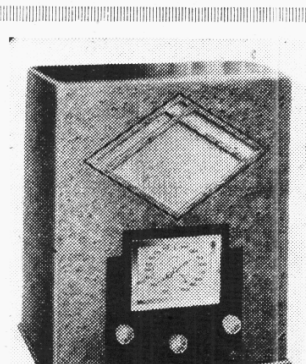
Supplement to The Wireless & Electrical Trader, February 13, 1943

"TRADER" SERVICE SHEET 607

ULTRA 22DC
TABLE MODEL & RADIOGRAM



The Ultra 22DC table model.

A THREE-VALVE (without rectifier) circuit is employed in the Ultra 22DC receiver, a two-band superhet designed to operate from DC mains of 200-250 V. A barretter accommodates variations within this range, and no voltage adjustment is provided.

A double diode pentode valve is used in the output stage, and no provision is made for a gramophone pick-up, but instructions are given for adding one if desired. There is provision for connecting an external speaker, and for internal speaker muting.

The differences in the radiogram version of the receiver are described under "Radiogram Modifications," but this *Service Sheet* was prepared on a table model.

Release date, both models : 1934.

Original prices: Table, £13 13s.; *Radiogram*, £23 2s.

CIRCUIT DESCRIPTION

Aerial input via mains isolating condensers **C1, C2** and coupling coils **L1** (MW) and **L2** (LW) to inductively coupled band-pass filter. Primary coils **L3, L4** are tuned by **C20;** secondary coils **L6, L7** by **C22.** Coupling by mutual inductance of primary and secondary windings. Secondary loading coil **L5** balances the load imposed on the primary by aerial coupling coil.

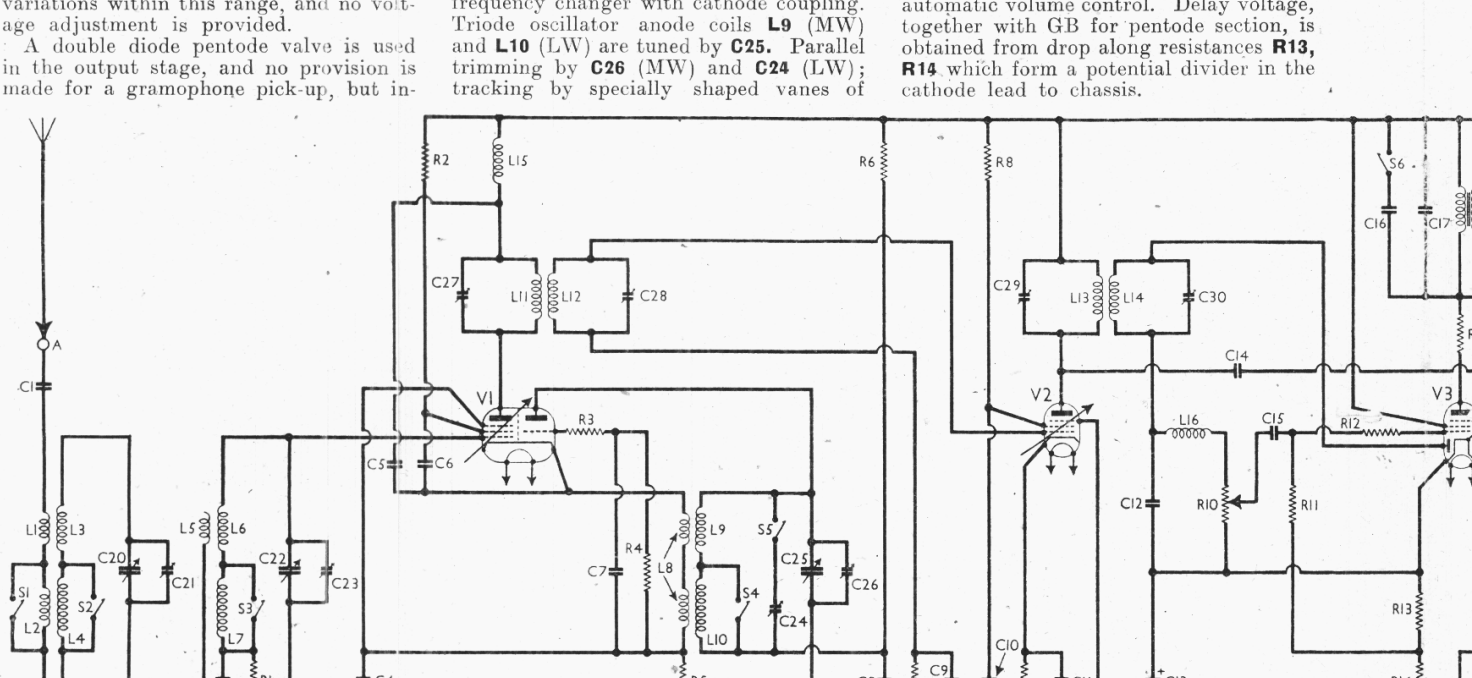
First valve **(V1, Mazda metallised TP2620)** is a triode-pentode operating as frequency changer with cathode coupling. Triode oscillator anode coils **L9** (MW) and **L10** (LW) are tuned by **C25.** Parallel trimming by **C26** (MW) and **C24** (LW); tracking by specially shaped vanes of **C25.** Reaction from cathode via coupling coil **L8.** The triode control grid is tied down to cathode via the resistance **R4** and shunted by **C7.**

Second valve **(V2, Mazda metallised VP1321)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C27, L11, L12, C28** and **C29, L13, L14, C30.**

Intermediate frequency 456 KC/S.

Diode second detector is part of double diode output pentode valve **(V3, Mazda PenDD4020).** Audio frequency component in rectified output is developed across manual volume control **R10,** which also operates as load resistance, and passed via AF coupling condenser **C15** and grid stopper **R12** to CG of pentode section, which provides the total AF amplification. IF filtering by choke **L16** and by-pass condenser **C12.**

Second diode of **V3,** fed from **V2** anode via **C14,** provides DC potentials which are developed across load resistances **R16, R17** and fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control. Delay voltage, together with GB for pentode section, is obtained from drop along resistances **R13, R14** which form a potential divider in the cathode lead to chassis.



Circuit diagram of the Ultra 22DC superhet. **L5** is fitted in order to balance in **L6** the load imposed on **L3** by the coupling coil **L1.** Band-pass couplin and secondary coils. Replacements for the TP2620 frequency changer **V1** and double diode output pentode **V3** are given under "Valve Substitutions" rectifier is employed. The barretter controls the heater current, and no manual voltage adjustment is provided. Differences in the radiogram version ar

Fixed tone correction in pentode anode circuit by **C17, C18** and **R18.** Two-position tone control by **C16** and **S6,** also in pentode anode circuit. Provision for connection of low impedance external speaker across secondary winding of output transformer **T1,** while a plug and socket device permits the internal speaker to be muted if desired.

HT current is obtained directly from DC mains via a filter circuit comprising the smoothing choke **L19** and **reversible** electrolytic condenser **C19.**

Valve heaters, together with scale lamps, speaker field coil **L18** and current regulating resistance **(Barretter, Philips C1)** are connected in series across DC mains input circuit.

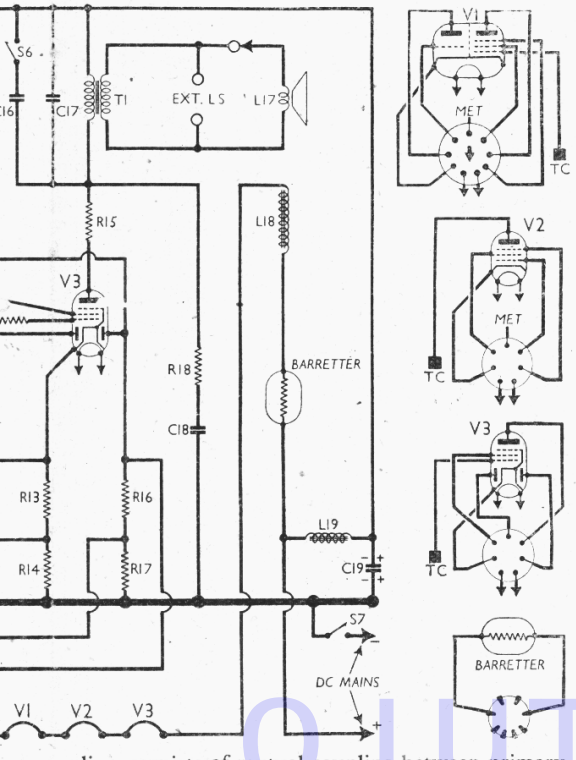
VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on DC mains of 220 V DC.

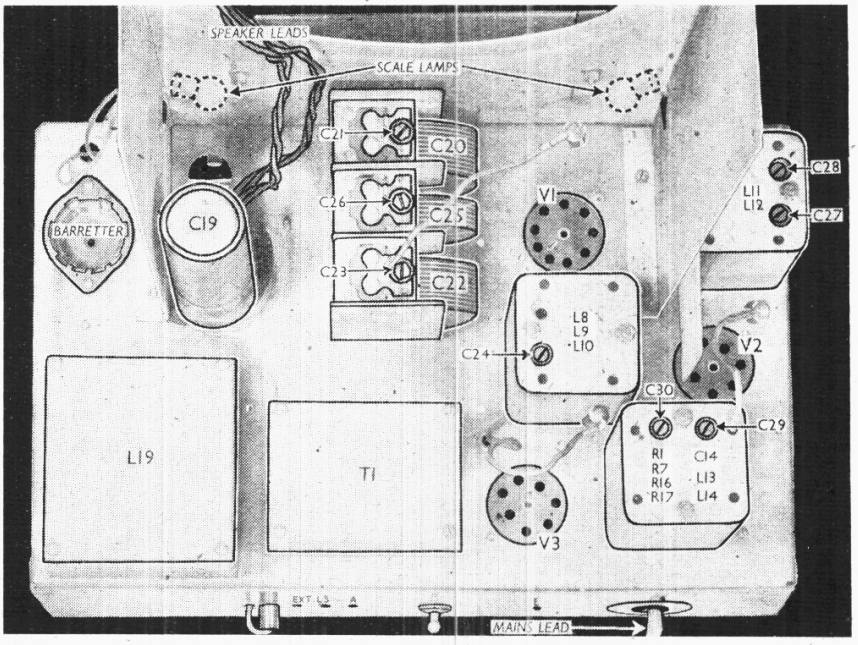
The receiver was tuned to the lowest wavelength on the MW band, and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 400 V scale of the model 7 Universal Avometer, chassis being the negative connection.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TP2620	217	5·1	155	1·75
	Oscillator			
	78	1·7		
V2 VP1321	217	4·8	165	1·2
V3 Pen DD4020	195	50·0	217	6·8



ass coupling consists of mutual coupling between primary stitutions" overleaf. **C19** is a reversible electrolytic, as no version are described under "Radiogram Modifications."



Plan view of the chassis. The speaker is mounted on the metal baffle seen rising off the top of the illustration. Several components in addition to the coils and tuning condensers are contained in the **L13, L14** IF unit.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 pent. CG decoupling	1,000,000
R2	V1 SG HT feed	25,000
R3	V1 osc. CG stabiliser	1,000
R4	V1 osc. CG resistance	50,000
R5	V1 fixed GB resistance	660
R6	V1 osc. anode HT feed	50,000
R7	V2 CG decoupling	1,000,000
R8	V2 SG HT feed	30,000
R9	V2 fixed GB	165
R10	Manual volume control; V3 signal diode load	500,000
R11	V3 pent. CG resistance	1,000,000
R12	V3 pent. grid stopper	1,000
R13	V3 pentode GB and AVC delay resistances	110
R14		110
R15	V3 pent. anode stopper	60
R16	V3 AVC diode load resistances	250,000
R17		750,000
R18	Part tone corrector	15,000

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial coupling coils	1·5
L2		48·5
L3	Band-pass primary coils	4·7
L4		11·3
L5	B-P secondary loading coil	1·3
L6	Band-pass secondary coils	4·7
L7		11·3
L8	Osc. cathode coupling coil	1·2
L9	Oscillator circuit tuning coils	8·5
L10		4·0
L11	1st IF trans. Pri.	5·6
L12	Sec.	5·6
L13	2nd IF trans. Pri.	5·6
L14	Sec.	5·6
L15	V1 pent. anode decoupling choke	55·0
L16	IF rejector choke	500·0
L17	Speaker speech coil	4·7
L18	Speaker field coil	100·0
L19	HT smoothing choke	42·0
T1	Output trans. Pri.	400·0
	Sec.	0·35
S1–S5	Waveband switches	—
S6	Tone control switch	—
S7	Mains switch, gauged R10	—

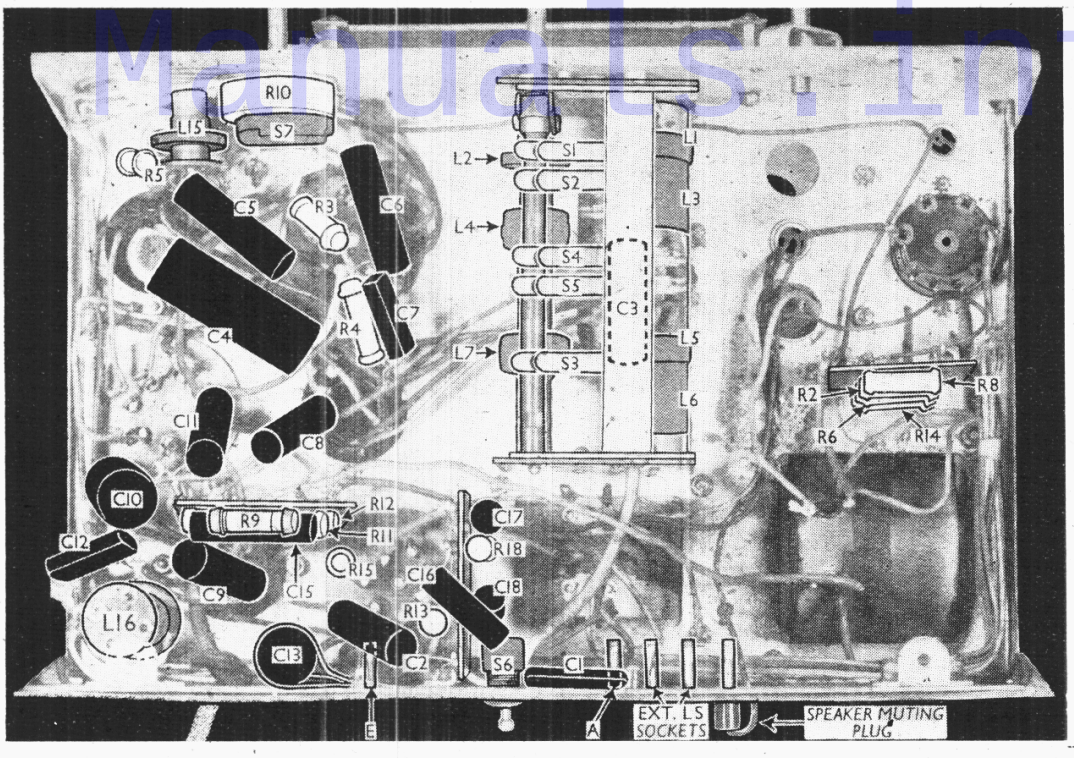
	CONDENSERS	Values (μF)
C1	Aerial isolating condenser	0·004
C2	Earth isolating condenser	0·1
C3	V1 pent. CG decoupling	0·05
C4	V1 cathode by-pass	0·5
C5	V1 pent. anode decoupling	0·1
C6	V1 SG decoupling	0·1
C7	V1 osc. CG shunt	0·0002
C8	V1 osc. anode decoupling	0·1
C9	V2 CG decoupling	0·05
C10	V2 SG decoupling	0·5
C11	V2 cathode by-pass	0·1
C12	IF by-pass	0·0002
C13*	V3 cathode by-pass	50·0
C14	Coupling to V3 AVC diode	0·0002
C15	AF coupling to V3 pentode	0·01
C16	Tone control condenser	0·01
C17	Fixed tone corrector condensers	0·001
C18		0·01
C19§	HT smoothing condenser	16·0
C20†	Band-pass pri. tuning	—
C21‡	B-P pri. MW trimmer	—
C22†	Band-pass sec. tuning	—
C23‡	B-P sec. MW trimmer	—
C24‡	Osc. circ. LW trimmer	—
C25†	Oscillator circuit tuning	—
C26‡	Osc. circ. MW trimmer	—
C27‡	1st IF trans. pri. tuning	—
C28‡	1st IF trans. sec. tuning	—
C29‡	2nd IF trans. pri. tuning	—
C30‡	2nd IF trans. sec. tuning	—

* Electrolytic. § Reversible electrolytic.
† Variable. ‡ Pre-set.

DISMANTLING THE SET

Removing Chassis.—Remove the three control knobs (recessed grub screws). remove the small wooden block (two countersunk-head wood screws) holding the top of the speaker assembly at the top of the cabinet; remove the four screws (with washers) holding the chassis to the bottom of the cabinet.

The chassis, complete with speaker assem-



Under-chassis view. The switches are individually identified here. In the radiogram model, two additional sections are added between the **S3** section and the rear of the assembly; the fixing holes are just visible. The band-pass and aerial coupling coils are seen grouped beneath the switch assembly. Normally a screen, which has been removed for photographing, encloses the entire switch and coil unit.

bly, can now be withdrawn from the cabinet as a single unit.

Removing Speaker.—First remove the chassis from the cabinet as described above.

Open the cloth dust-excluder, and unsolder from the connecting panel inside the four leads from chassis;

with the chassis laid face down, remove the four countersunk screws (with washers, lock-washers and lock-nuts) holding the speaker to the metal baffle.

When replacing, the connecting panel should be at the top.

The leads should be connected as follows, numbering the tags from left to right when viewed from the rear:

1, red, or blue with black tracer;
2, black with white tracer from **T1**;
3, plain black from **T1**;
4, blue (or green) to speaker field.

GENERAL NOTES

Switches.—S1-S5 are the waveband switches in a single leaf type unit beneath the chassis. Normally, the unit is obscured from view by a rectangular screen, but it is seen in our under-chassis view, where the screen has been removed, and the individual switches are indicated.

Switches **S1, S2, S3 and S4** all close when the control is turned to the MW position, while **S5** opens; when the control is turned to LW, the position is reversed, **S5** closing and the remainder opening.

S6 is the two-position tone control. In one position **C16** is connected across **V3** pentode anode circuit, while in the other it is disconnected.

S7 is the QMB mains switch, ganged with the volume control **R10.**

Coils.—The aerial and band-pass coils **L1-L7** are in two tubular units mounted horizontally beneath the chassis about the **S1-S5** switch unit. The screen which covers the switches also covers the coils.

The oscillator coils **L8-L10** are in a screened unit on the chassis deck, with **C24.**

The IF transformers **L11, L12** and **L13, L14** are in two further screened units on the chassis deck with their associated tuning condensers. Resistances **R1, R7, R16, R17** and condenser **C14** are also housed in the **L13, L14** unit.

The RF and IF chokes **L15** and **L16** are mounted beneath the chassis, **L15** near one end of the front member and **L16** near the same end of the rear member.

Scale Lamps.—These are two Osram MES types, rated at 6 V, 0.3 A, with clear spherical bulbs.

Gramophone Pick-up.—No provision is made for this, and as AF amplification is only provided in the output stage, it would not be satisfactory to connect a pick-up (via some isolating device) across the volume control unless it had a very large output. A pick-up could be connected as it is in the radiogram model, however, if the modifications described under "Radiogram Modifications" were carried out, adding a separate two-way switch.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (6-10 Ω) external speaker. A plug and socket device to the left of these two sockets permits the internal speaker speech coil circuit to be broken if desired.

Condenser C19: Warning.—This is a **reversible** electrolytic rated at 16 μF. It is very important in a DC receiver that replacements in this position shall be reversible, as otherwise, if the mains plug is inserted in its socket the wrong way round, reverse polarity will be applied to the condenser, resulting in damage to the condenser itself at least if the ordinary polarised type of electrolytic is used.

If the correct type cannot be obtained, a replacement may be made by using two polarised electrolytics connected in series **back to back:** i.e., with the two negative leads joined together and insulated, leaving two positive outers. If this is done, the condensers must be of the same type and capacity, each of the required maximum working voltage (300 V), and the total capacity will be half of that of each condenser. A dual unit is very suitable if provided with a separate pair of leads for each condenser.

Control Knobs.—In order to isolate the metal control knobs from the mains, there is an insulating insert between the outer part of each knob and the bush which fits the spindle. It is important, therefore, that the correct knobs should be used, or that replacements are of non-conducting material, and that the grub screws should sink well into their housings. The screw heads should be covered with wax, and must not come into metallic contact with the outer portion of a metal knob.

CIRCUIT ALIGNMENT

IF Stages.—Connect the signal generator leads via a 0.1 μF condenser to the control grid (top cap) of **V1** and chassis, and turn the volume control and gang to maximum. Feed in a 456 KC/S (657.9 m) signal and adjust **C30, C29, C27** and **C28** in that order for maximum output.

RF and Oscillator Stages.—With the gang at maximum, adjust the pointer so that its short hand covers the dot immediately on the left-hand side of the "12 o'clock" position on the tuning scale. Connect the signal generator leads via a suitable dummy aerial to **A** and **E** sockets.

MW.—Switch set to MW, tune to 200 m on scale, feed in a 200 m (1,500 KC/S)

signal, and adjust **C26, C21** and **C23** in that order for maximum output.

Should a whistle occur at about 350 m, readjust **C21** and **C22** until it disappears.

LW.—Switch set to LW, tune to 1,500 m on scale, feed in a 1,500 m (200 KC/S) signal, and adjust **C24** for maximum output.

RADIOGRAM MODIFICATIONS

Except for certain modifications concerned directly with the pick-up input and its subsequent amplification, an alteration to the position of the mains switch **S7,** and the method of mounting the speaker, the chassis in the model 22 DC radiogram is similar to that used in the table model. The modifications are seen in the diagram in cols. 5 and 6.

The cabinet is, of course, different, and **S7** is replaced by a QMB toggle switch, attached to the chassis by a flexible lead. It is mounted in a cupped escutcheon, which is fitted on the side of the cabinet. The voltage ranges of the motor are 100-130 V and 200-250 V AC/DC, and the adjustment terminals, which are protected by a cover-plate, are marked A, B, C and D. A is the common connection, B is for 200-250 V DC mains, C for 100-130 V DC or 200-250 V AC, and D is for 100-130 V AC. The motor leads are connected directly to the mains input, and the adjustment leads should be on terminals A and B for this receiver.

In order to obtain sufficient amplification for pick-up work, the IF amplifying valve **V2** is used as an AF amplifier. The alterations to the circuit, involving the addition of two fixed resistances, a potentiometer, six fixed condensers and two switches, are as follows :

A potentiometer **R21** is ganged with **R10** in the place of **S7,** and the pick-up output is taken to the two ends of its stator element. The slider and one end of the stator are then taken as a pair to **V2** grid circuit, which is broken between **L12** and **C9** to accept them; the two points of connection are then shunted by a condenser **C33.**

The anode feed lead to **V2** is broken between **L13** and the HT positive line, and two resistances **R19, R20** in series are inserted in the gap, **R19** being nearer the HT positive side. From the junction of the two resistances a condenser **C34** is taken to chassis, while another condenser **C35** is taken from the junction of **R20** and **L13** to chassis.

A pair of switches **S8, S9,** having between them a single-pole, double-throw action, are added to the waveband switch unit between **S3** and the rear end of the unit. The lead between **R10** slider and **C15** is broken, and the common of the switches is connected to **C15,** while the outer side of **S9** goes to **R10** slider. Finally, a coupling condenser **C36** is connected between the outer contact of **S8** and the junction of **R20** and **L13.**

In operation, the pick-up input appears across **C33,** which has a very high impedance at audio frequencies, but by-passes the pick-up at intermediate frequency. In **V2** anode circuit, the AF signal is developed across **R20, C35** having a negligible effect, although at IF it acts as a decoupling condenser and prevents the IF signal from developing across **R20. R19** and **C34** form a decoupling circuit at audio frequencies.

Switch **S8** closes on gram, a third position on the waveband control, so that the pick-up signal as it appears across **R20** is conveyed via **C36** and **S8** to **C15** and the grid circuit of **V3** pentode, and so on to the output circuit. Since **S9** opens on gram, the radio volume control **R10** is inoperative.

The table below gives the values of the additional components. All the remaining components in the radiogram are the same as in the table model.

	COMPONENTS	Values
R19	V2 anode decoupling ...	10,000 O
R20	V2 anode AF load ...	3,000 O
R21	PU volume control ...	50,000 O
C31, C32	PU input mains isolating condensers	0·1 μF
C33	PU IF by-pass	0·0002 μF
C34	V2 anode AF decoupling	0·5 μF
C35	V2 anode IF by-pass ...	0·002 μF
C36	AF coupling to V3 pent.	0·1

VALVE SUBSTITUTIONS

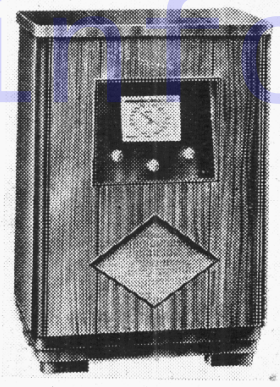
If difficulty is experienced in procuring replacement valves of the original type for **V1** and **V3** in the model 22, other valves can be substituted, although some modifications will then have to be made to the chassis to accommodate the substitutes, particularly in the case of **V1.**

There are several suitable substitute valves which can be used to replace the Mazda TP2620, although in some cases they perform better on the MW band than on the LW band.

The makers' original instructions for substitutions for **V1** were published in our *Service Sheet* 504, while another article on substituting a Mullard FC13 for the TP2620 appeared in "Service Short Cuts" of the March 15, 1941, issue of *The Trader.*

For the convenience of those who may not have these references handy, the following is a rough indication of the modifications necessary when substituting a Mazda TH233.

Replace the original valve holder with a Mazda octal type.



The appearance of the Ultra 22DC radiogram.

Replace the oscillator anode HT feed resistance **R6** by one of 5,000 O.

Replace the fixed GB resistance **R5** by one of 200 O.

Replace the 0.0002 μF oscillator control grid shunt condenser **C7** by one of 0.002 μF.

Remove the 1,000 O oscillator grid stabilising resistance **R3** altogether.

Check alignment.

Old and New Base Connections

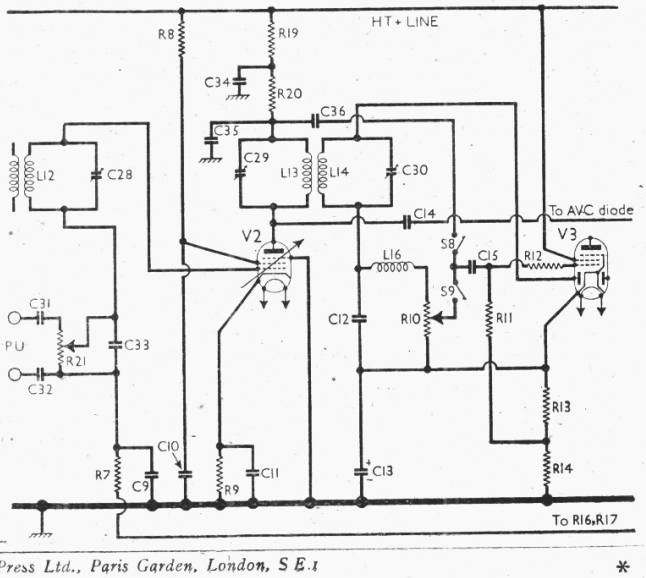
For the convenience of those who are not familiar with the Mazda TH233 base connections, they are as follows :

Pin 1, heater; 2, cathode; 3, heptode anode; 4, oscillator anode; 5, oscillator grid; 6, metallising; 7, screen; 8, heater.

When replacing the valve-holder, the simplest method is first to label the connecting leads, then unsolder them, connecting them again, according to the labels, to the new holder.

PenDD4020.—A good substitute for this valve is the Mullard Pen40DD, which can be plugged straight in to the original holder if the anode and cathode connections (pins 2 and 6) are transposed. The Mazda PenDD4021 is not a good substitute unless the output transformer and GB resistances are suitably replaced.

Part of the circuit diagram overleaf, redrawn to show the modified circuit of the radiogram chassis. The differences, which are concerned solely with the accommodation of the pick-up, are described elsewhere on this page.



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