 suppressor grid goes direct to earth.

**Chassis Removal.**—First remove the back of the cabinet which is secured by six sliding clips. Remove the control knobs (grub screws). Then turn the set on its side with the receiver chassis nearest the bench and remove the four fixing bolts and washers securing the chassis to the cabinet. The chassis can then be removed to the extent of the tuning cable and speaker cable.

Now turn the tuning pointer to 450 metres and undo the fixing screw observed behind the wavelength dial on the top of the cabinet

(outside)—not the screw holding the glass but the screw nearest the wood of the cabinet. The tuning cable and pointer can now be slipped down from the top of the cabinet and the chassis is free to the extent of the speaker cable.

The speaker may be removed from the cabinet by unscrewing the three sliding clips securing it to the baffle or, alternatively, unsoldering the leads to the speaker transformer.

The speaker cable consists of six flex leads connected in the following manner, counting from left to right: black, blue, black with grey, green with black, red, and lastly yellow.

### Alignment Notes

**I.F. Circuits.**—Connect an output meter across the external speaker sockets. Inject a signal of 456 kc. from a service oscillator between the top grid cap of V1 and chassis and adjust variable cores of the I.F. transformers IFT4, IFT3 (left hand and right hand screw slots under condenser drum) and IFT2, IFT1 (upper and lower screw slots in first I.F. transformer), in that order for maximum response in the output meter. Reduce the input as the circuits come into line to render the A.V.C. inoperative.

**Signal Circuits.**—Leave the output meter connected as before but connect service oscillator to aerial and earth sockets of the receiver.

Inject a signal of 456 kc. and adjust the variable core of the I.F. wavetrap (through side of aerial unit nearest the mains transformer) for zero output.

**Medium Waves.**—(1) Tune the set to 200 metres (1,500 kc.) and inject a signal of that wavelength. Adjust medium oscillator trimmer T1 for maximum response in the output meter, then adjust trimmers T2, T3.

(2) Tune the set and generator to 500 metres (600 kc.) and adjust padder PI for maximum, optimum results.

Repeat operations 1 and 2 until maximum response is obtained at both points.

CONDENSERS		
C.	Purpose.	Mfds.
1	Aerial I.F. filter ... ..	.001
2	Medium-wave aerial coupling ... ..	.00005
3	Long-wave aerial coupling ... ..	.00001
4	V1 grid isolating ... ..	Capacity coupling.
5	Bottom band-pass coupling... ..	.075
6	Bottom band-pass coupling ... ..	.025
7	V1 A.V.C. decoupling ... ..	.05
8	V1 screen decoupling ... ..	.1
9	V1 cathode shunt ... ..	.5
10	Short wave fixed osc. grid padder ... ..	.004
11	V1 S.W. grid coupling ... ..	.0001
12	Grid return ... ..	.001
13	Osc. anode coupling... ..	.0001
14	I.F. T.1 primary fixed trimmer ... ..	.00015
15	I.F. T.1 secondary fixed trimmer ... ..	.00015
16	V2 A.V.C. decoupling ... ..	.05
17	V2 cathode shunt ... ..	.1
18	V2 decoupling suppressor grid ... ..	.05
19	I.F. T.2 primary fixed trimmer ... ..	.00015
20	I.F. T.2 secondary fixed trimmer ... ..	.00015
21	L.F. coupling... ..	.0002
22	R.F. by-pass ... ..	.0002
23	V3 cathode shunt ... ..	.50
24	L.F. coupling... ..	.01
25	Pentode compensator ... ..	.004
26	H.T. smoothing ... ..	.16
27	H.T. smoothing ... ..	.8
28	L.W. osc. fixed trimmer ... ..	.00006

RESISTANCES		
R.	Purpose.	Ohms.
1	V1 grid return ... ..	25,000
2	V1 screen decoupling ... ..	30,000
3	V1 screen series resistor ... ..	60
4	V1 cathode bias ... ..	480
5	Oscillator anode load ... ..	40,000
6	Regeneration modifier ... ..	60
7	V1 grid leak ... ..	25,000
8	V2 cathode bias ... ..	30
9	V3 A.V.C. diode load (part) ... ..	250,000
10	V3 A.V.C. diode load (part) ... ..	750,000
11	V3 demodulator diode load ... ..	500,000
12	V1 A.V.C. decoupling ... ..	1 meg.
13	V2 A.V.C. decoupling ... ..	1 meg.
14	V3 cathode bias ... ..	138
15	V3 cathode bias ... ..	138
16	V3 anode stabiliser ... ..	60
17	V3 grid stopper ... ..	1,000
18	Volume control ... ..	1 meg.
19	Grid stopper ... ..	10,000
20	See Special Notes ... ..	1½ meg.

## Ultra 121 on Test

**MODEL 121.**—Standard model for A.C. mains operation, 200-250 volts, 40-100 cycles. Price 12½ gns.

**DESCRIPTION.**—Three waveband, three-valve, plus rectifier, superhet table model.

**FEATURES.**—Projecting, illuminated glass scale calibrated in station names and wavelengths. Controls for volume, tuning and wave selection. Sockets for pick-up and extension speaker.

**LOADING.**—80 watts.

**Sensitivity and Selectivity**  
**SHORT WAVES (16.8-50 metres).**—Good gain, representative selectivity. Concentric slow motion gives ease of tuning. No appreciable drift.  
**MEDIUM WAVES (200-550 metres).**—Useful number of programmes received, with apparent knife-edge selectivity owing to inter-carrier suppression device. No provision for altering sensitivity.  
**LONG WAVES (900-2,000 metres).**—General performance similar to medium waveband, inter-carrier suppression set in our model so that Deutschlandsender was not noticeable during daylight. All other stations easily and well received.

**Acoustic Output**  
 Representative balanced pentode output, with reasonable low-note response. Very little colouration and fairly good high-note response.

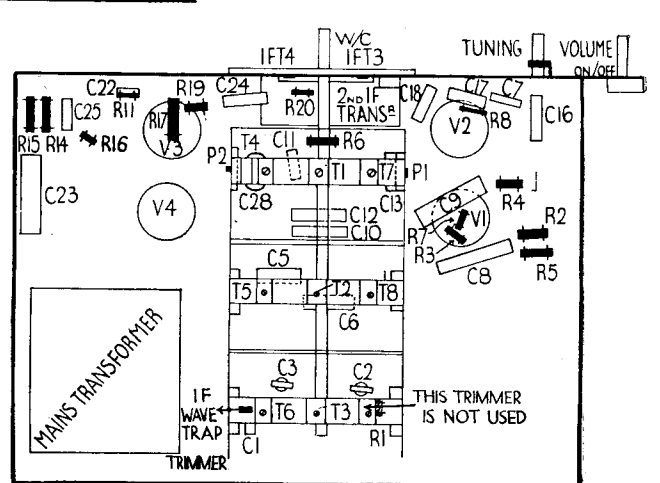
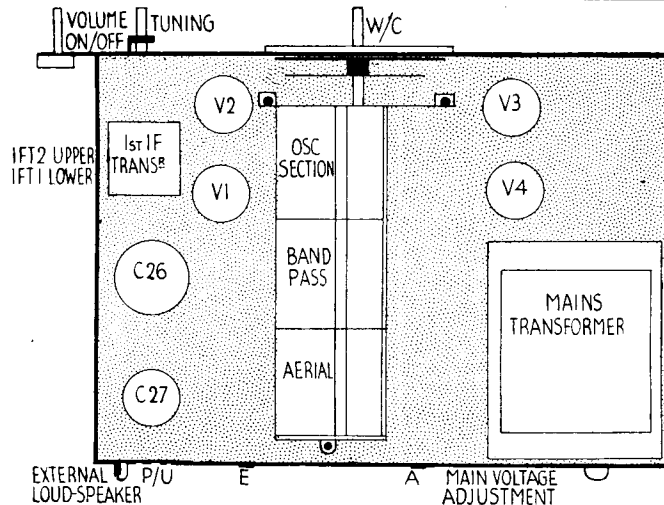
**Long Waves (3).**—Inject an oscillator signal of 1,050 metres (approx. 286 kc.) and tune the set to that wavelength. Adjust long wave oscillator trimmer T4 and trimmers T5 and T6 for maximum.

(4) Tune the set and generator to 1,700 metres (176 kc. approx.) and adjust long wave padder P2, simultaneously rocking the gang.

Repeat operations 3 and 4 until maximum readings are obtained at both points.

**Short Waves.**—Tune the set and service oscillator to 17 metres (17,647 kc. approx.) and adjust trimmers T7 and T8 for maximum. Check calibration at 30 and 51 metres.

Exact replacement condensers available from A. H. Hunt, Ltd., are: C 26, 3056, 7s. 6d.; C 27, 3055, 6s., and C 23, 2915, 1s. 9d.



These two diagrams show practical details of the 121. The tinted drawing gives the top view. Note, in the underside diagram, right, all resistors are in solid black.

# ULTRA 121, 133, 140, 150

Three-valve, plus rectifier, three waveband superhet for AC mains, 200-250 volts, 40-60 cycles. Model 121 is a table model (with provision for pickup), models 133, 140, 150 are radiograms, manufactured by Ultra Electric, Ltd., Acton, London, W3. Service dept., Erskine Road, Chalk Farm, London, NW3.

**A**ERIAL coupling to the grid of V1, a triode hexode frequency changer, is via a set of band-pass coils L1, L3 (MW) and L2, L4 (LW) on the medium and long wave bands, while on short waves the coupling is effected by transformer coils L5, L6. The oscillator circuits employ tuned reaction coils fed via C13 from the oscillator anode with untuned grid coils. The coils are L9, L12 (SW), L10, L13 (MW) and L11, L14 (LW).

An inductively trimmed dust-cored IF transformer, L15, L16, couples V1 to V2, the IF amplifier. It will be noticed that on gramophone the pick-up potentials are fed to the control grid of V2 for extra amplification, the screen grid being used as an anode.

R22 acts as the LF anode load and the LF coupling condenser, C28, leads to a switch arrangement and thence via a further coupling condenser, C23, and HF stopper resistance, R20, to the volume control, R19. On radio this arrangement is rendered inoperative by shorting C28 to earth and V2 functions as a conventional IF amplifier.

In the table model (121) the pick-up sockets are connected to chassis and C23, so the pick-up must be one having a high output.

A second dust-cored transformer couples V2 to the signal diode of V3, a double diode pentode valve. R14 is the signal load resistance filtered by C21 and the LF signal is fed to the switch, S6, and thence to the volume control, R19, via C23 and R20. From the volume control the signal is passed to the grid of the pen-

tode section of V3 through a grid stopper R18.

The AVC diode is fed by a coupling condenser, C20, from the anode of V2, and provides a DC potential across R10 and R11 that is fed back to the grids of V1 and V2 for automatic volume control.

A conventional output circuit couples V3 to the energised low impedance moving coil loudspeaker. Sockets are provided for an extra loudspeaker which should have an impedance of approximately 2 ohms.

Mains equipment consists of a mains transformer, a full-wave rectifying valve, V4, and electrolytic smoothing condensers C25, C26, across the speaker field, L21, which acts as the smoothing choke.

### GANGING

**IF circuits:** Connect an output meter across the primary of the speaker transformer. Switch set to MW; turn gang to maximum. Connect a service oscillator between the top grid cap of V1 and chassis.

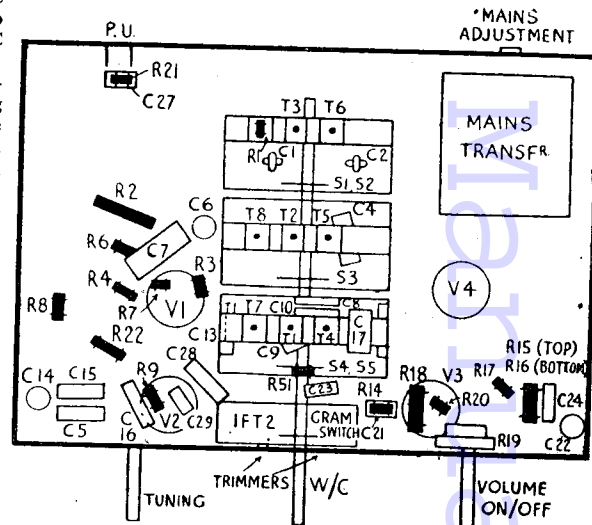
Tune service oscillator to 456 kc and adjust the variable iron cores of IFT2 and then IFT1 for maximum output, reducing the input from service oscillator as

the circuits come into line so as to render the AVC inoperative.

**MW Band:** Adjust the tuning pointer to coincide with the lower left black dial line when the gang is fully closed.

Connect the service oscillator to the A and E sockets, preferably via a dummy aerial or fixed condenser only, feeding sufficient input to obtain definite peaks in the output meter.

Tuneset and service oscillator to 200 metres (1,500 kc) and adjust T1,



### CONDENSERS

C	Mfd	C	Mfd
1	.000005	16	.1
2	.00001	17	.00006
3	.00001	18	.00015
4	.025	19	.00015
5	.05	20	.0002
6	.1	21	.0002
7	.5	22	.50
8	.004	23	.01
9	.0001	24	.004
10	.001	25	.16
11	.00015	26	.8
12	.00015	27	.0002
13	.0001	28	.1
14	.2	29	.001
15	.05		

### WINDINGS

L	Ohms	L	Ohms
1	15	14	9.5
2	70	15	4
3	1.5	16	4
4	19	17	4
5	.5	18	4
6	.25	19	462
7	1.6	20	.3
8	.18	21	1,400
9	.7	22	.2
10	1	23	.12
11	1.2	24	565 total
12	Very low	25	Very low
13	5.5	26	28 total

T2, T3 in that order for maximum response. Tune set and oscillator to 500 metres (600 kc) and adjust P1 for maximum output while rocking the gang.

**Repeat both operations.**  
**LW band:** Tune set and service oscillator to 1,500 metres (200 kc) and adjust T4, T5 and T6 in that order for maximum response.

Tune set and service oscillator to 1,700 metres (176.5 kc) and adjust P2 for maximum output while rocking the gang.

**Repeat both operations.**  
**SW band:** Tune set and oscillator to 17 metres (17,647 kc) and adjust T7 and then T8 for maximum response.

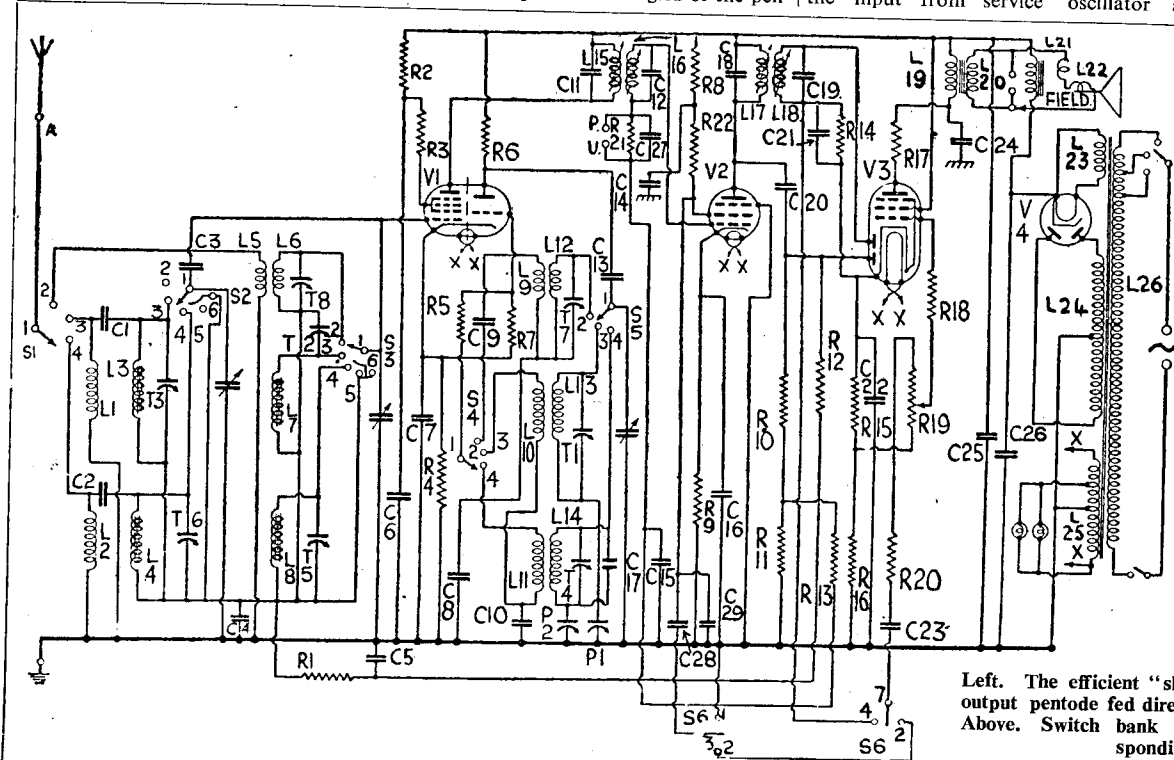
### RESISTANCES

R	Ohms	R	Ohms
1	25,000	12	1 meg.
2	20,000	13	1 meg.
3	60	14	500,000
4	165	15	138
5	60	16	276
6	40,000	17	60
7	25,000	18	1,000
8	15,000	19	1 meg.
9	60	20	10,000
10	250,000	21	10,000
11	750,000	22	7,000

### VALVE READINGS

V	Type	Electrode	Volts	Mas
1	All Mazda	Anode	260	4.5
	AC/TH1	Osc anode	70	4.6
		Screen	105	8.2
2	AC/VP2	Anode	260	12
		Screen	185	3.2
3	AC2/PenDD	Anode	245	33
		Screen	260	8.4
4	UU4	Heater	330	—

Readings taken on 230v mains, no signal input, vol control maximum, MW minimum capacity.



Left. The efficient "short" superhet circuit with a high-slope output pentode fed direct from a diode in the same envelope. Above. Switch bank showing numbered connections, corresponding with the circuit.