DL 41 Battery output pentode

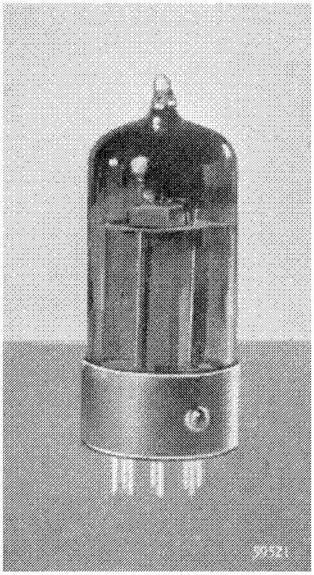

Fig. 1
The battery output pentode DL 41 (approximately actual size).

The DL 41 is a directly heated output valve intended for use in receivers working on fairly high H.T. voltages (90-150 V). For sets operating on lower voltages the DL 92 is the better valve. The output of the DL 41 is about 360 mW at 90 V, or approximately 600 mW at 120 V, but two of these valves in Class B output will yield almost 2 W at an anode voltage of 150 V, or nearly as much as the output of a mains receiver.

Consequently, the DL 41 is a very useful valve for the type of battery set that is expected to give a performance equal to that of a mains receiver in districts where no electrical mains supplies exist; in particular, this would include sets operated by vibrators fed from an accumulator and, also, the type that can be switched for use on either batteries or mains (so-called "ABC" sets). The use of Class B amplification in these cases assures a relatively low consumption of current.

The filament of the DL 41 is made in two V-shaped sections which can be connected either in series or in parallel; when connected in parallel the filament takes 100 mA at 1.4 V, whilst in the series arrangement the current is 50 mA at 2.8 V. In the latter case the valve can be used with its filament connected in series with those of other battery valves. (See, however, the Introduction on page 270.)

For use in low-consumption receivers it is sufficient to employ only one of the filament sections, in which case the current consumed is 50 mA at 1.4 V. With an anode voltage of 90 V this will give an output of roughly 180 mW, the anode current being only 4 mA.

If the valve is to be operated in conjunction with a switch to run either normally or with reduced current consumption, it should be remembered that the optimum load differs considerably in these two cases: when the filament connections are switched over, the load resistance should be simultaneously changed.

Generally speaking, when two of these valves are used in Class B, in a set driven not direct from batteries, but from a vibrator or rectifier, the positive voltages will increase as a result of the smaller current taken when there is no signal on the input of the receiver. A voltage of up to 180 V is permissible in these circumstances and involves no risk of damage to the valve, but, when the receiver is delivering its maximum output, the anode and screen potentials must not exceed 150 V.

In view of the high output of the DL 41, special care has been taken in the design of the valve to avoid microphony; many features have been incorporated to suppress this trouble and no difficulties should be experienced from this cause.

TECHNICAL DATA OF THE BATTERY OUTPUT PENTODE DL 41

Filament data

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

A. *Filament connections* 1 *and* 8 (one section of the filament)

In parallel with other valves :			
Filament voltage .	V_f	=	1.4 V
Filament current	I_f	=	50 mA
In series with other valves :			
Filament voltage	V_f	=	1.3 V

B. *Filament connections* 1 and 7+8 (two sections in parallel)

In parallel with other valves :			
Filament voltage . . .	V_f	=	1.4 V
Filament current	I_f	=	100 mA

C. *Filament connections* 7 *and* 8 (the two sections in series)

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

Capacitances (measured on the cold valve)

Input capacitance	C_{g1}	=	4.7 pF
Output capacitance	C_a	=	5.3 pF
Between anode and control grid	C_{ag1}	<	0.5 pF

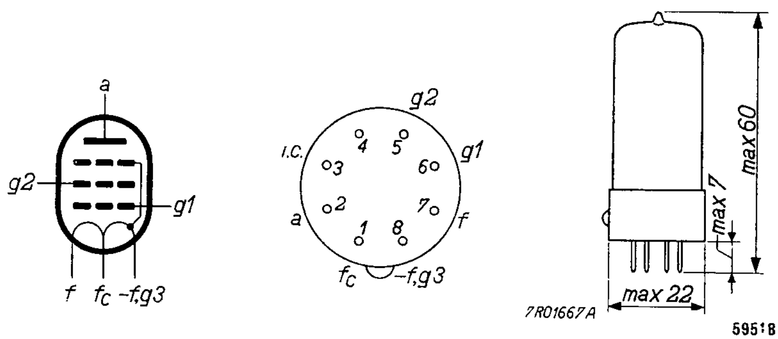

Fig. 2
Electrode arrangement, electrode connections and maximum dimensions in mm of the DL 41.

DL 41

Single valve used for Class A operation (economy circuit, filament connections 1 and 8, V_f=1.4 V, I_f=50 mA)

Anode voltage	V_a	=	90	120	V
Screen grid voltage	V_{g2}	=	90	120	V
Grid bias	V_{g1}	=	—3.6	—5.8	V
Anode current	I_a	=	4	5	mA
Screen grid current	I_{g2}	=	0.65	0.82	mA
Mutual conductance	S	=	1.25	1.35	mA/V
Amplification factor, grid 2 with respect to grid 1	μ_{g2g1}	=	10	10	
Internal resistance	R_i	=	175	165	kΩ
Optimum load	R_a	=	22.5	24	kΩ
Output with 10% distortion	$W_o(d=10\%)$	=	160	270	mW
Alternating input voltage for 10% distortion	$V_i(d=10\%)$	=	3	3.5	V_{RMS}
Output at grid current starting point	$W_o(I_{g1}=+0.3\mu A)$	=	180	300	mW
Sensitivity	$V_i(W_o=50mW)$	=	1.4	1.3	V_{RMS}

Single valve used for Class A operation (filament connections 1 and 7+8, V_f=1.4 V, I_f=100 mA)

Anode voltage	V_a	=	90	120	V
Screen grid voltage	V_{g2}	=	90	120	V
Grid bias	V_{g1}	=	—3.6	—5.65	V
Anode current	I_a	=	8	10	mA
Screen grid current	I_{g2}	=	1.3	1.65	mA
Mutual conductance	S	=	2.45	2.55	mA/V
Amplification factor, grid 2 with respect to grid 1	μ_{g2g1}	=	10	10	
Internal resistance	R_i	=	90	80	kΩ
Optimum load	Ra	=	11.3	12	kΩ
Output with 10% distortion	$W_o(d=10\%)$	=	330	550	mW
Alternating input voltage for 10% distortion	$V_i(d=10\%)$	=	3.1	3.8	V_{RMS}
Output at grid current starting point	$W_o(I_{g1}=+0.3\mu A)$	=	360	600	mW
Sensitivity	$V_i(W_o=50mW)$	=	1.05	0.9	V_{RMS}

Single valve Class A operation (filament connections 7 and 8, V_f=2.8 V; I_f=50 mA)

Anode voltage	V_a	=	90	120	V
Screen grid voltage	V_{g2}	=	90	120	V
Grid bias	V_{g1}	=	—3.6	—5.45	V
Anode current	I_a	=	6	9	mA
Screen grid current	I_{g2}	=	0.95	1.45	mA
Mutual conductance	S	=	2.2	2.45	mA/V
Internal resistance	R_i	=	100	95	kΩ
Optimum load	R_a	=	15	13.5	kΩ
Output with 10% distortion	$W_o(d=10\%)$	=	235	490	mW
Alternating input voltage for 10% distortion	$V_i(d=10\%)$	=	2.6	3.5	V_{RMS}
Output at grid current starting point	$W_o(I_{g1}=+0.3\mu A)$	=	270	540	mW
Sensitivity	$V_i(W_o=50\ mW)$	=	1.0	0.9	V_{RMS}

Two valves in Class B push-pull operation (filament connections 1 and 7+8, V_f=1.4 V, I_f=100 mA)

Anode voltage	V_a	=	90		V
Screen grid voltage	V_{g2}	=	90		V
Grid bias	V_{g1}	=	—7		V
Optimum load	R_{aa}	=	20		kΩ
Alternating input voltage	V_i	=	0	5.5	V_{RMS}
Anode current	I_a	=	2× 1.5	2×5.6	mA
Screen grid current	I_{g2}	=	2×0.25	2×2.0	mA
Output power	W_o	=	0	560	mW
Distortion	d	=	—	6	%

Anode voltage	V_a	=	150[1]		V
Screen grid voltage	V_{g2}	=	150[1]		V
Grid bias	V_{g1}	=	—13.2		V
Optimum load	R_{aa}	=	15		kΩ
Alternating input voltage	V_i	=	0	10.6	V_{RMS}
Anode current	I_a	=	2× 1.5	2×11.5	mA
Screen grid current	I_{g2}	=	2×0.25	2×4	mA
Output power	W_o	=	0	2100	mW
Distortion	d	=	—	5	%

[1]) Without input signal V_a and V_{g2} may rise to max. 180 V.

DL 41

Two valves in Class B push-pull operation (filament connections 7 and 8, V_f=2.8 V, I_f=50 mA)

Anode voltage	V_a	=	150[1])		V
Screen grid voltage	V_{g2}	=	150[1])		V
Grid bias	V_{g1}	=	—12.6		V
Optimum load	R_{aa}	=	15		kΩ
Alternating grid voltage	V_i	=	0	10	V_{RMS}
Anode current	I_a	=	2× 1.5	2×11	mA
Screen grid current	I_{g2}	=	2×0.25	2×3.3	mA
Output power	W_o	=	0	1850	mW
Distortion	d	=	—	3.5	%

Limiting values

Anode voltage	V_a	= max.	150 V[1])
Anode dissipation	W_a	= max.	1.2 W
Screen grid voltage	V_{g2}	= max.	150 V[1])
Screen grid dissipation without input signal	$W_{g2}(V_i=0)$	= max.	0.3 W
Screen grid dissipation at maximum output	$W_{g2}(W_o=\text{max})$	= max.	0.6 W
Grid current starting point	$V_{g1}(I_{g1}=+0.3\mu A)$	= max.	—0.2 V
Cathode current (filament connections 1 and 8)	$I_k(V_f=1.4\ V, I_f=50\ mA)$	= max.	7 mA
Cathode current (filament connections 1 and 7+8)	$I_k(V_f=1.4\ V, I_f=100\ mA)$	= max.	16 mA
Cathode current (filament connections 7 and 8)	$I_k(V_f=2.8\ V, I_f=50\ mA)$	= max.	16 mA
External resistance between control grid and filament	R_{g1}	= max.	2 MΩ

1) Without input signal V_a and V_{g2} may rise to max. 180 V.

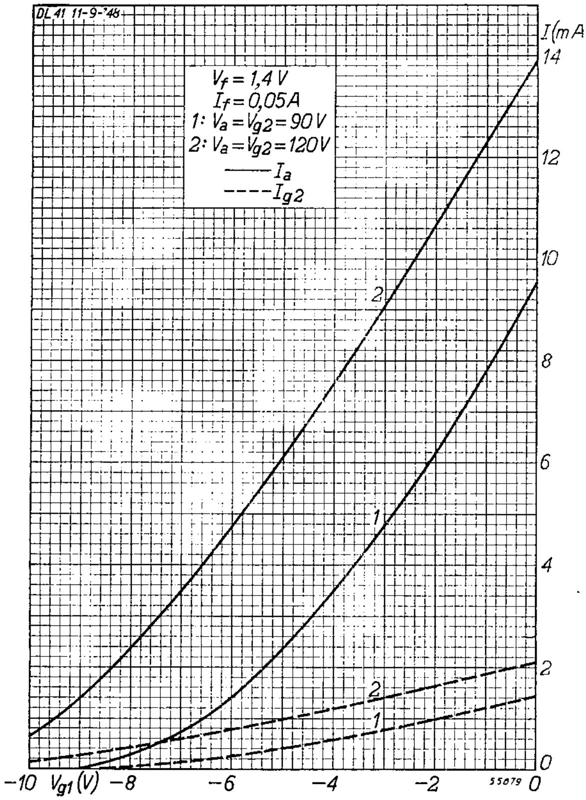

Fig. 3
Anode current (I_a) and screen grid current (I_{g2}) of the DL 41 as functions of the grid bias (V_{g1}), for battery voltages of 90 and 120 V. Filament connections 1 and 8 (V_f $=1.4$ V, $I_f=50$ mA).

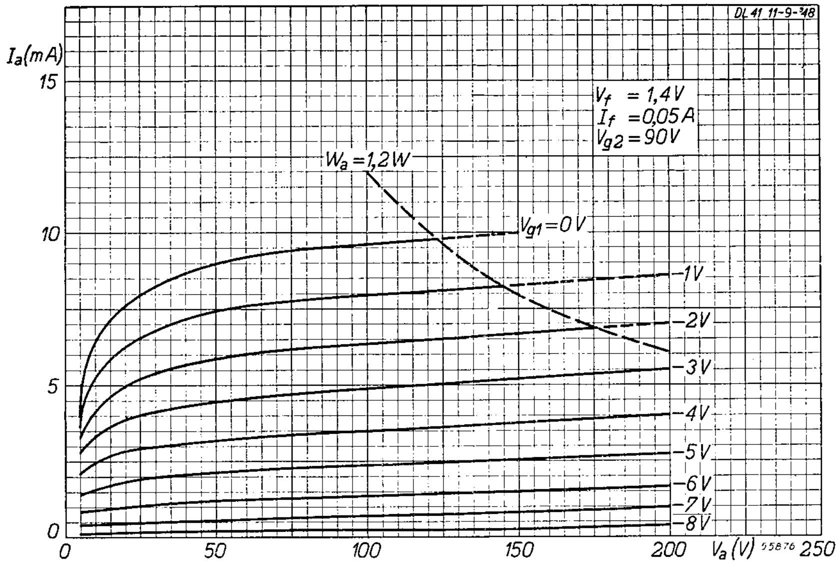

Fig. 4
I_a/V_a characteristics of the DL 41 for a screen grid voltage of 90 V. Filament connections 1 and 8 (V_f=1.4 V, I_f=50 mA).

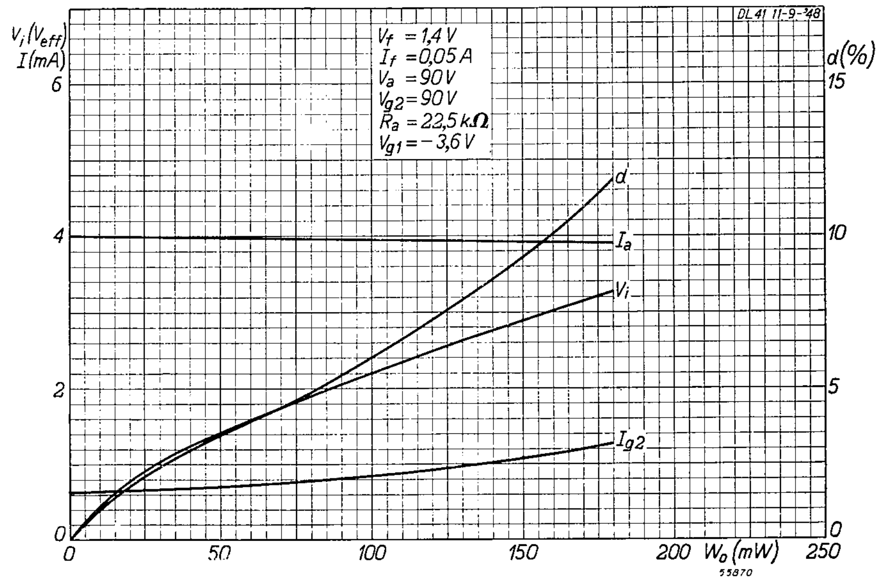

Fig. 5
Anode current (I_a), screen grid current (I_{g2}), distortion (d) and alternating grid voltage (V_i) as functions of the output (W_o), with a battery supply of 90 V. Filament connections 1 and 8 (V_f=1.4 V, I_f=50 mA).

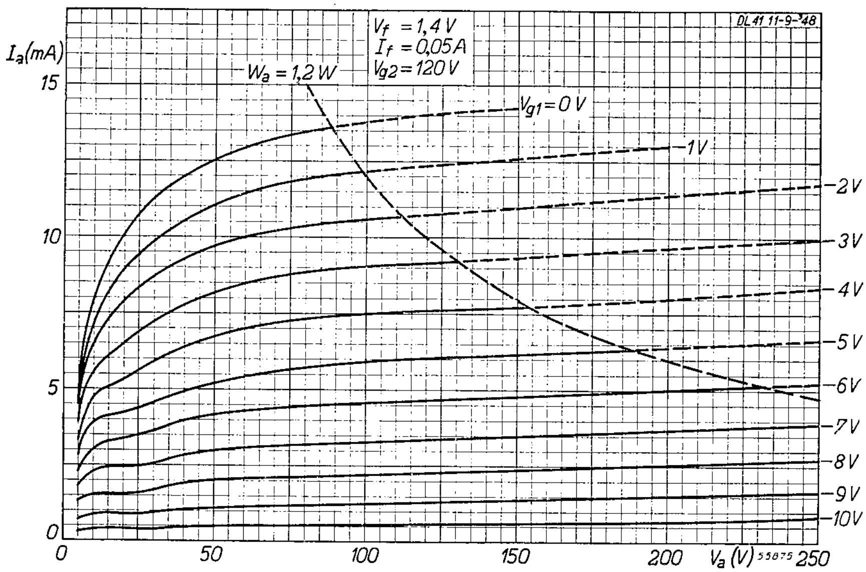

Fig. 6
As Fig. 4, but for a 120 V battery. Filament connections 1 and 8 (V_f=1.4 V, I_f=50 mA).

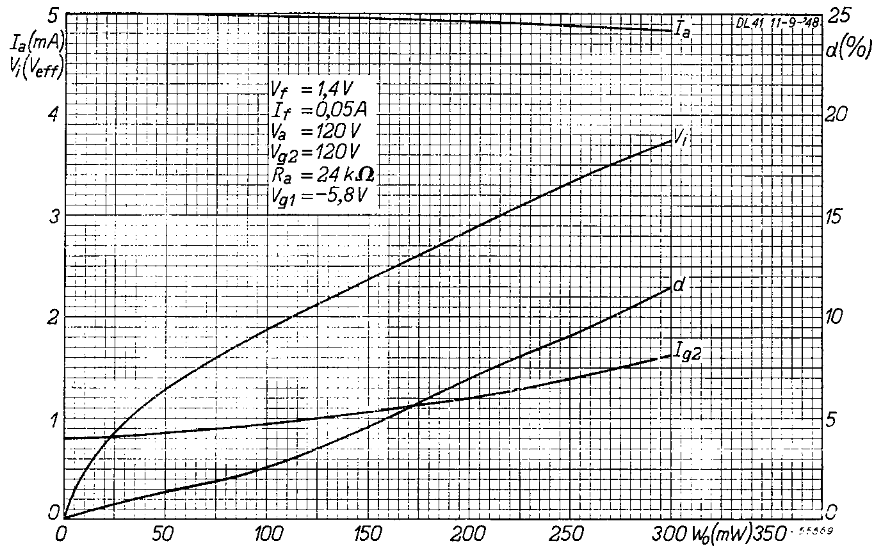

Fig. 7
As Fig. 5, but for a 120 V battery. Filament connections 1 and 8 (V_f=1.4 V, I_f=50 mA).

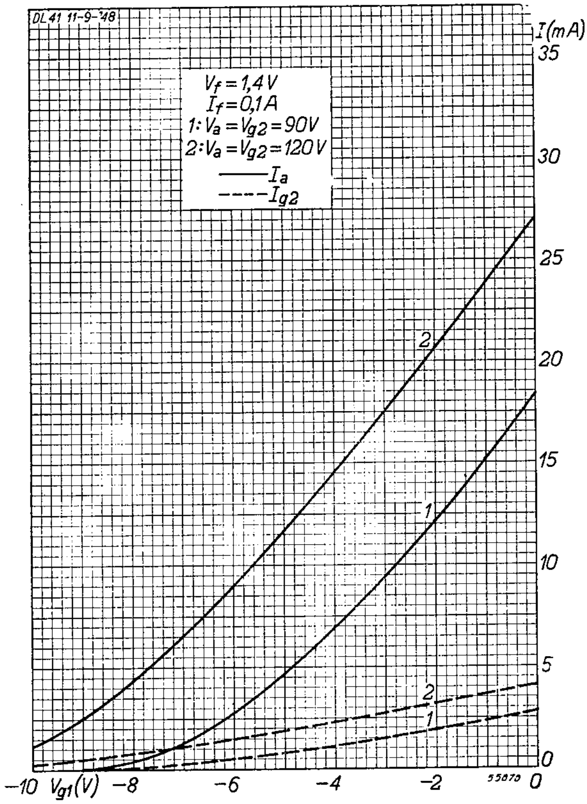

Fig. 8
Anode current (I_a) and screen grid current (I_{g2}) as functions of the grid bias (V_{g1}), with battery voltages of 90 and 120 V. Filament connections 1 and 7+8 (V_f=1.4 V, I_f= 0.1 A).

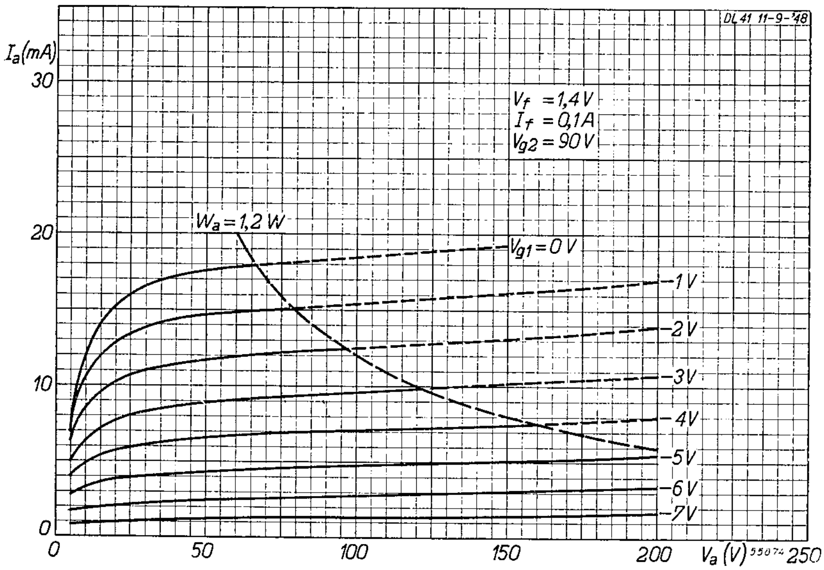

Fig. 9
I_a/V_a characteristics for a screen grid voltage of 90 V. Filament connections 1 and 7+8 (V_f=1.4 V, I_f=100 mA).

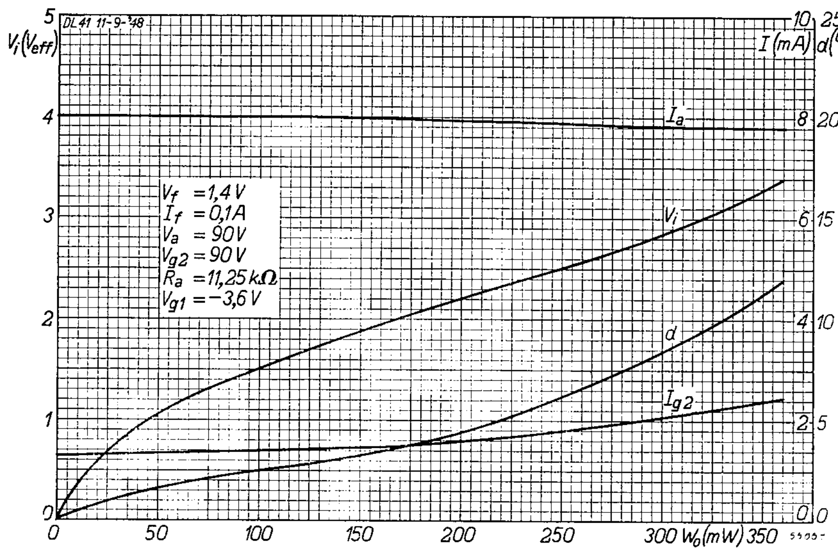

Fig. 10
Anode current (I_a), screen grid current (I_{g2}), distortion (d) and alternating grid voltage (V_i) as functions of the output power (W_o). 90 V battery. Filament connections 1 and 7+8 (V_f=1.4 V, I_f=100 mA).

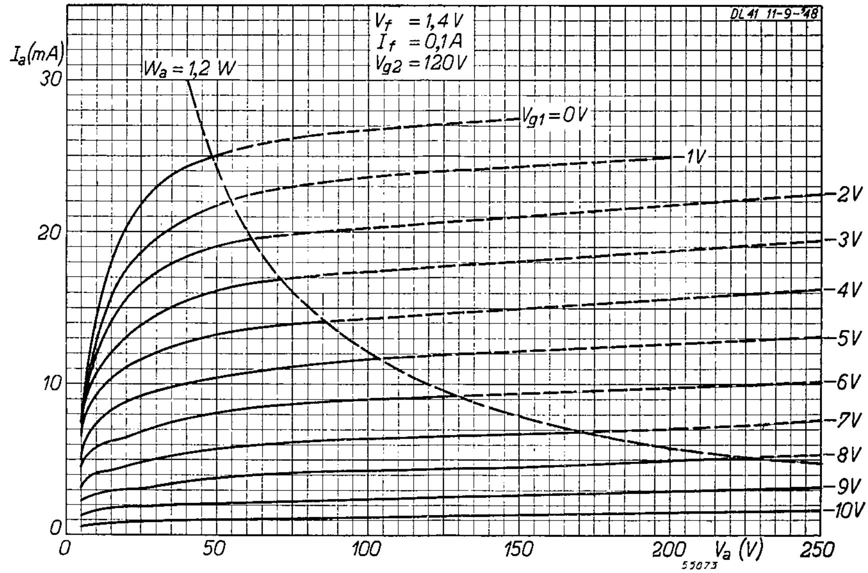

Fig. 11
As Fig. 9, but for a screen grid voltage of 120 V. Filament connections 1 and 7+8 (V_f=1.4 V, I_f=100 mA).

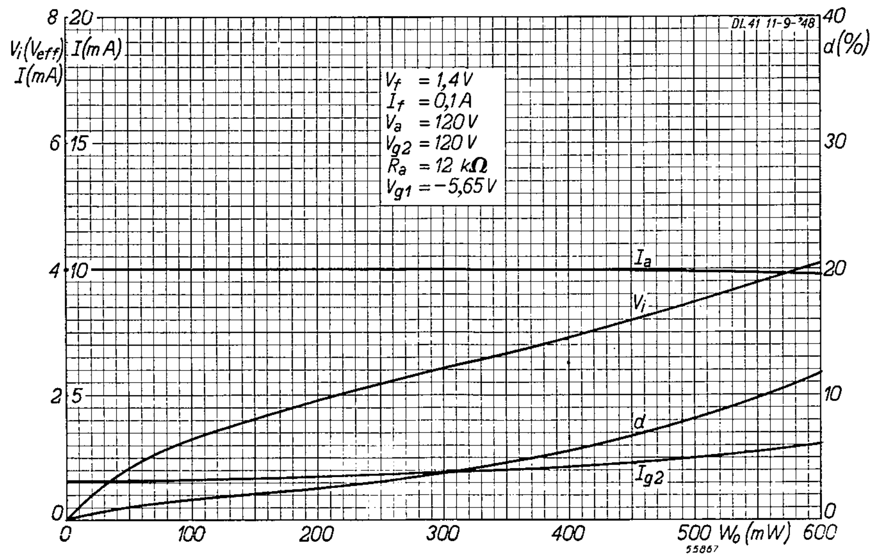

Fig. 12
As Fig. 10, but for a 120 V battery. Filament connections 1 and 7+8 (V_f=1.4 V, I_f=100 mA).

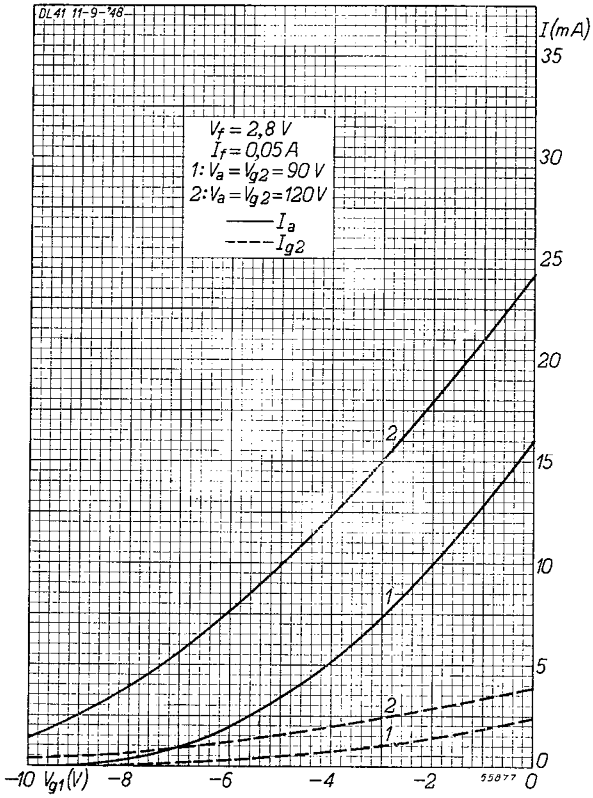

Fig. 13
Anode current (I_a) and screen grid current (I_{g2}) as functions of the grid bias (V_{g1}), with 90 V and 120 V batteries. Filament connections 7 and 8 (V_f=2.8 V, I_f=50 mA).

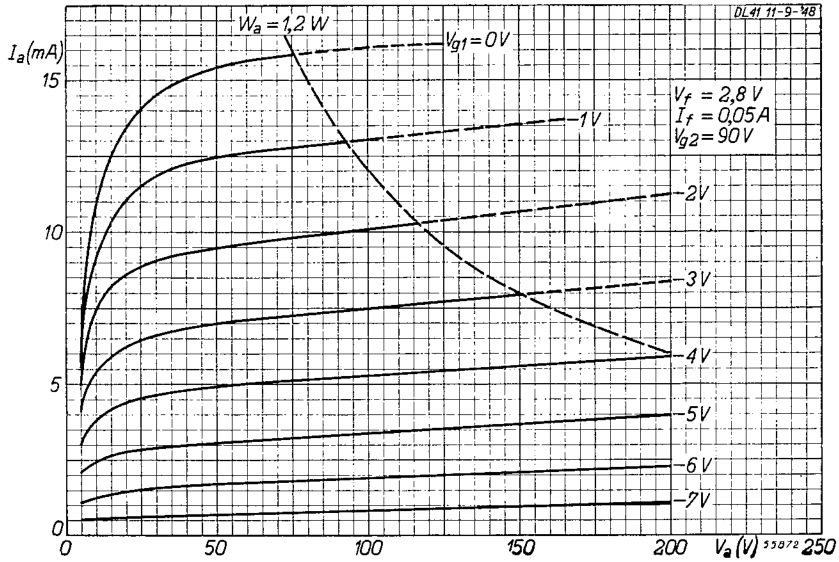

Fig. 14
I_a/V_a characteristics for a screen grid voltage of 90 V. Filament connections 7 and 8 (V_f=2.8 V, I_f=50 mA).

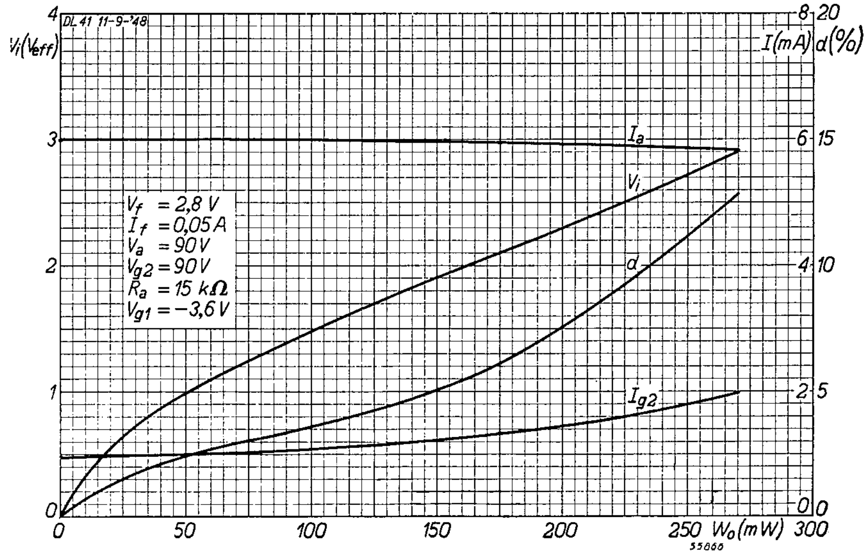

Fig. 15
Anode current (I_a), screen grid current (I_{g2}), distortion (d) and alternating grid voltage (V_i) as functions of the output power (W_o). 90 V battery. Filament connections 7 and 8 (V_f=2.8 V, I_f=50 mA).

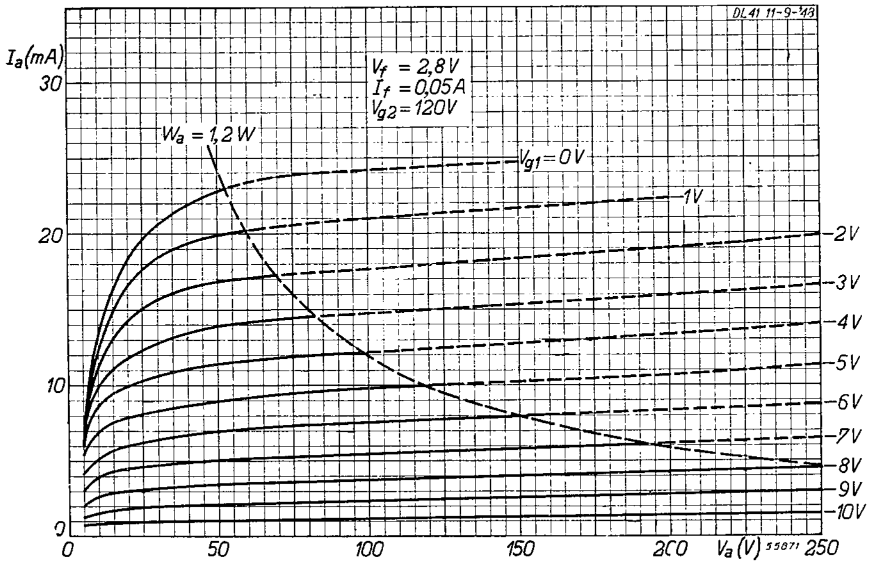

Fig. 16
As Fig. 14, but for a screen grid voltage of 120 V. Filament connections 7 and 8 (V_f=2.8 V, I_f=50 mA).

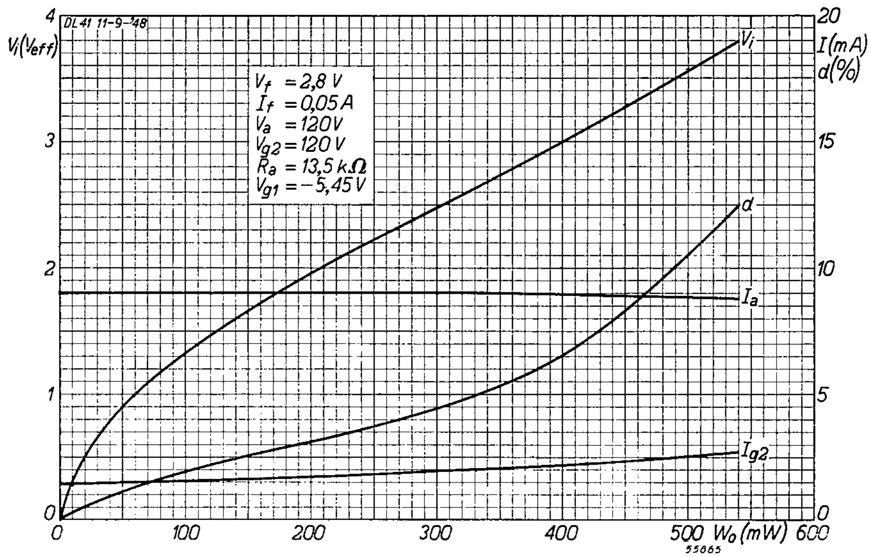

Fig. 17
As Fig. 15, but for a 120 V battery. Filament connections 7 and 8 (V_f=2.8 V, I_f=50 mA).

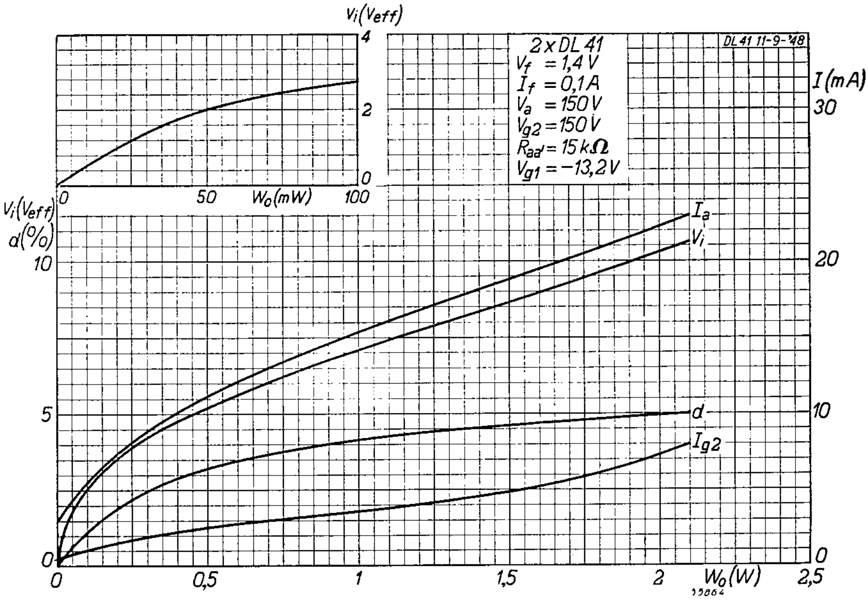

Fig. 18
Total anode current (I_a), total screen grid current (I_{g2}), distortion (d) and alternating grid voltage (V_i) as functions of the output (W_o) in Class B operation. 150 V battery. Filament connections 1 and 7+8 (V_f=1.4 V, I_f=100 mA). The inset shows the alternating grid voltage at lower output values.

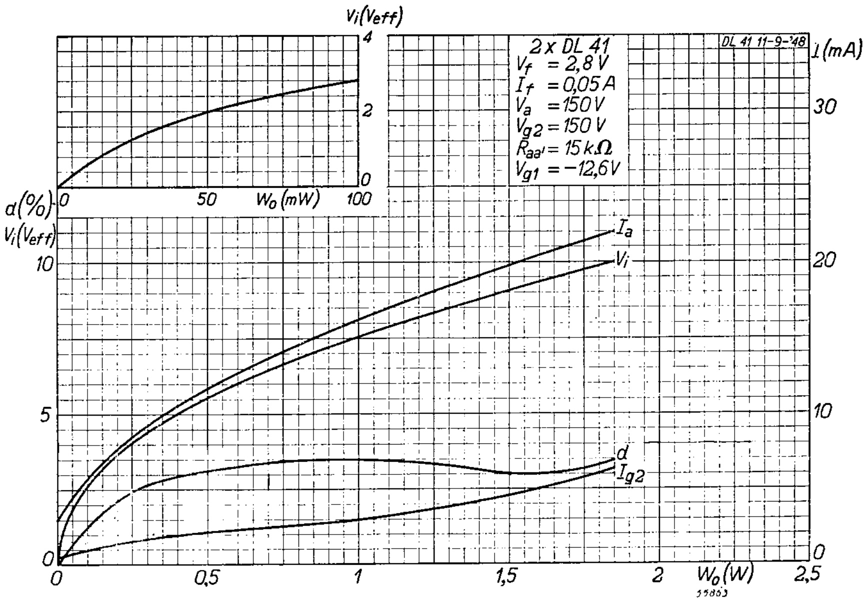

Fig. 19
As Fig. 18, but for filament connections 7 and 8 (V_f=2.8 V,