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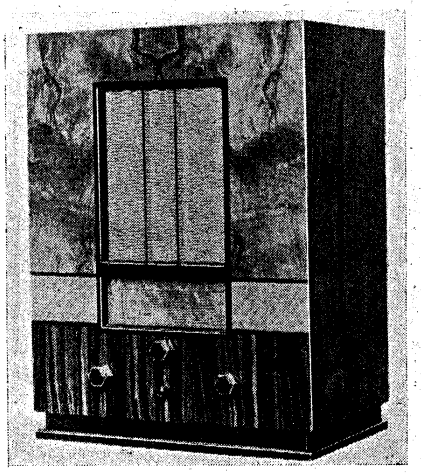
FERRANTI 1935/6 AC/DC LANCASTRIA AND NOVA



The Ferranti AC/DC Lancastria.

THE Ferranti Lancastria 1935/6 Universal receiver is a 4-valve (plus rectifier) 2-band superhet, designed to operate from AC or DC mains of 200-250 V, 40-100 C/S in the case of AC.

A special inter-station noise suppression circuit is included, and a tuning indicator is fitted. The receiver is also equipped with tone, volume and wave-band indicators, in the form of small pointers on the scale panel. Terminals are provided on the speaker assembly for an external speaker, while a switch near them permits the internal speaker to be muted.

The same type of chassis is employed in the Nova 1935/6 Universal receiver, but certain refinements included in the Lancastria chassis are omitted here, as described overleaf, and the Nova is fitted in a bakelite cabinet.

Release date, both models: September, 1935.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1** (MW) and **L2** (LW) to mixed coupled band-pass filter. Additional aerial "top" coupling by small condenser **C3.** Band-pass primary coils **L3, L4** are tuned by **C25;** secondary coils **L8, L9** are tuned by **C27.** Inductive coupling by **L6** (MW) and **L7** (LW); capacitative "bottom" coupling by **C4.** **L7** consists of a few turns at the low potential end of **L9.**

Aerial and earth sockets are isolated from the chassis, which is "live" to the mains, by condensers **C1** and **C2** respectively.

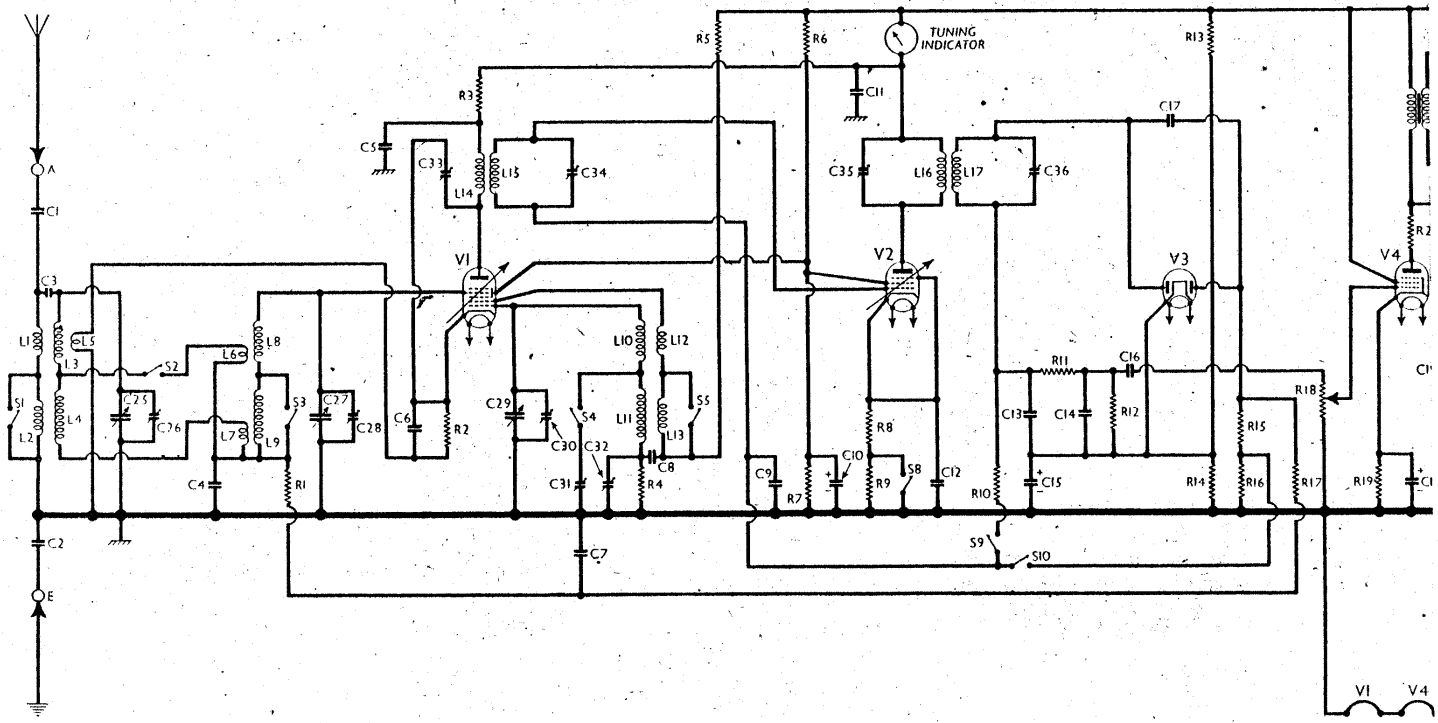
First valve **(V1, Osram** or **Marconi metallised X30)** is a heptode operating as frequency changer with electron coupling. Oscillator control grid coils **L10** (MW) and **L11** (LW) are tuned by **C29.** Parallel trimming by **C30** (MW); series tracking by **C31** (MW) and **C32** (LW). Reaction coupling by coils **L12, L13** in oscillator anode circuit, with additional coupling, via **C8,** across the impedance of the tracking condensers, which is common to grid and anode circuits.

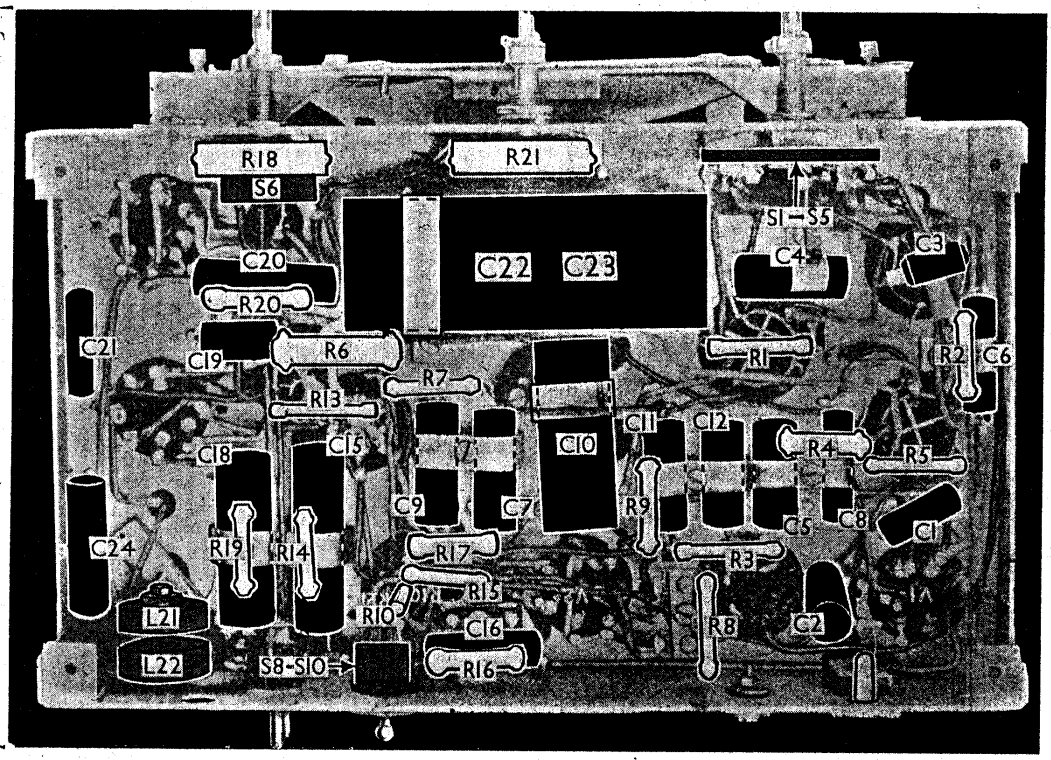
Image suppression by coil **L5** which is connected in **V1** cathode lead to chassis and coupled to the aerial circuit.

Second valve **(V2, Osram** or **Marconi metallised W31)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C33, L14, L15, C34** and **C35, L16, L17, C36.** **Intermediate frequency 125 KC/S.**

Diode second detector is part of separate double diode valve **(V3, Osram** or **Marconi metallised D41).** Audio frequency component in rectified output is developed across load resistance **R12** and fed via AF coupling condenser **C16** and manual volume control **R18** to control grid of pentode output valve **(V4, Osram** or **Marconi N31).** IF filtering by **C13, R11** and **C14.**

Fixed tone correction by **C19** in **V4** anode circuit; variable tone control by **C20, R21,** also in anode circuit. Provision for connection of low-impedance external speaker by terminals across the secondary winding of the internal speaker input transformer **T1,** while switch **S7** permits the internal speaker speech coil circuit to be broken, muting the internal speaker if desired. The metal parts of the speaker assembly, and the speech coil circuit, are connected via a high-voltage isolating





Under - chassis view. The wave-band switch unit **S1-S5** is indicated here and shown in detail in the sketch in col. 1 overleaf. **S8-S10** is the QAVC switch unit. Condensers **C1, C2, C21** and **C24** are subject to the full mains voltage. Replacements should be of high voltage rating type.

condenser **C21** to chassis, so that the external speaker leads are safe to handle, and may be earthed.

Second diode of **V3,** fed from **L17** via coupling condenser **C17,** provides DC potentials which are developed across load resistances **R15, R16** and fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control. Delay voltage is obtained from the junction of the two resistances **R13, R14,** which form a potential divider across the HT circuit, and applied to **V3** cathode.

For inter-station noise suppression, a system of QAVC is employed. The change-over from normal conditions to QAVC is effected by a two-pole double-throw switch unit **S8, S9, S10.** Normally **S8** and **S10** are closed, and **S9** is open. When the change-over is made, **S8** opens, and the fixed GB applied to **V2** is increased by the addition of a high resistance **R9** in its cathode circuit, and all signals below a certain strength are suppressed.

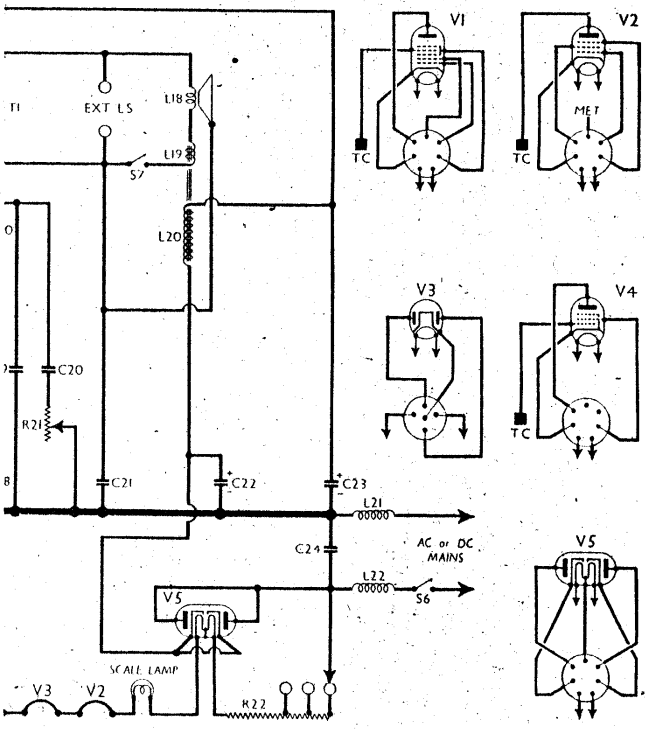
The normal AVC line to **V2** is disconnected by opening **S10,** and the grid circuit is returned via **S9** (now closed) and decoupling resistance **R10 to R11,** so that the positive potential applied from potential divider **R13, R14** to **V3** cathode is applied also to **V2** control grid via **R12, R11, R10, S9** and **L15,** and tends to off-set the large negative bias voltage.

When a signal large enough to reach the signal diode is received, the DC potential developed across **R11, R12** is applied to **V2** control grid, where it acts as a separate AVC potential for **V2** only.

The changing value of **V1** and **V2** anode currents with change of AVC potential is used to operate a meter-type tuning indicator **T.I.,** which is connected in series with the common HT supply lead to these valves.

When the receiver is used with AC mains, HT current is supplied by a rectifying valve **(V5, Osram** or **Marconi U30)** whose two sections are connected in parallel to operate as a single half-wave rectifier. With DC mains, **V5** operates as a low resistance. Smoothing is effected by speaker field **L20** and dry electrolytic condensers **C22, C23.**

Valve heaters, together with scale lamp and ballast resistance **R22,** are connected in series across the mains input, while a filter circuit comprising air-cored chokes **L21, L22** and condenser **C24** suppresses mains-borne interference.



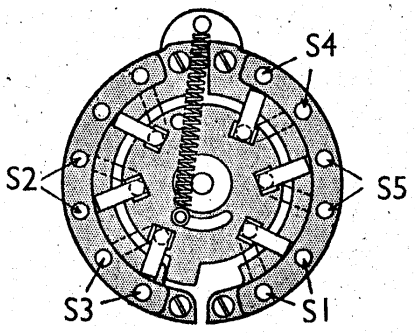
Circuit diagram of the Ferranti 1935/6 Lancastria Universal superhet. **L5** is the image rejector coil. The QAVC noise suppression circuit is brought into action by switches **S8–S10.** When in action, **S8, S10** are open, and AVC for **V2** is applied via **S9** from the signal diode. The fixed negative GB voltage is increased by the addition of **R9,** but is offset by a positive potential from **R13, R14,** applied via the diode circuit. The Nova Universal circuit is similar except that the QAVC circuit and tuning indicator are omitted, so that **S8–S10** and **R9, R10** will not be present.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 CG decoupling ...	250,000
R2	V1 fixed GB resistance ...	300
R3	V1 pent. anode decoupling	1,000
R4	V1 osc. CG resistance ...	30,000
R5	V1 osc. anode HT feed ...	100,000
R6	V1, V2 SG's HT feed potential divider ...	25,000
R7		50,000
R8	V2 fixed GB resistance ...	300
R9	Noise suppressor	3,000
R10	QAVC decoupling ...	250,000
R11	IF stopper	100,000
R12	V3 signal diode load ...	500,000
R13	AVC delay potential divider	250,000
R14		50,000
R15	V3 AVC diode load resistances	1,000,000
R16		250,000
R17	AVC line decoupling ...	500,000
R18	Manual volume control ...	1,000,000
R19	V4 GB resistance... ...	140
R20	V4 anode stopper ...	140
R21	Variable tone control ...	50,000
R22	Heater circuit ballast ...	547†

† Tapped at 377 O + 100 O + 70 O from end connected to V5 heater.

	CONDENSERS	Values (μF)
C1	Aerial isolating condenser	0·002
C2	Earth isolating condenser	0·05
C3	Aerial " top " coupling...	0·000016
C4	Band-pass coupling ...	0·05
C5	V1 pentode anode decoupling	0·1
C6	V1 cathode by-pass ...	0·05
C7	AVC line decoupling ...	0·05
C8	Reaction coupling condenser	0·01
C9	V2 CG decoupling ...	0·15
C10*	V1, V2 CG's decoupling...	4·0
C11	V2 anode decoupling ...	0·1
C12	V2 cathode by-pass ...	0·1
C13	IF by-pass condensers ...	0·00015
C14		0·00015
C15*	V3 cathode by-pass ...	4·0
C16	AF coupling to V4 ...	0·02
C17	Coupling to V3 AVC diode	0·00015
C18*	V4 cathode by-pass ...	50·0
C19	Fixed tone corrector ...	0·002
C20	Part variable tone control	0·05
C21	Speaker isolating condenser	0·002
C22*	HT smoothing condensers	8·0
C23*		24·0
C24	Mains RF by-pass ...	0·1
C25†	Band-pass pri. tuning ...	—
C26‡	B-P pri. MW trimmer ...	—
C27†	Band-pass sec. tuning ...	—
C28‡	B-P sec. MW trimmer ...	—
C29†	Oscillator circuit tuning	—
C30‡	Osc. circ. MW trimmer...	—
C31‡	Osc. circ. MW tracker ...	—
C32‡	Osc. circ. LW tracker ...	—
C33‡	1st IF trans. pri. tuning	—
C34‡	1st IF trans. sec. tuning	—
C35‡	2nd IF trans. pri. tuning	—
C36‡	2nd IF trans. sec. tuning	—



Sketch showing the details of the waveband switch unit. It is viewed as indicated by the arrow in the underchassis illustration.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial coupling coils ...	17·0
L2		68·0
L3	Band-pass primary coils	5·0
L4		41·0
L5	Image suppressor coil ...	0·5
L6	Band-pass coupling coils	0·2
L7		—
L8	Band-pass secondary coils	5·0
L9		41·0
L10	Osc. circ. MW tuning coil	4·0
L11	Osc. circ. LW tuning coil	25·0
L12	Oscillator reaction coils	6·5
L13		3·2
L14	1st IF trans. Pri. ...	80·0
L15	Sec. ...	80·0
L16	2nd IF trans. Pri. ...	80·0
L17	Sec. ...	80·0
L18	Speaker speech coil ...	4·0
L19	Hum neutralising coil ...	0·5
L20	Speaker field coil ...	700·0
L21	Mains filter chokes ...	3·0
L22		3·0
T1	Speaker input trans. Pri. ...	200·0
	Sec. ...	0·5
T.I.	Tuning indicator winding	1,200·0
S1-S5	Waveband switches ...	—
S6	Mains switch, ganged R18	—
S7	Speaker muting switch...	—
S8-S10	QAVC switches	—

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (pull-off) from the front of the cabinet;
withdraw from the four pins on the connecting panel on the chassis deck the four leads from the speaker;
remove the four screws holding the chassis to the bottom of the cabinet.

When replacing, connect the four hollow speaker connections to the speaker connecting panel as follows, using the lead colours and numbering the prongs from front to rear :
1, blue;
2, green;
3, red;
4, Black.

Removing Speaker.—Withdraw the four connections from their prongs on the panel on the chassis deck;
open the dust cover, and remove the four nuts holding the speaker to the sub-baffle.

When replacing, the transformer should be at the top, and the leads should be connected as previously indicated.

VALVE ANALYSIS

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 X30	200	1·0	55	3·0
	Oscillator			
	80	1·1		
V2 W31	200	3·0	55	2·0
V3 D41*	—	—	—	—
V4 N31	195	33·0	200	8·0
V5 U30	220†	—	—	—

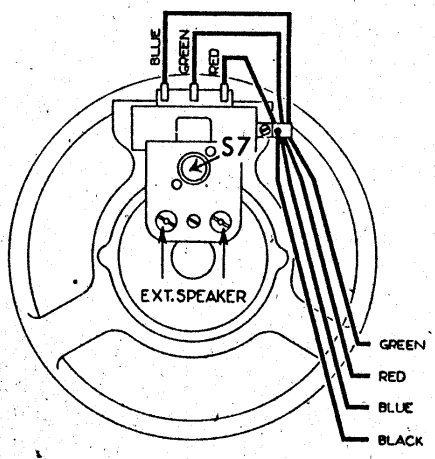
* Cathode to chassis, 30V, DC.
† Anode to chassis, AC.

Valve voltages and currents given in the table above are those quoted in the makers' manual. They represent conditions to be expected in the average receiver, working with no aerial or earth connection, on AC supply mains of 220 V, 50 C/S. The QAVC switch should be "off."

Voltages were measured on the 300 V scale of a Ferranti AC/DC circuit tester (resistance 300,000 O), the negative lead of which was connected to chassis.

When measuring the anode and screen currents of **V1** and **V2**, unless the meter is inserted in the low potential end of the circuit, a condenser of about 0.1 μF should be connected between the top cap of the valve under test and chassis to avoid misleading readings due to instability.

The total HT current is quoted as 57 mA, and the voltage drop across the speaker field **L20** as 40 V.



Sketch showing the connections to the speaker assembly, with the colour coding of the leads. Switch **S7** and the external speaker terminals are also indicated.

GENERAL NOTES

Switches.—S1-S5 are the waveband switches, in a single rotary unit beneath the chassis. The unit is mounted on the front chassis member, and is indicated in our under-chassis view. A diagram of the unit, as seen when viewed from the rear of the underside of the chassis, appears in col. 1. All the switches are closed on MW, and open on LW.

S6 is the mains switch, ganged with the volume control **R18.**

S7 is the internal speaker muting switch, mounted on the rear of the speaker assembly. Its position is indicated in the sketch of the assembly above. The switch knob is mounted on an extension shaft, and is accessible through a hole in the back cover of the receiver.

S8-S10 are the QAVC switches, in a single QMB unit mounted on the rear chassis member. In the normal position, **S8** and **S10** are closed, and **S9** is open; in the "Q" position, these conditions are reversed.

Coils.—L1-L5 are the aerial coupling, band-pass primary and image suppressor coils; **L6-L9** are the band-pass coupling and secondary coils, **L7** being formed by a few turns of **L9; L10-L13** are the oscillator circuit coils and **L14, L15** and **L16, L17** are the IF transformers, in five screened units on the chassis deck. The oscillator and IF transformer units contain their associated pre-set condensers, and the **L16, L17** unit contains several other components in addition.

The mains input filter chokes **L21, L22** are in a small unscreened assembly in one corner at the rear beneath the chassis.

Scale Lamp.—This is an Osram S-type lamp, with an MES base, rated at 6.5 V, 0.3 A.

External Speaker.—Two terminals are provided on the rear of the speaker assembly for the connection of a low impedance (4-6 O) external speaker. The internal speaker may be muted by **S7** as described under "Switches."

The terminals are in metallic contact with the speech coil circuit, and are isolated from the chassis, which is "live" to the mains, by a high-voltage condenser **C21.** As a safety measure, therefore, one side of the external speaker circuit could be earthed if desired. The position of the terminals is indicated in the sketch of the speaker assembly in col. 3.

Condensers C22, C23.—These are two dry electrolytics in a single rectangular cardboard container, rated at 500 V peak. They are mounted on the underside of the chassis deck. The black lead is the common negative connection, the red lead is the positive of **C22** (8 μF), and the yellow lead the positive of **C23** (24 μF).

Condensers C1, C2, C21, C24.—The first three of these are mains isolating condensers, while the fourth is connected across the mains. For this reason, only high-voltage test condensers may be used in these positions as replacements. The original condensers were rated at 1,500 V test.

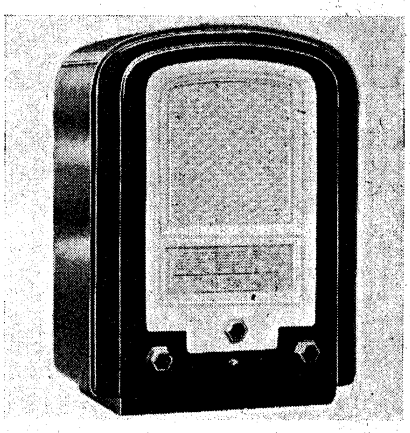
Alternative Valves.—The Marconi-Osram X32 can be substituted as a direct equivalent for the X30 in **V1** position. A Mullard FC13C can be used instead if its heater, which is rated at 13 V, 0.2 A, is shunted by a 130 O 1.3 W resistance to by-pass the surplus 0.1 A.

For **V2,** a Marconi-Osram W30 or Ferranti VPTS or VPTSB can be substituted directly for the W.31. For **V3,** a valve such as the Mullard 2D13C could be used if the heater were shunted by a 130 O resistance as in the case of the FC13C. Alternatively, the diodes of a double diode triode could be used if the holder were replaced. For the N31 **V4,** the Marconi-Osram KT31 and Ferranti PTSA are direct equivalents.

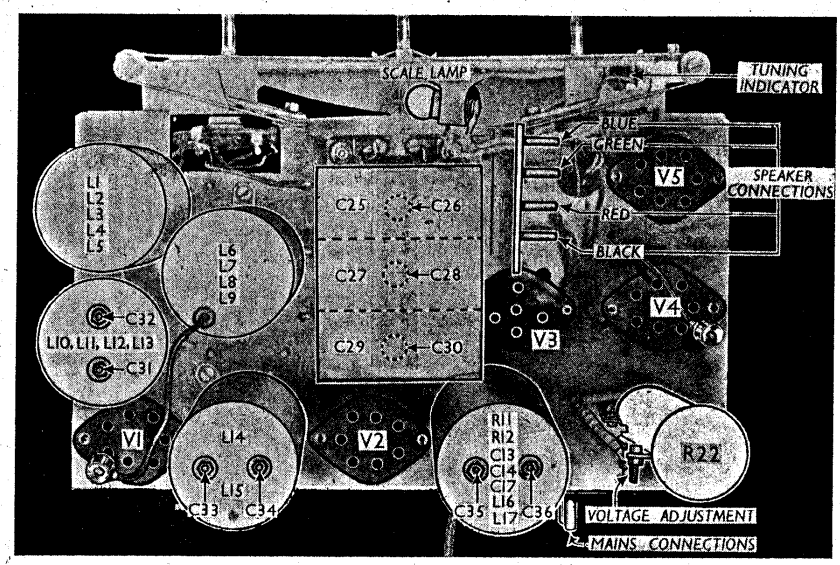
For the rectifier **V5,** the Tungsram PV25 is a direct equivalent or, if a shunt resistance is connected across the heater, a Mullard UR3C can be used. The value of the shunt resistance would be 300 O, as the heater of the UR3C is rated at 30 V, 0.2 A, whereas that of the U30 is 26 V, 0.3 A. The base connections are the same, except that the UR3C has no centre-tap to the heater, but as the centre-tap is not used in this receiver, that is of no consequence.

The Marconi-Osram U31 or the American type 25Z6 could also be used if the valve holder were replaced with universal octal type holder. The connections for the 25Z6 are as follows: pin 1, blank; pin 2, heater; pin 3, anode (a); pin 4, cathode (a); pin 5, anode (b); pin 6, no pin; pin 7, heater; pin 8, cathode (b). The 25Z6 is of the voltage-doubler type, like the Marconi-Osram U30, and as it is used here as a half-wave rectifier, pins 4 and 8 will be strapped together, as will also pins 3 and 5. The U31 is a half-wave rectifier only, but if the holder is wired as explained above, either the 25Z6 or the U31 can be used without alteration.

If the 25Z6 valve is to be used, a 100 O 1 W resistance should be inserted in the common lead to the anodes when used in a receiver of this type, for mains in the neighbourhood of 200 V. This is not necessary in the case of the U31, but if fitted it may be left in circuit.



The Ferranti AC/DC Nova.



Plan view of the chassis. All the alignment adjustments, together with the speaker connections, are indicated here.

NOVA UNIVERSAL MODIFICATIONS

The same type of chassis is used in the 1935/6 Nova Universal as is used in the 1935/6 Lancastria Universal, but the tuning indicator and the QAVC inter-station noise suppressor are omitted. The cabinet is different also, as will be seen from the illustrations.

The QAVC switch unit **S8-S10** and resistances **R9, R10** will, therefore, not be found on the Nova model. As the tuning indicator is not fitted, the upper ends of **R3** and **L16** will go straight to the HT positive line, and **C11** will become in effect an HT circuit RF by-pass condenser.

In addition to the omission of these refinements in the Nova model, there are other slight modifications. **V2** CG decoupling condenser **C9** in the Lancastria is 0.15 μF, but in the Nova a 0.05 μF condenser is used. Also, if it is desired to remove the speaker from a Nova model, it should be removed complete with its sub-baffle, which is held by four bolts.

CIRCUIT ALIGNMENT

All the pre-set condensers in this receiver have adjustments consisting of screwed rods with flattened ends. In the case of the IF trimmers, these are also fitted with lock-nuts, for which a 6BA box spanner will be required.

IF Stages.—Connect the signal generator leads to control grid (top cap of **V1** and, via 0.05 μF condenser, to chassis, turn the volume control to maximum, and the tone control to low, and slacken off the trimmer lock-nuts. Feed in a 125 KC/S (2,400 m) signal, and adjust **C36, C35, C34** and **C33** in that order for maximum output. Tighten up lock-nuts.

R.F. and Oscillator Stages.—With the gang at minimum, the pointer should coincide with the 200 m calibration mark on the scale. Leave the signal generator connected as for IF trimming.

MW.—Switch set to MW, and screw up **C30** fully. With the gang at minimum, feed in a 200 m (1,500 KC/S) signal, and unscrew **C30** carefully until the *second*, peak is reached.

Transfer signal generator leads to **A** and **E** sockets via a suitable dummy aerial (or a 0.0002 μF condenser may be used instead), tune 228 m on scale, feed in a 228 m (1,315 KC/S) signal, and adjust **C28** and **C26** for maximum output. Feed in a 500 m (600 KC/S) signal, tune it in, and adjust **C31** for maximum output while rocking the gang for optimum results.

LW.—Switch set to LW, feed in an 1,807 m (166 KC/S) signal, tune it in, and adjust **C32** for maximum output while rocking the gang for optimum results. Check calibration at 1,128 m (266 KC/S).

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