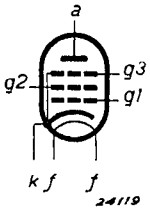
CL 4 Output pentode



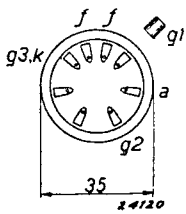


Fig. 2
Arrangement of electrodes and base connections.

The CL 4 is an indirectly-heated 9 W output pentode of high mutual conductance, especially for use in A.C./D.C. receivers; it lends itself admirably to the construction of simple types of receivers. As the mutual conductance, as stated, is very high, the heater power is also on the high side; the current with 33 V is 200 mA.

The CL 4 may be employed either as a Class A amplifier or in balanced output circuits, and in the latter instance will deliver 8 W with 1.5 % distortion; with a potential of 250 V on both anode and screen, as much as 13.5 W can be obtained from this valve with 5.7 % distortion (the anode-to-anode load is 6,000 ohms). The cathode biasing resistor must then be 175 ohms and the alternating grid voltage 12.5 $V_{(eff)}$, per grid.

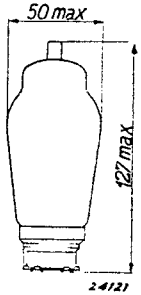


Fig. 1
Dimensions in mm.

HEATER RATINGS

Heating: indirect, by A.C. or D.C., series supply.

Heater voltage	V_f	= 33 V
Heater current	I_f	= 0.200 A

CAPACITANCES

Anode-grid	C_{ag1}	< 1 $\mu\mu$F

OPERATING DATA: CL 4 used as single output valve

Anode voltage	V_a	= 200 V
Screen-grid voltage	V_{g2}	= 200 V
Cathode resistor	R_k	= 170 ohms
Grid bias	V_{g1}	= —8.5 V
Anode current	I_a	= 45 mA
Screen-grid current	I_{g2}	= 6 mA
Mutual conductance	S	= 8 mA/V
Internal resistance	R_i	= 35,000 ohms
Load resistor	R_a	= 4,500 ohms
Output power with 10 % distortion	W_o	= 4 W
Alternating input voltage	V_i	= 5 V_{eff}
Sensitivity (W_o = 50 mW)	V_i	= 0.5 V_{eff}

OPERATING DATA: CL 4 used in balanced stage (2 valves)

Anode voltage	V_a	= 200 V
Screen-grid voltage	V_{g2}	= 200 V
Cathode resistor	R_k	= 135 ohms
Anode current (without signal)	I_{ao}	= 2 × 33 mA
Anode current at max. modulation	I_{amax}	= 2 × 40 mA
Screen-grid current (without signal)	I_{g2o}	= 2 × 3.5 mA
Screen-grid current at max. modulation	I_{g2max}	= 2 × 6 mA
Load resistor, anode-to-anode	R_{aa}	= 4,500 ohms
Output power at max. modulation	W_o	= 8 W
Total distortion at max. modulation	d_{tot}	= 1.5 %

MAXIMUM RATINGS

V_{ao}	= max. 400 V
V_a	= max. 250 V
W_a	= max. 9 W
V_{g2o}	= max. 400 V
V_{g2}	= max. 250 V
W_{g2}	= max. 2 W
I_k	= max. 70 mA
$V_{g1}(I_{g1}=+0.3\mu A)$	= max. —1.3 V
R_{g1k}	= max. 1 M ohm
R_{fk}	= max. 5,000 ohms
V_{fk}	= max. 125 V [1])

[1]) Direct voltage or effective value of alternating voltage.

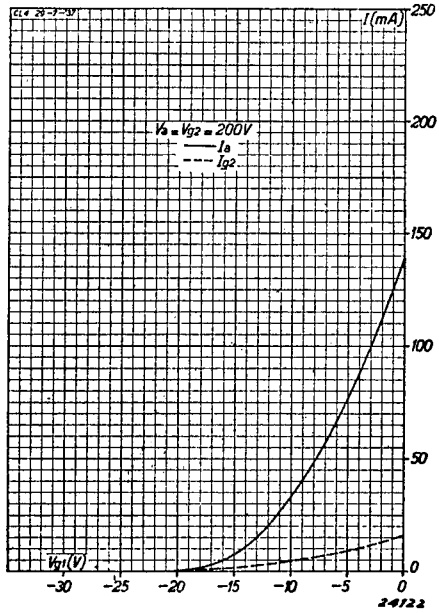


Fig. 3
Anode current as a function of the grid bias at $Va = Vg_2 = 200$ V.

Grid bias is to be obtained only by means of a cathode resistor; semi-automatic bias may be employed provided that the cathode current of the valve is more than 50 % of the current passing through the resistor producing the voltage drop. The decoupling capacitor should, generally speaking, be 2 μF, but for better reproduction of the lower tones it is better to use an electrolytic capacitor of 25 to 50 μF.

Leads to the valve contacts must be kept as short as possible, whilst a resistor of about 100 ohms in the control grid circuit is often desirable. Tables I and II relating to the CBL 1 also apply to this valve; they provide details of the output power, having regard to the voltage drop in the output transformer. The circuits employed for the measurements given in these tables are reproduced in the text relating to the EL 2.

In balanced output circuits employing two type CL 4 valves, a suitable pre-amplifier is the EBC 3, the EF 6 connected as triode, or the CL 4, also connected as triode. A satisfactory ratio for the coupling transformer is 1 : (2 + 2) for the EBC 3 and EF 6 (as triode), or 1 : (3 + 3) for the CL 4 (as triode).

The CL 4 is also very useful in A.C./D.C. receivers employing negative feed-back to reduce distortion and to improve the frequency-response curve of the amplifier.

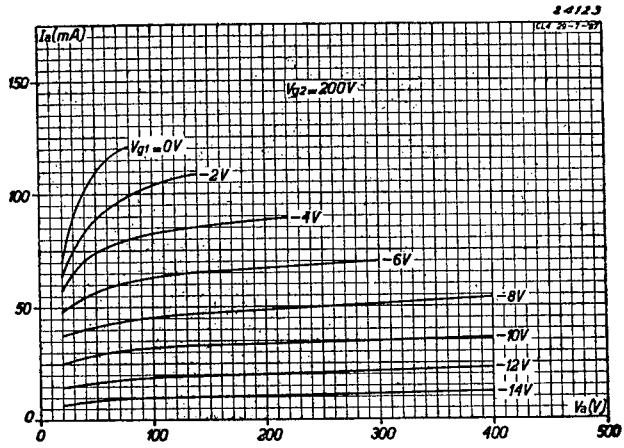


Fig. 4
Anode current as a function of the anode voltage at V_{g_2} = 200 V, for different values of grid bias.

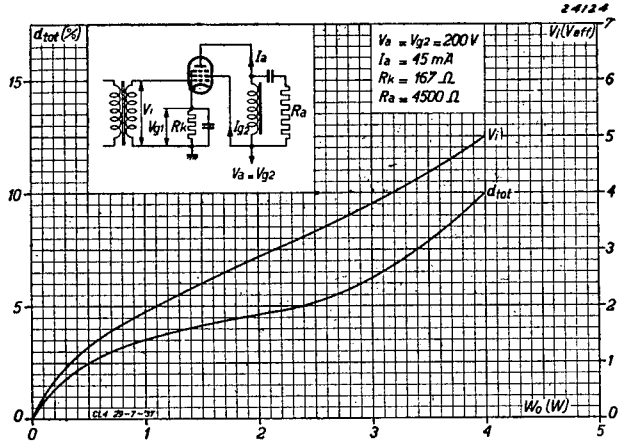


Fig. 5
Alternating grid voltage and total distortion as functions of the output power of the CL 4 when used as a single output valve.

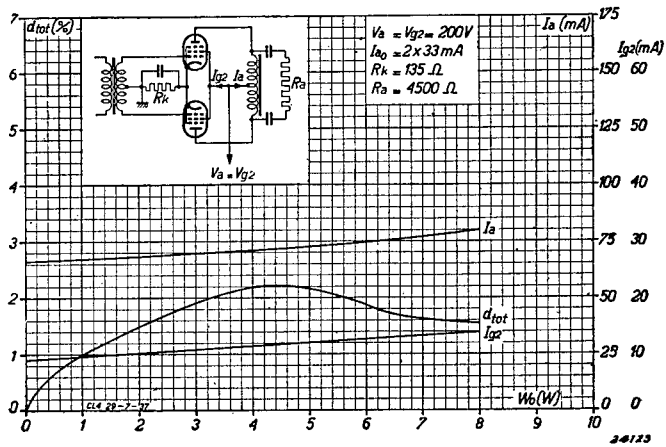


Fig. 6
Anode current, screen current and total distortion as functions of the output power for two CL 4 valves in a balanced output stage.