DL 92 Battery output pentode

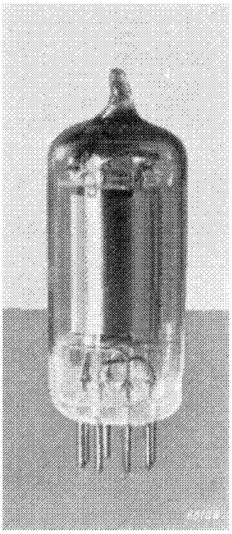


Fig. 1. The DL 92, approximately full-size.

The DL 92 is an output pentode which was specially developed for small (portable) battery sets. Accordingly, the maximum permissible voltages are low (67.5 V screen grid, 90 V anode). With 67.5 V on both anode and screen grid the output power is 180 mW; if the anode voltage is increased to 90 V the output power is 270 mW: for this output the total cathode-current consumption is nearly 9 mA.

The filament of the DL 92 is made in two identical sections, which can be connected either in series or in parallel. In the former arrangement the nominal filament voltage is 2.8 V and the nominal filament current 50 mA, in the latter arrangement 1.4 V and 100 mA. When the filament sections are connected in series, the filament as a whole can be connected in series with other valves in the circuit, which is important whether power is derived from an accumulator or from the mains.

In order to ensure that filaments connected in series will not be overloaded in the event of voltage fluctuations, it is advisable to adjust the voltage across each filament section to 1.3 V. Furthermore, a 250 to 300 ohm resistor must be connected across the negative half, to prevent the current emitted by the positive half from flowing through it. If necessary, another resistor may be connected across the whole of the filament, to provide a shunt for the cathode current from other valves.

TECHNICAL DATA OF THE BATTERY OUTPUT PENTODE DL 92

Filament data

Heating : direct, from battery, rectified A.C., or D.C.; series or parallel feed

A. *Both sections of filament connected in parallel*

a. In parallel with other valves			
Filament voltage	V_f	=	1.4 V
Filament current	I_f	=	100 mA
b. In series with other valves			
Filament voltage	V_f	=	1.3 V

B. *Both sections of filament connected in series*

a. In parallel with other valves			
Filament voltage . .	V_f	=	2.8 V
Filament current	I_f	=	50 mA
b. In series with other valves			
Filament voltage	V_f	=	2.6 V

Capacitances (cold valve)

Input capacitance	C_{g1}	=	4.35 pF
Output capacitance	C_a	=	6.0 pF
Anode - control grid . . .	C_{ag1}	<	0.4 pF

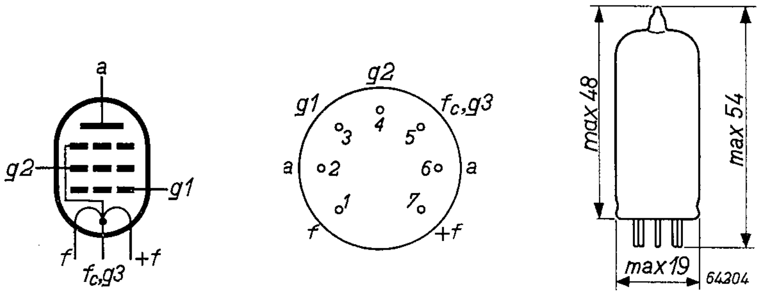


Fig. 2
Electrode arrangement, electrode connections and max. dimensions in mm.

Operating characteristics of a single valve in Class A

(base connections 5 (—) and 1 + 7 (+), V_f=1.4 V, I_f=100 mA)

Anode voltage	V_a	=	45	67.5	90	V
Screen grid voltage	V_{g2}	=	45	67.5	67.5	V
Grid bias	V_{g1}	=	—4.5	—7	—7	V
Anode current	I_a	=	3.8	7.2	7.4	mA
Screen grid current . . .	I_{g2}	=	0.8	1.5	1.4	mA
Mutual conductance . .	S	=	1250	1550	1570	μA/V
Internal resistance	R_i	=	0.1	0.1	0.1	MΩ
Amplification factor of grid 2 with respect to grid 1 .	μ_{g2g1}	=	5	5	5	
Optimum load resistance . .	R_a	=	8	5	8	kΩ
Output power	W_0	=	65	180	270	mW
Alternating input voltage .	$V_i(W_0=\text{max})$	=	3.5	5.5	5.5	V_{RMS}
Distortion	$d_{tot}(W_0=\text{max})$	=	12	10	12	%
Sensitivity	$V_i(W_0=50\text{mW})$	=	2.8	2.5	1.95	V_{RMS}

Operating characteristics of a single valve in Class A

(base connections 1 (—) and 7 (+), V_f=2.8 V, I_f=50 mA)

Anode voltage	V_a	=	45	67.5	90	V
Screen grid voltage	V_{g2}	=	45	67.5	67.5	V
Grid bias	V_{g1}	=	—4.5	—7	—7	V
Anode current	I_a	=	3.0	6.0	6.1	mA
Screen grid current	I_{g2}	=	0.7	1.2	1.1	mA
Mutual conductance	S	=	1100	1400	1420	µA/V
Internal resistance	R_i	=	0.1	0.1	0.1	MΩ
Amplification factor of grid 2 with respect to grid 1	μ_{g2g1}	=	5	5	5	
Optimum load resistance	R_a	=	8	5	8	kΩ
Output power	W_0	=	50	160	235	mW
Alternating input voltage	$V_i(W_0=\text{max})$	=	3.5	5.5	5.5	V_{RMS}
Distortion	$d_{tot}(W_0=\text{max})$	=	12.5	12	13	%
Sensitivity	$V_i(W_0=50\text{mW})$	=	3.5	2.5	1.95	V_{RMS}

Operating characteristics of two valves in Class B push-pull

(base connections 5 (—) and 1 + 7 (+), V_f = 1.4 V, I_f= 100 mA per valve)

Battery voltage	V_b	=	90		V
Anode voltage	V_a	=	80		V
Screen grid voltage	V_{g2}	=	57.5		V
Grid bias	V_{g1}	=	—9.9		V
Optimum load resistance between the two anodes	R_{aa}	=	16		kΩ
Alternating input voltage	V_i	=	0	7.3	V_{RMS}
Anode current	I_a	=	2×1.5	2×4.4	mA
Screen grid current	I_{g2}	=	2×0.3	2×1.35	mA
Output power	W_0	=	0	325	mW
Distortion	d_{tot}	=	—	5	%

Operating characteristics of two valves in Class B push-pull

(base connections 1 (—) and 7 (+), V_f = 2.8 V, I_f = 50 mA per valve)

Battery voltage	V_b	=	90		V
Anode voltage	V_a	=	81		V
Screen grid voltage	V_{g2}	=	58.5		V
Grid bias	V_{g1}	=	—9.2		V
Optimum load resistance between the two anodes	R_{aa}	=	18		kΩ
Alternating input voltage	V_i	=	0	7.0	V_{RMS}
Anode current	I_a	=	2×1.5	2×4.2	mA
Screen grid current	I_{g2}	=	2×0.3	2×1.25	mA
Output power	W_0	=	0	315	mW
Distortion	d_{tot}	=	—	4.7	%

Limiting values

Anode voltage	V_a	= max.	90 V
Anode dissipation	W_a	= max.	0.7 W
Screen grid voltage . . .	V_{g2}	= max.	67.5 V
Screen grid dissipation without input signal	$W_{g2}(V_i=0)$	— max.	0.12 W
Screen grid dissipation at maximum output power .	$W_{g2}(W_0=\text{max})$	= max.	0.2 W
Grid current starting point .	$V_{g1}(I_{g1}=+0.3\ \mu A)$	= max.	+0.2 V
Cathode current	I_k	= max.	11 mA
External resistance between control grid and cathode	R_{g1}	= max.	2 MΩ

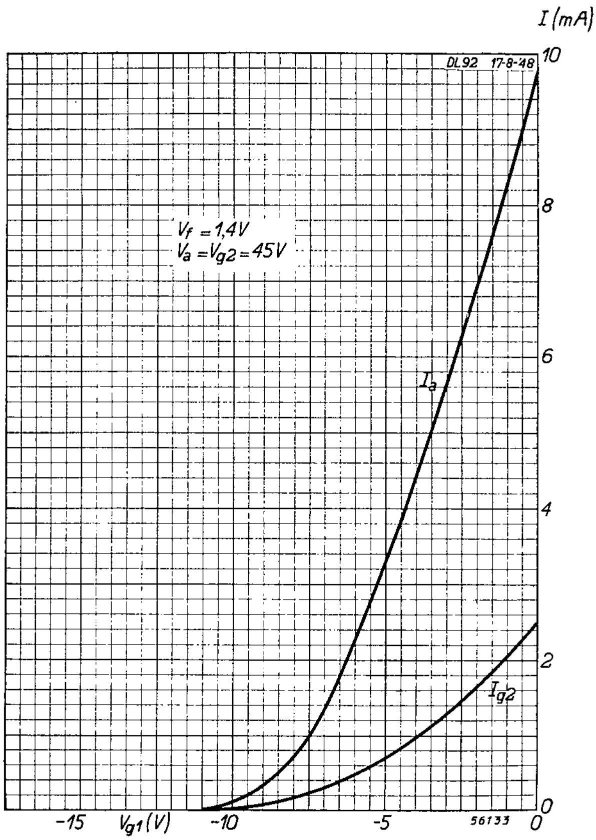


Fig. 3
Anode current (I_a) and screen grid current (I_{g2}) as functions of the grid bias (V_{g1}), at $V_a = V_{g2} = 45$ V.

DL 92

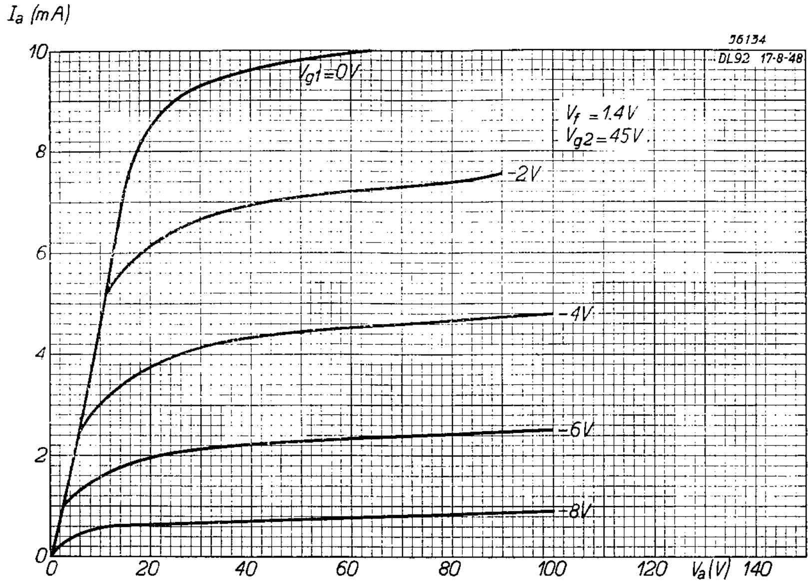


Fig. 4
Anode current (I_a) as a function of the anode voltage (V_a) with grid bias (V_{g1}) as parameter, at a screen grid voltage (V_{g2}) = 45 V. Filament connections 5 (—) and 1 + 7 (+), V_f = 1.4 V, I_f = 100 mA.

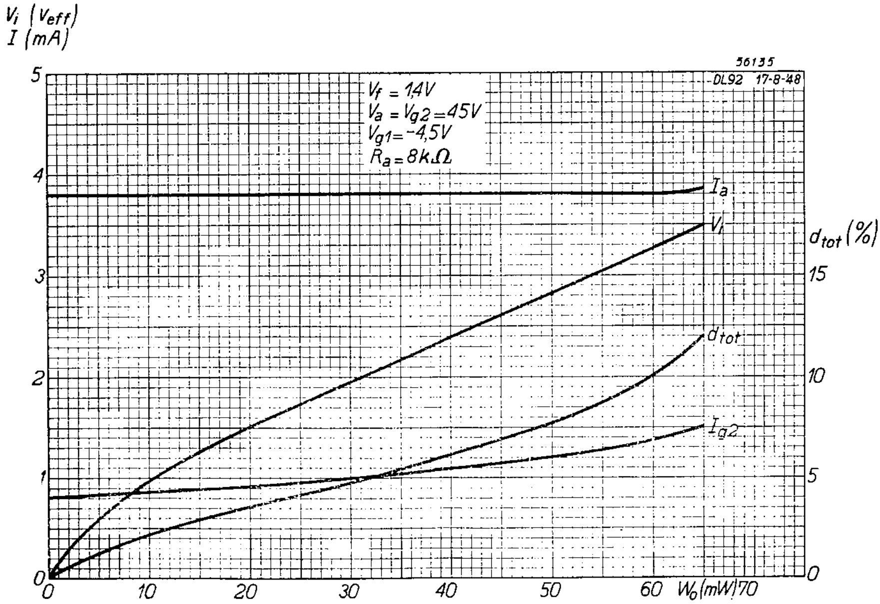


Fig. 5
Anode current (I_a), screen grid current (I_{g2}), required alternating input voltage (V_i) and distortion (d_{tot}) as functions of the output power (W_0), at $V_a = V_{g2} = 45$ V. Filament connections as for Fig. 4

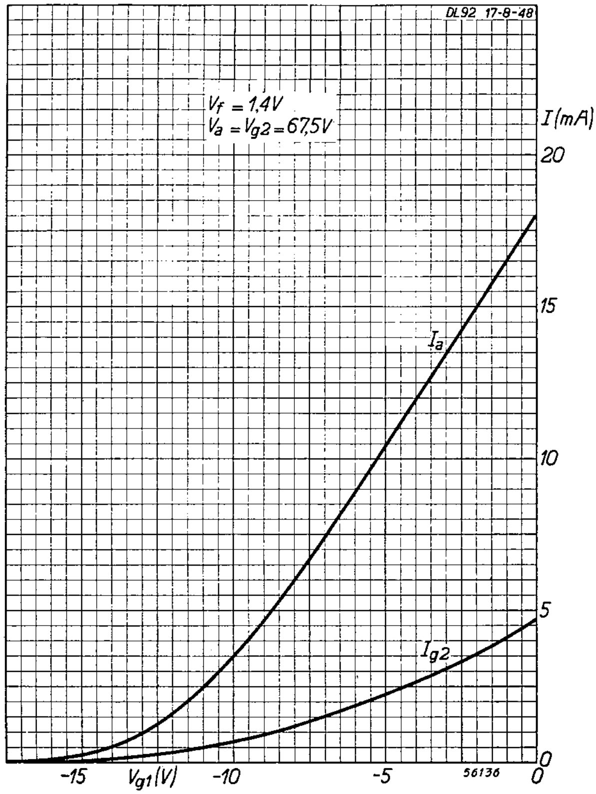
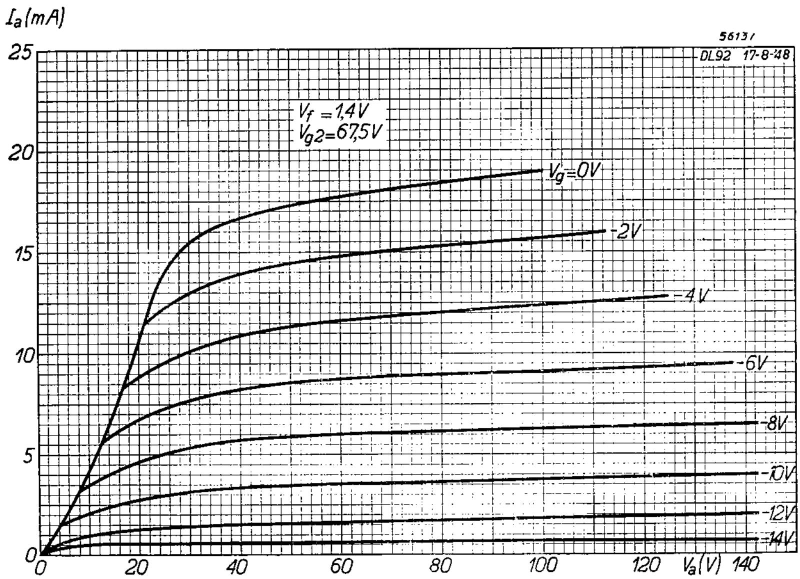


Fig. 6
Anode current (I_a) and screen grid current (I_{g2}) as functions of the grid bias (V_{g1}), at $V_a = V_{g2} = 67.5$ V. Filament connections 5 (—) and 1+7 (+), $V_f = 1.4$ V, $I_f =$ 100 mA.

Fig. 7
I_a/V_a characteristics; voltages and filament connections as for Fig. 6.



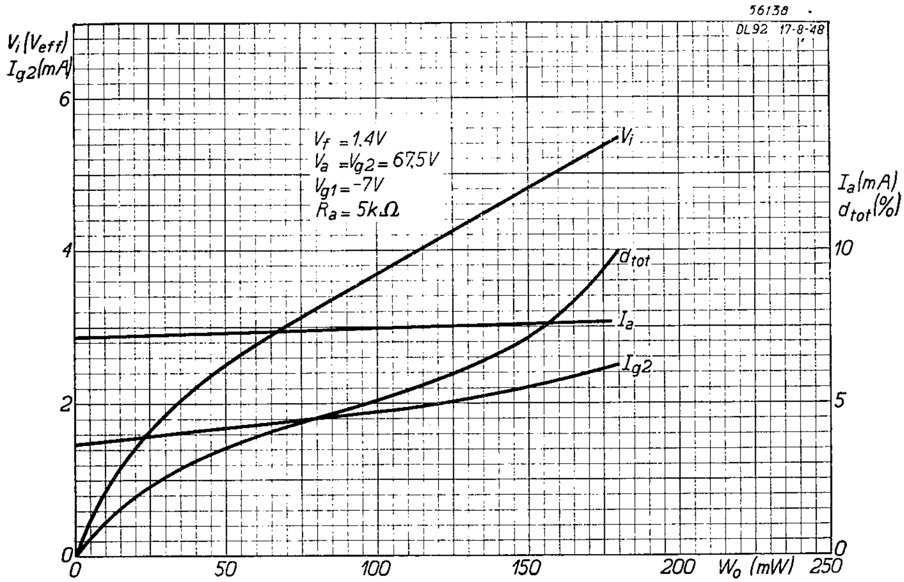


Fig. 8
Anode current (I_a), screen grid current (I_{g2}), required alternating input voltage (V_i) and distortion (d_{tot}) as functions of the output power (W_0), at $V_a = V_{g2} = 67.5$ V. Filament connections as for Fig. 6.

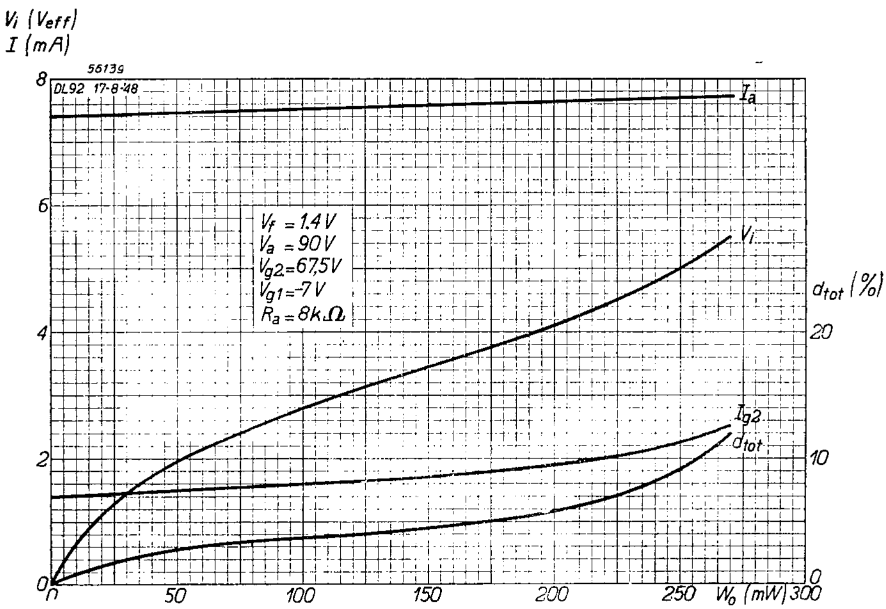


Fig. 9
As Fig. 8, but at $V_a = 90$ V and $V_{g2} = 67.5$ V.

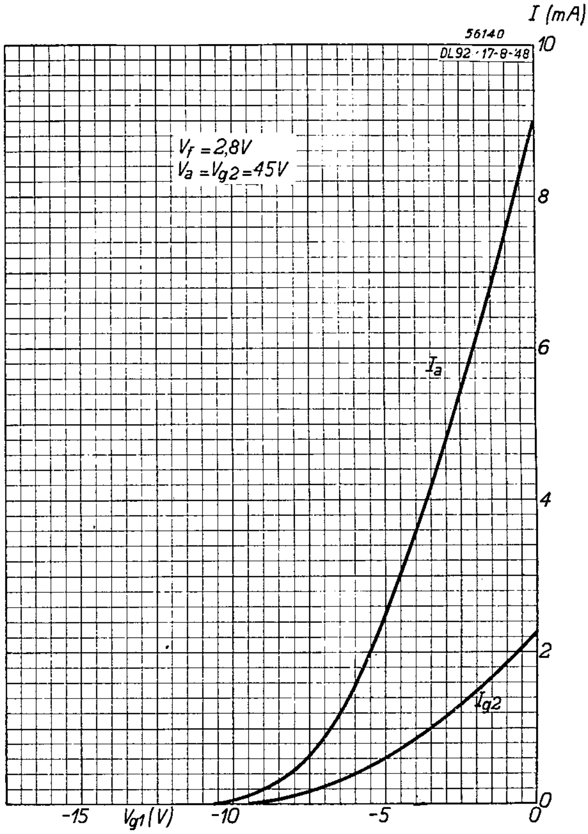


Fig. 10
Anode current (I_a) and screen grid current (I_{g2}) as functions of the grid bias (V_{g1}), at $V_a = V_{g2} = 45$ V. Filament connections 1 (—) and 7 (+), $V_f = 2.8$ V, $I_f = 50$ mA.

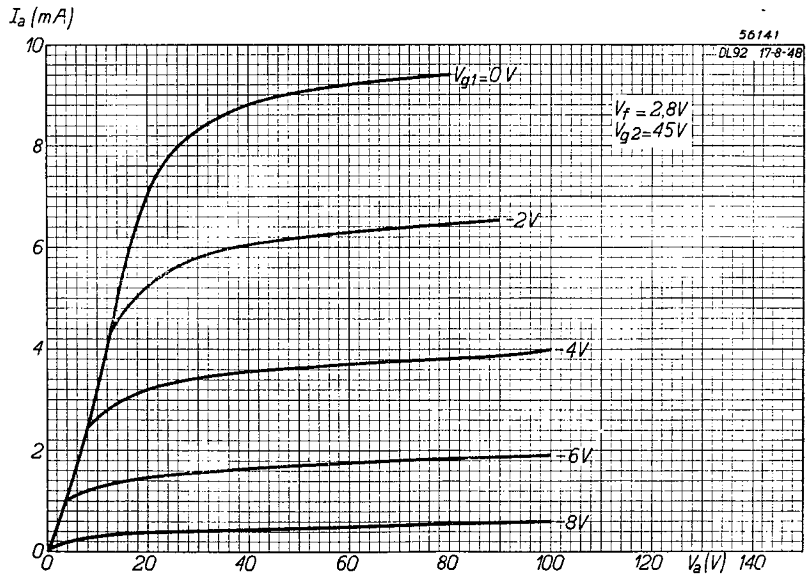


Fig. 11
I_a/V_a characteristics at $V_{g2}=45$ V. Filament connections 1 (—) and 7 (+), $V_f=2.8$ V, $I_f=50$ mA.

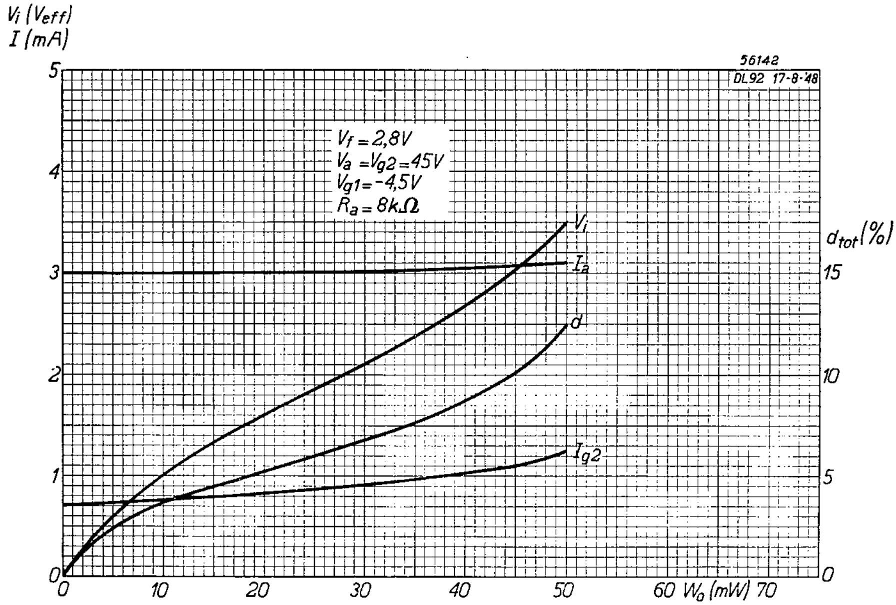


Fig. 12
Anode current (I_a), screen grid current (I_{g2}), required alternating input voltage (V_i) and distortion (d_{tot}) as functions of the output power (W_0), at $V_a=V_{g2}=45$ V. Filament connections as for Fig. 11.

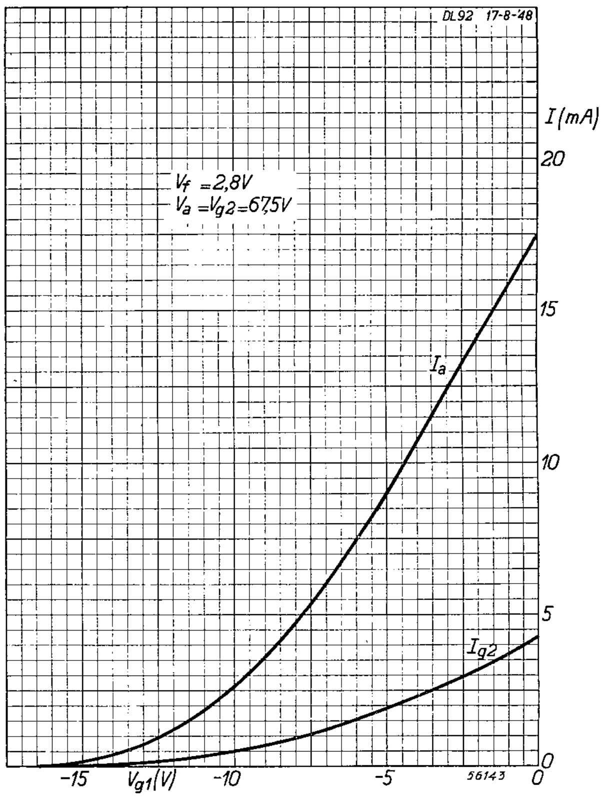
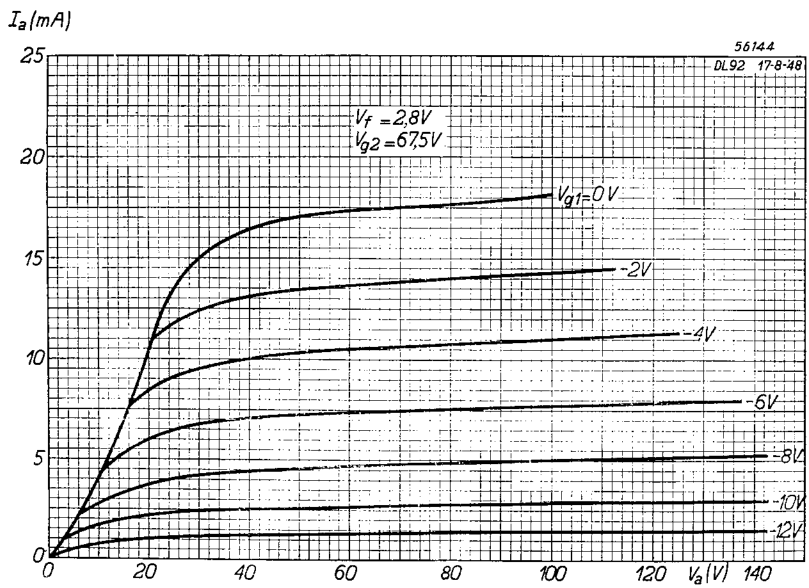


Fig. 13
Anode current (I_a) and screen grid current (I_{g2}) as functions of the grid bias (V_{g1}), at $V_a = V_{g2} = 67.5$ V. Filament connections 1 (—) and 7 (+), $V_f = 2.8$ V, $I_f = 50$ mA.

Fig. 14
I_a/V_a characteristics at $V_{g2} = 67.5$ V. Filament connections as for Fig. 13.



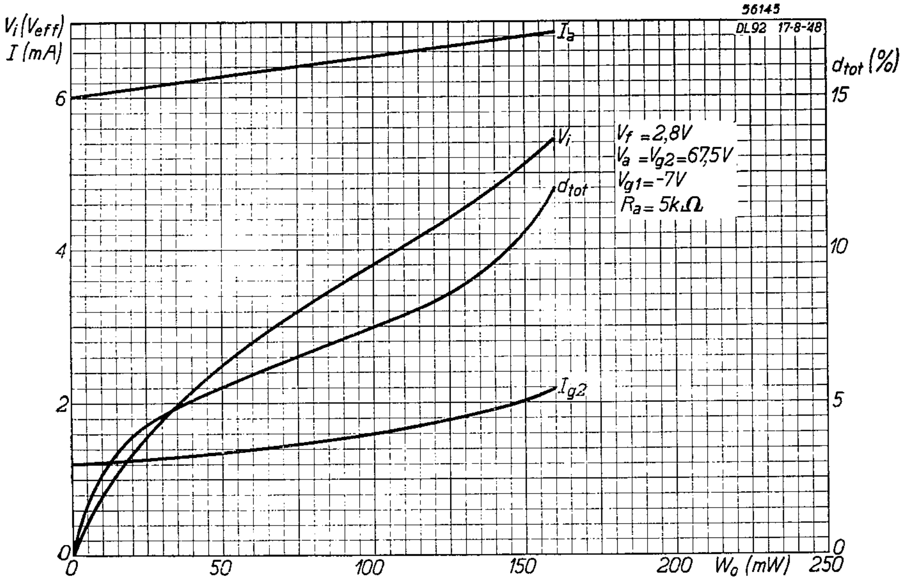


Fig. 15
Anode current (I_a), screen grid current (I_{g2}), required alternating input voltage (V_i) and distortion (d_{tot}) as functions of the output power (W_0), at $V_a = V_{g2} = 67.5$ V. Filament connections 1 (—) and 7 (+), $V_f = 2.8$ V, $I_f = 50$ mA.

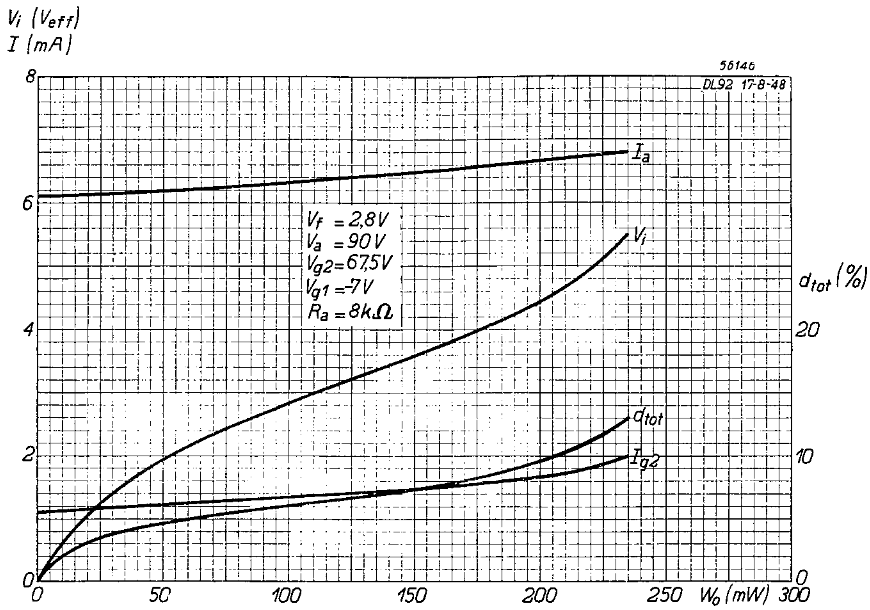


Fig. 16
As Fig. 15, but at $V_a = 90$ V and $V_{g2} = 67.5$ V.