AMPEREX TUBE TYPE 6CA7

(EL34)

The 6CA7 is a power pentode designed especially for high fidelity audio systems. It has a plate dissipation of 25 watts and delivers high power without drawing control-grid current.

The 6CA7 features high efficiency with extremely low distortion. Great care is taken in manufacturing so that there is very little spread in characteristics of individual tubes. Thus, the rated output power can be obtained with all tubes. The tube also features high sensitivity. (A small signal amplitude is sufficient to obtain the maximum output power)

The plate dissipation is a large proportion of the total input power and it is not necessary to use a grid leak of low value which reduces the gain of the pre-amplifier stage or - in the case of the output tube preceeded by the detector stage - increases the distortion of this stage.

GENERAL CHARACTERISTICS

ELECTRICAL

Cathode	coated unipotential
Heater Voltage	6.3 volts
Heater current	1.5 amps

Direct Interelectrode Capacitances

Grid No. 1 to all other elements except plate	15.2	uuf
Plate to all other elements except grid No. 1	8.4	uuf
Plate to grid No. 1	max. 1.1	uuf
Grid No. 1 to heater	max. 1.0	uuf
Heater to cathode	10	uuf

MECHANICAL

Base	JETEC #8ET, octal, 8 pin
Bulb	Tubular, 1 5/16" max. dia.
Max. overall length	4 7/16"
Max. seated height	3 7/8"
Max. diameter	1 1/2"
Mounting position	any

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MAXIMUM RATINGS (Design Center Values)

Plate voltage	800	volts
Plate voltage without plate current	2000	volts
Plate dissipation	25	watts
Plate dissipation without input signal	27.5	watts
Grid No. 2 voltage	425	volts
Grid No. 2 voltage without plate current	800	volts
Grid No. 2 dissipation	8	watts
Cathode current	150	ma
Grid current starting point, Grid No. 1 voltage when grid No. 1 current is 0.3 u amp	1.3	volts
Grid No. 1 circuit resistance (class A and AB)	0.7	megohm
Grid No. 1 circuit resistance (class B)	0.5	megohm
External resistance between heater and cathode	20,000	ohms
Voltage between heater and cathode	100	volts

Operating Characteristics Class A, one tube

Supply voltage	265	265	volts
Plate voltage	250	250	volts
Grid No. 2 series resistor	2000	0	ohms
Grid No. 3 voltage	0	0	volt
Grid No. 1 bias	−14.5	−13.5	volts
Plate current	70	100	ma
Grid No. 2 current	10	15	ma
Transconductance	9,000	11,000	micromhos
Amplification factor of grid No. 2 with respect to grid No. 1	11	11	
Plate resistance	18,000	15,000	ohms
Plate load resistance	3,000	2,000	ohms
Input voltage	9.3	8.7	volts (rms)
Max. signal power output	8	11	watts
Total harmonic distortion	10	10	percent
Input voltage for power output of 50 m watts	0.65	0.5	volt (rms)

Operating Characteristics Class B, two tubes

Supply voltage 425 volts

Common grid No. 2 resistor (without decoupling)		1000		ohms
Grid No. 1 bias		−38		volts
Grid No. 3 voltage		0		volts
Input voltage	0	27	27	volts (rms)
Load resistance, plate to plate	—	3400	4000	ohms
Supply voltage	425	425	400	volts
Plate voltage	420	400	375	volts
Plate current	2x30	2x120	2x100	ma
Grid No. 2 current	2x4.4	2x25	2x25	ma
Max. signal power output	0	55	45	watts
Total harmonic distortion	—	5	6	percent

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Operating Characteristics Class B, two tubes

Supply Voltage 375 volts

Common grid No. 2 resistor (without decoupling)		470		ohms ←
Grid No. 1 bias		− 32		volts
Grid No. 3 voltage		0		volt
Input voltage	0	22.7	22.7	volts (rms)
Load resistance, plate to plate	—	2800	3800	ohms
Supply voltage	375	375	350	volts
Plate voltage	370	350	325	volts
Plate current	2x35	2x120	2x93	ma
Grid No. 2 current	2x4.7	2x25	2x25	ma
Max. signal power output	0	44	36	watts
Total harmonic distortion	—	5	6	percent

Operating Characteristics Class B, two tubes

Supply voltage 500/400 volts

Common grid No. 2 resistor (without decoupling)		750		ohms ←
Grid No. 1 bias		− 36		volts
Grid No. 3 voltage		0		volt
Input voltage	0	25.8	25.8	volts (rms)
Load resistance, plate to plate	—	4000	5000	ohms
Plate supply voltage	500	500	475	volts
Plate voltage	495	475	450	volts
Grid No. 2 supply voltage	400	400	375	volts
Plate current	2x30	2x125	2x102	ma
Grid No. 2 current	2x4	2x25	2x25	ma
Max. signal power output	0	70	58	watts
Total harmonic distortion	—	5	6	percent

Operating Characteristics Class B, two tubes

Supply voltage 800/400 volts

Common grid No. 2 resistor (without decoupling)		750		ohms ←
Grid No. 1 bias		−39		volts
Grid No. 3 voltage		0		volt
Input voltage	0	23.4	23.4	volts (rms)
Load resistance, plate to plate	—	11,000	11,000	ohms
Plate supply voltage	800	800	750	volts
Plate supply	795	775	725	volts
Grid No. 2 supply voltage	400	400	375	volts
Plate current	2x25	2x91	2x84	ma
Grid No. 2 current	2x3	2x19	2x19	ma
Max. signal power output	0	100	90	watts
Total harmonic distortion	—	5	6	percent

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Operating Characteristics Class AB, two tubes

Supply voltage 375 volts

Load resistance, plate to plate		3400	ohms
Common grid No. 2 resistor		470	ohms
Cathode resistor		130	ohms
Grid No. 3 voltage		0	volt
Input voltage	0	21	volts (rms)
Supply voltage	375	375	volts
Plate voltage + voltage across cathode resistor	355	350	volts
Plate current	2x75	2x95	ma
Grid No. 2 current	2x11.5	2x22.5	ma
Max. signal power output	0	35	watts
Total harmonic distortion	—	5	percent

Operating Characteristics in Triode Connection

(Grid No. 2 connected to plate)
Class A, one tube, supply voltage 375 volts

Supply voltage	375	volts
Grid No. 3 voltage	0	volt
Cathode resistor	370	ohms
Load resistance	3000	ohms
Input voltage	18.9	volts(rms)
Plate current	70	ma
Max. signal power output	6	watts
Total harmonic distortion	8	percent
Input voltage for power output of 50 milliwatts	1.7	volts(rms)

Operating Characteristics in Triode Connection

(Grid No. 2 connected to plate)
Class AB, two tubes, supply voltage 400 volts

Supply voltage		400	volts
Grid No. 3 voltage		0	volt
Cathode resistor		220	ohms
Load resistance, plate to plate		5000	ohms
Input voltage	0	22	volts(rms)
Plate current	2x65	2x71	ma
Max. signal power output	0	16.5	watts
Total harmonic distortion	—	3	percent

Data for Ultralinear (Output transformer screen tap) connection.

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TENTATIVE DATA

Class AB_1 Audio Amplifier
Distributed Load Connection

Maximum Ratings (Design Center Values)

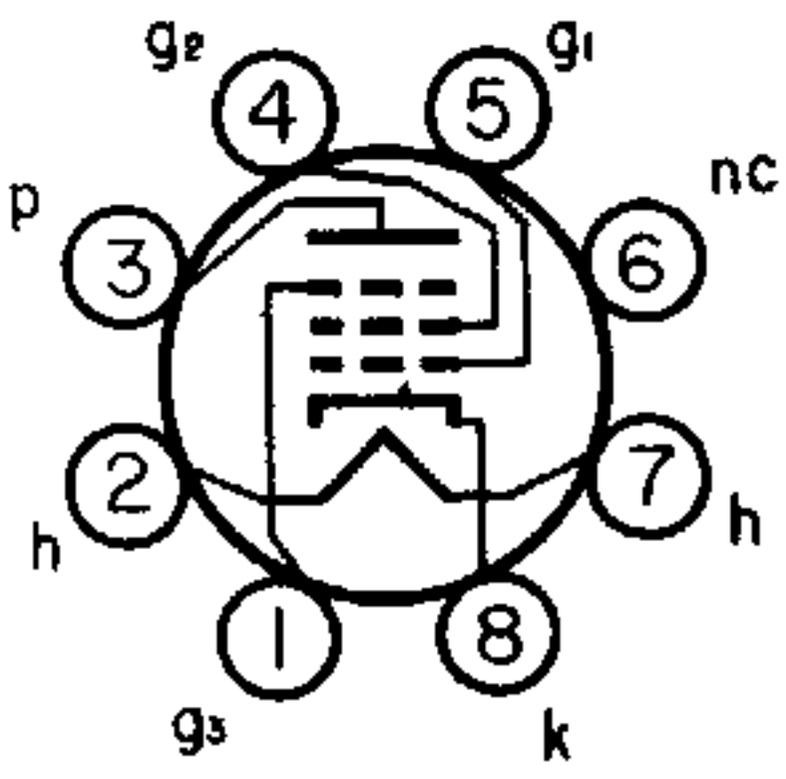
Plate and Grid No. 2 Supply Voltage	500 V
Plate Dissipation	25 W
Grid No. 2 Dissipation	8 W
Cathode Current	150 mA
Grid Current Starting Point - Grid No. 1 Voltage when Grid No. 1 Current is 0.3 μA	−1.3 V
Grid No. 1 Circuit Resistance	500 KΩ
External Resistance Between Heater and Cathode	20 KΩ
Voltage Between Heater and Cathode	100 V

Typical Operation (Fixed Bias - Two Tubes Push Pull)

Plate Supply Voltage	500 V
Grid No. 2 Supply Voltage	(See Note 1)
Grid No. 1 Bias	(approx.) −44.5 V
Plate to Plate Load Resistance	7000 Ω
Plate and Grid No. 2 Current (Zero Signal)	2x57 mA
Plate and Grid No. 2 Current (Max Signal)	2x112 mA
Input Signal Voltage (rms)	32 V
Power Output	60 W
Harmonic Distortion	2.5 %

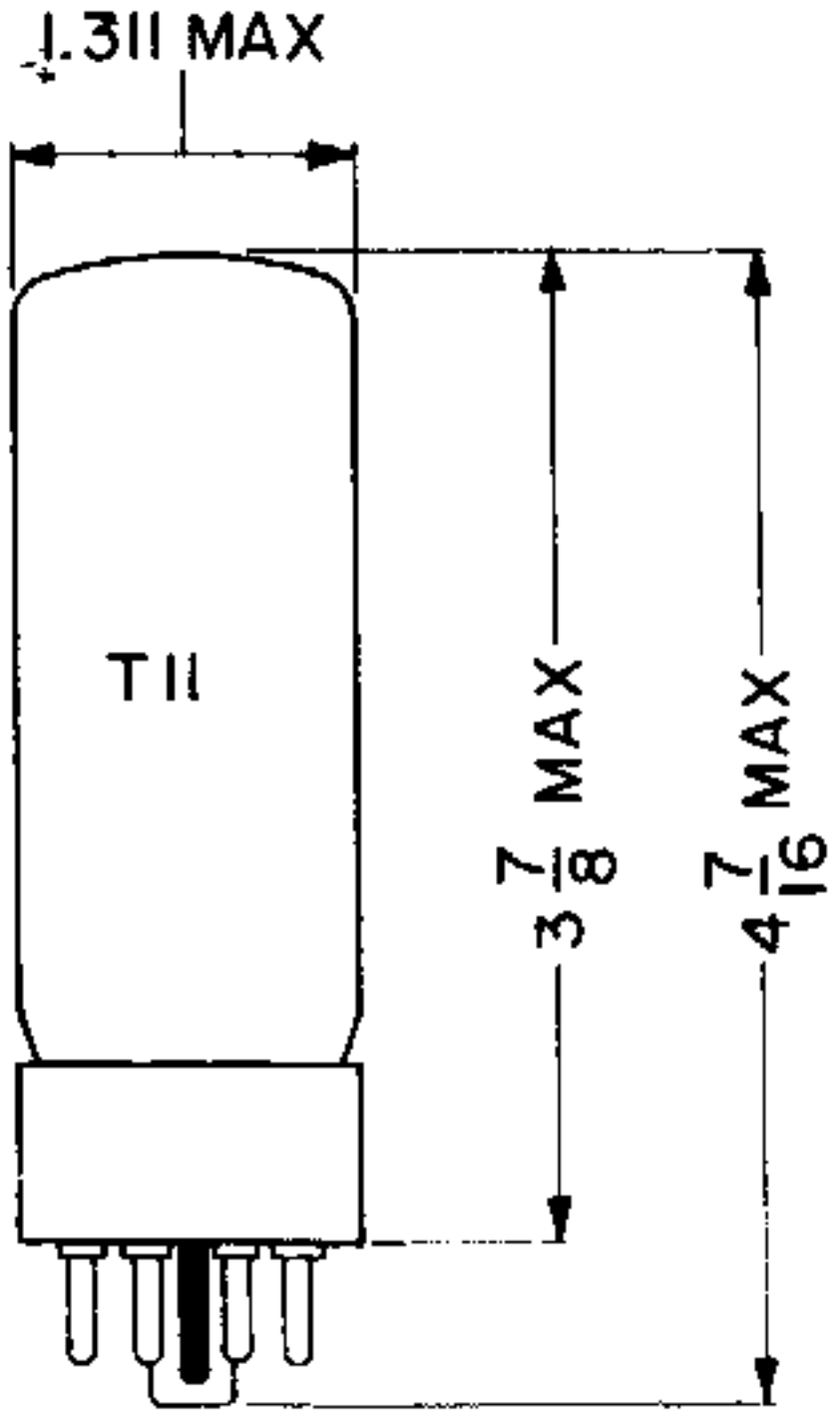
Note 1:

Screen voltage is obtained from taps located at 43% of the plate winding turns. An unbypassed resistor of 1 KΩ in series with each screen grid is necessary to prevent screen overload.



PIN CONNECTIONS

NO.1- GRID NO.3
NO.2- HEATER
NO.3- PLATE
NO.4- GRID NO.2
NO.5- GRID NO.1
NO.6- N.C.
NO.7- HEATER
NO.8- CATHODE



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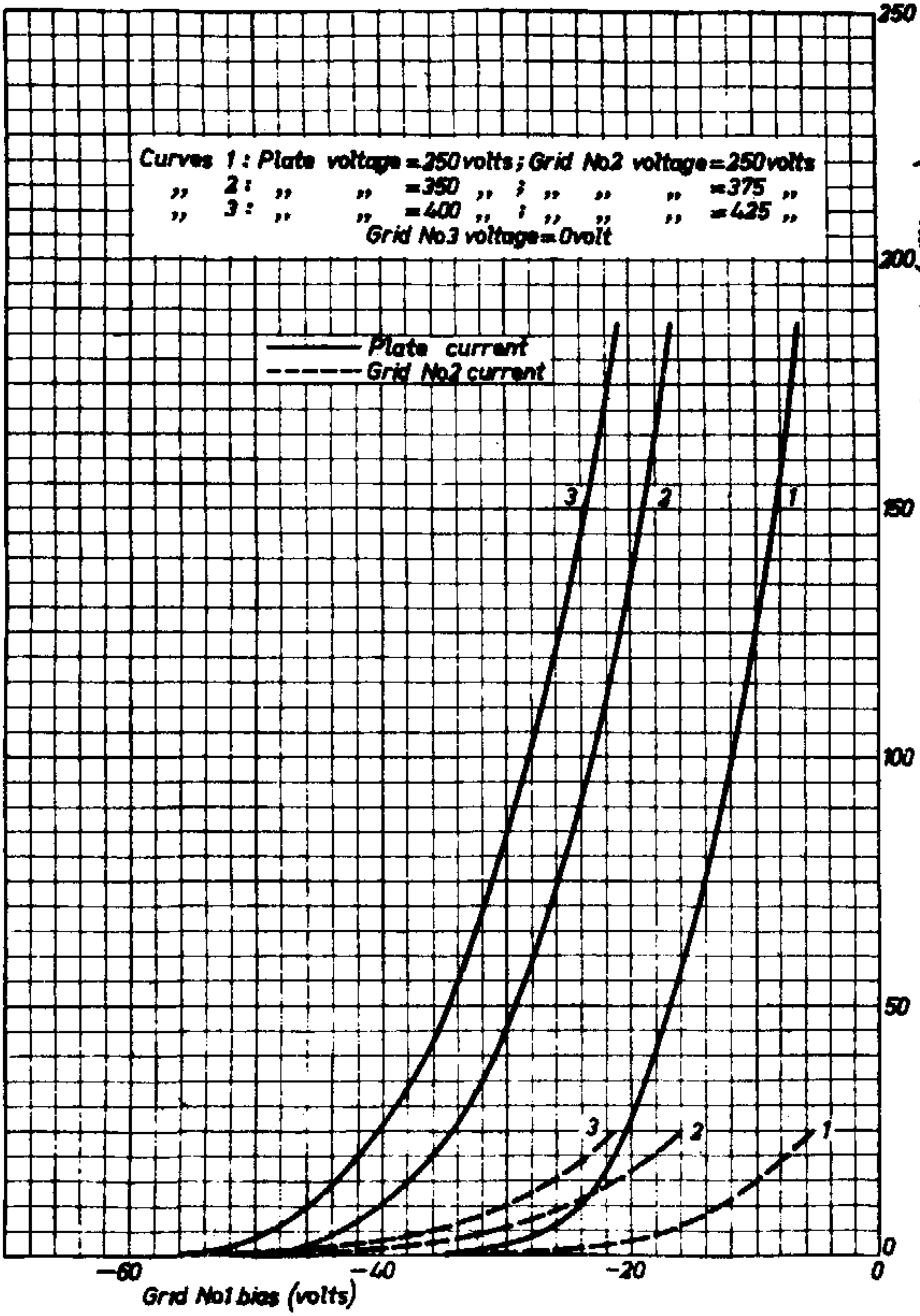
Curves for ultralinear connection



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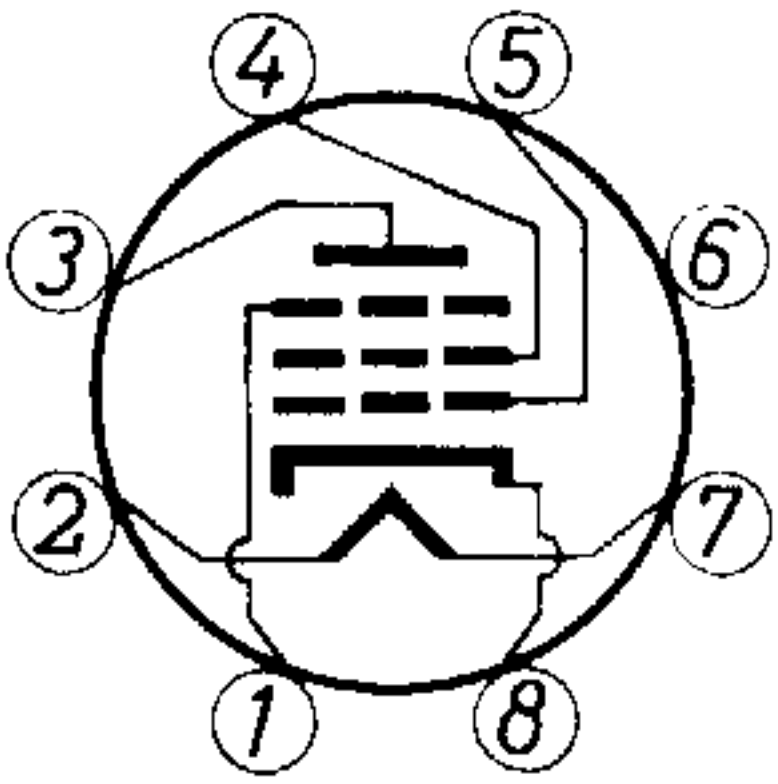
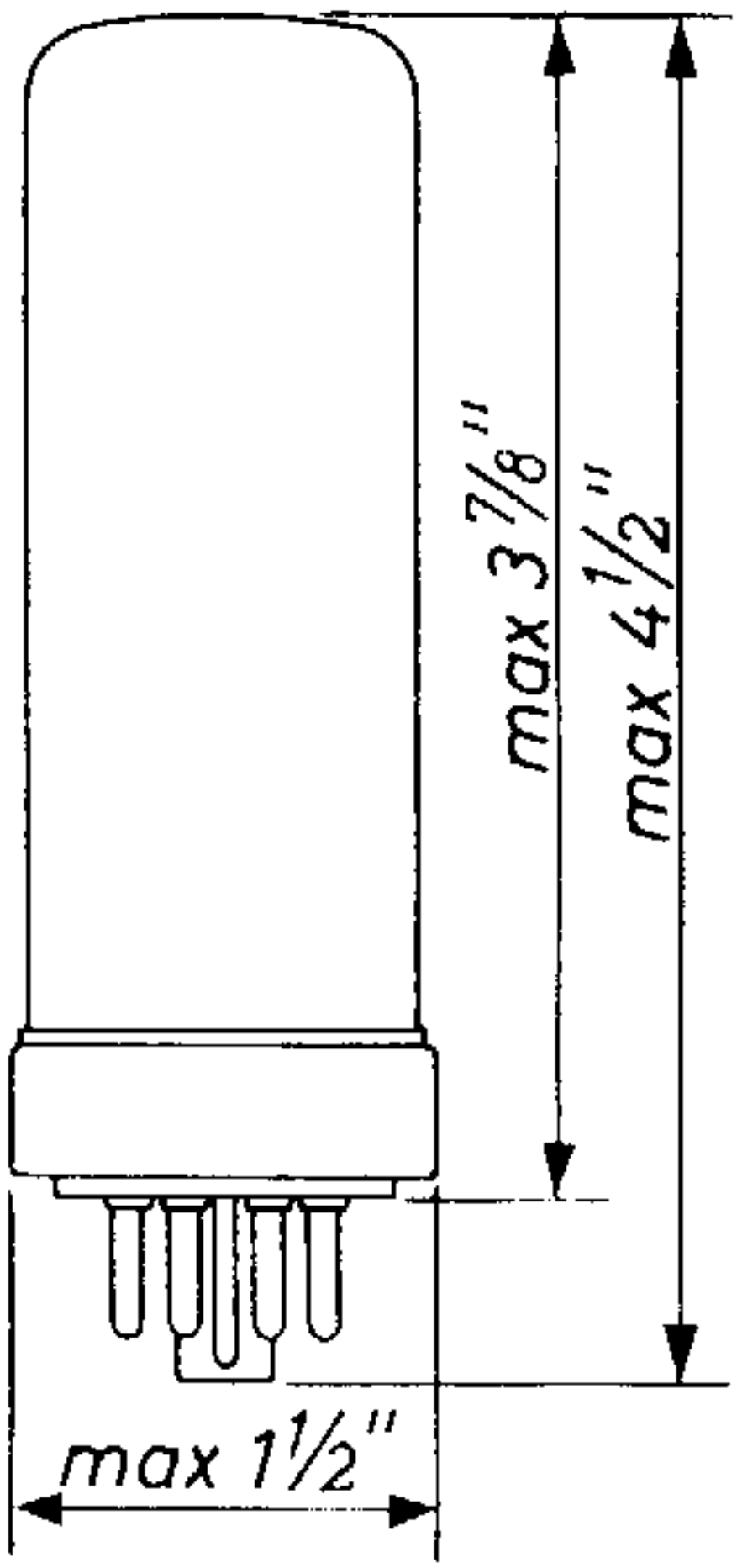
Pin 1 - Grid No. 3
Pin 2 - Heater
Pin 3 - Plate
Pin 4 - Grid No. 2
Pin 5 - Grid No. 1
Pin 6 - Not connected
Pin 7 - Heater
Pin 8 - Cathode





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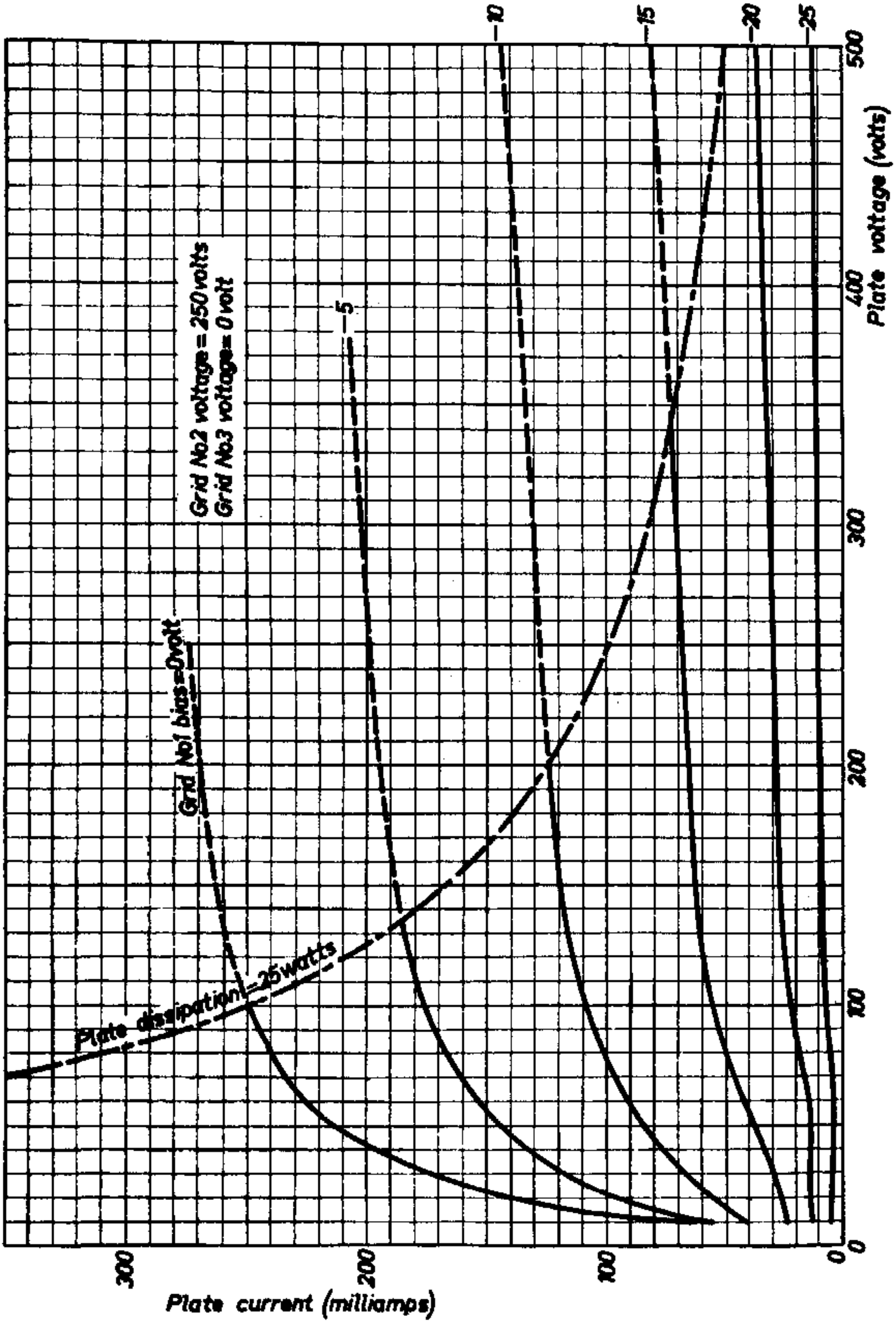
-10
-15
-20
-25
500
400
300
200
100
0
Plate voltage (volts)
Grid No2 voltage = 250 volts
Grid No3 voltage = 0 volt
-5
Grid No1 bias = 0 volt
Plate dissipation = 25 watts
300
200
100
0
Plate current (milliamps)

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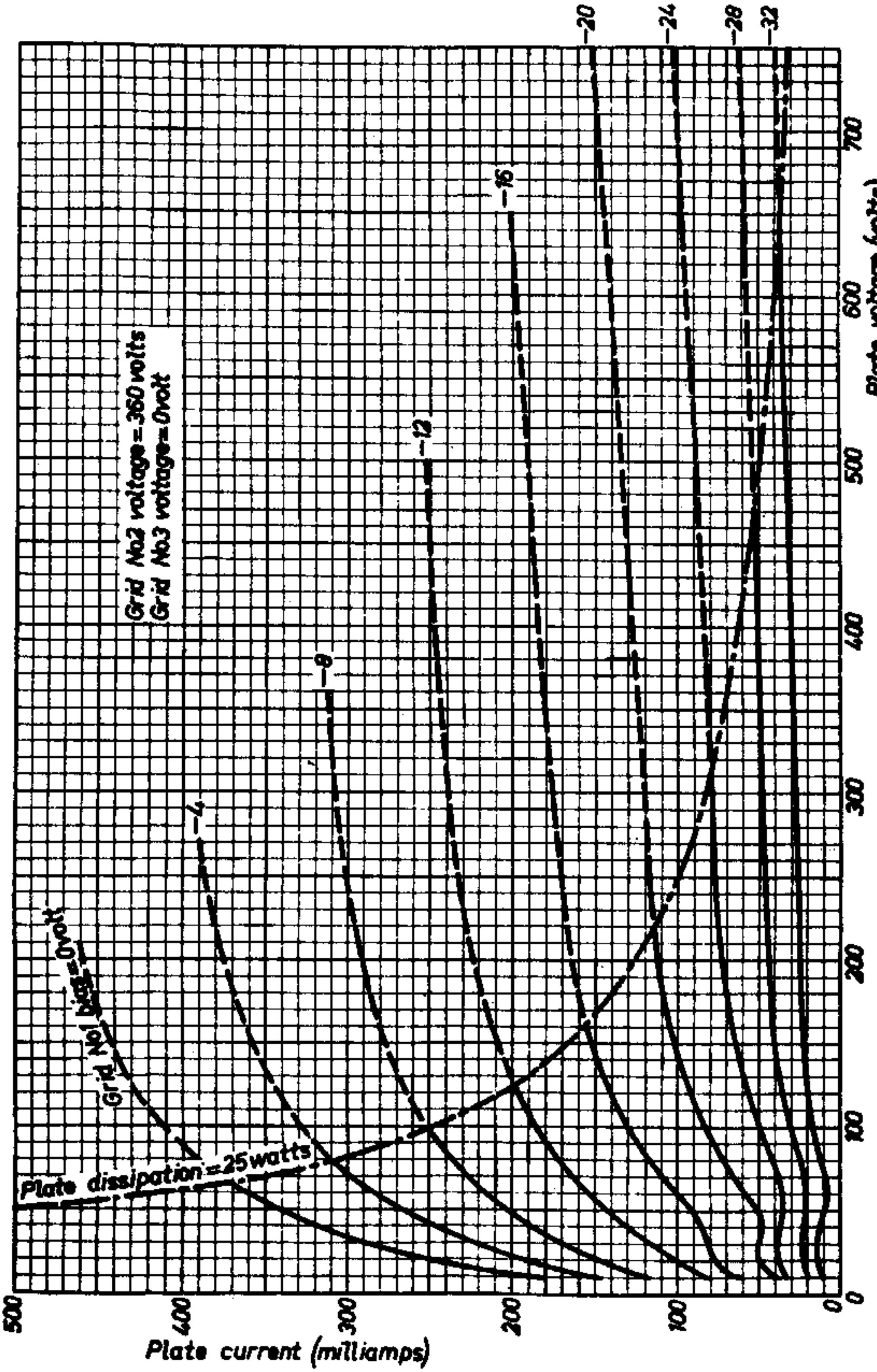
-20
-24
-28
-32
-16
-12
-9
-7
-5
Grid No2 voltage = 360 volts
Grid No3 voltage = 0 volt
Grid No1 Bias = 0 volt
Plate dissipation = 25 watts
700
600
500
400
300
200
100
0
Plate voltage (volts)
500
400
300
200
100
0
Plate current (milliamps)

6CA7

(EL34)

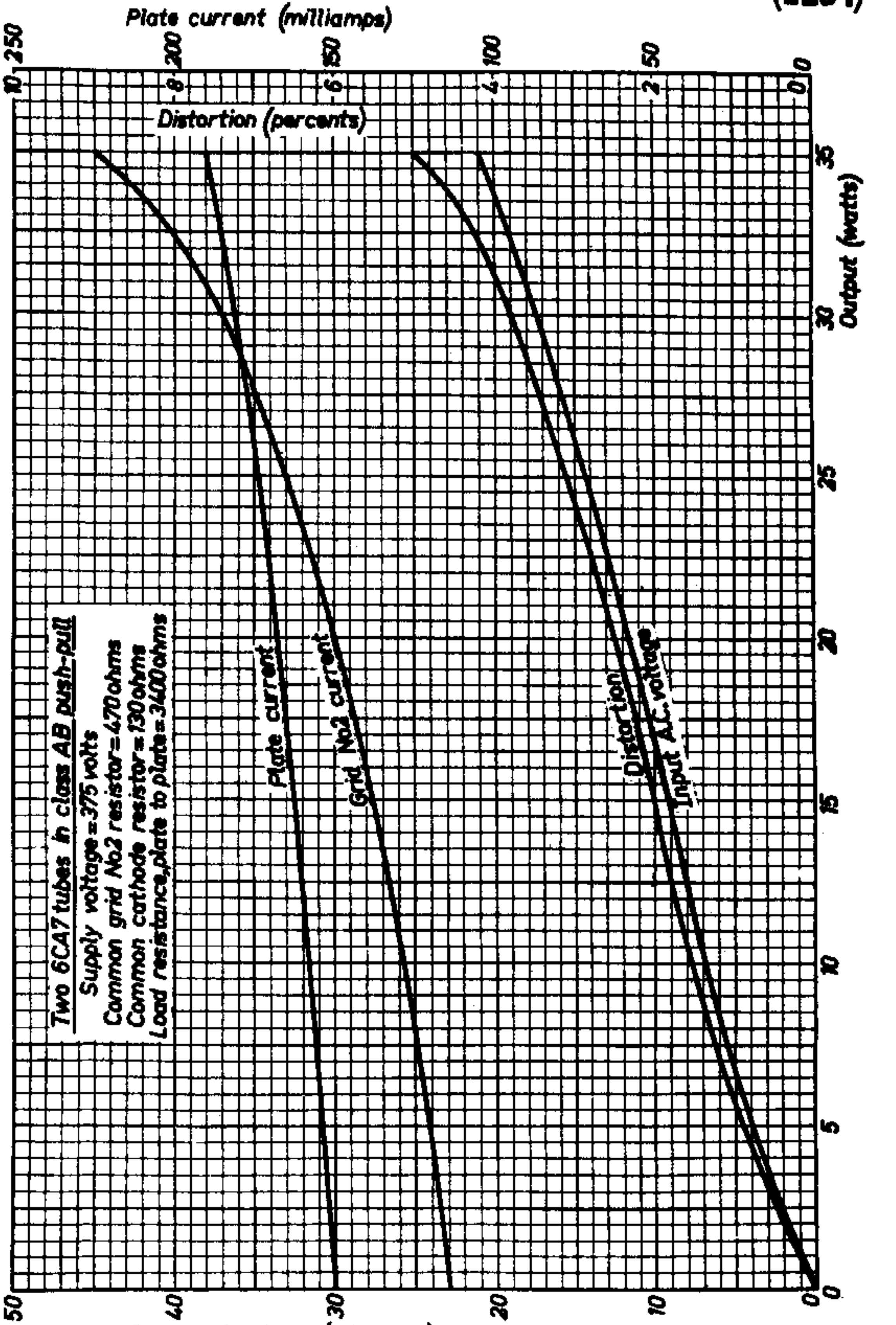
Plate current (milliamps)
250
200
150
100
50
0
10
8
6
4
2
0
Distortion (percents)
35
30
25
20
15
10
5
0
Output (watts)
Two 6CA7 tubes in class AB push-pull
Supply voltage = 375 volts
Common grid No2 resistor = 470 ohms
Common cathode resistor = 130 ohms
Load resistance, plate to plate = 3400 ohms
Plate current
Grid No2 current
Distortion
Input A.C. voltage
50
40
30
20
10
0
Input A.C. voltage (volts, rms)
Grid No2 current (milliamps)

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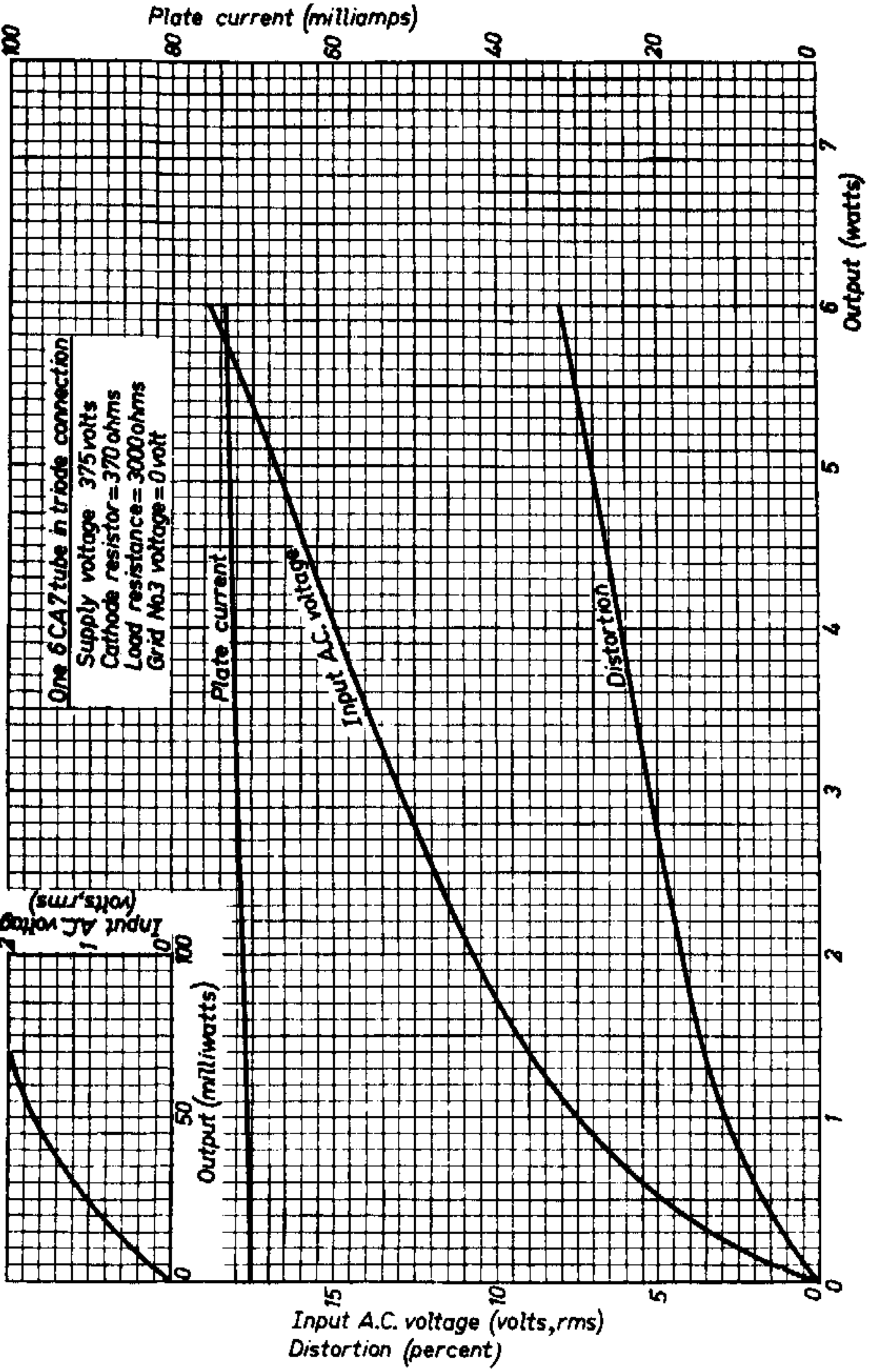
Plate current (milliamps)
100
80
60
40
20
0
7
6
5
4
3
2
1
0
Output (watts)
One 6CA7 tube in triode connection
Supply voltage 375 volts
Cathode resistor = 370 ohms
Load resistance = 3000 ohms
Grid No3 voltage = 0 volt
Plate current
Input AC voltage
Distortion
Input AC voltage (volts,rms)
100
50
0
Output (milliwatts)
15
10
5
0
Input A.C. voltage (volts,rms)
Distortion (percent)

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(EL34)

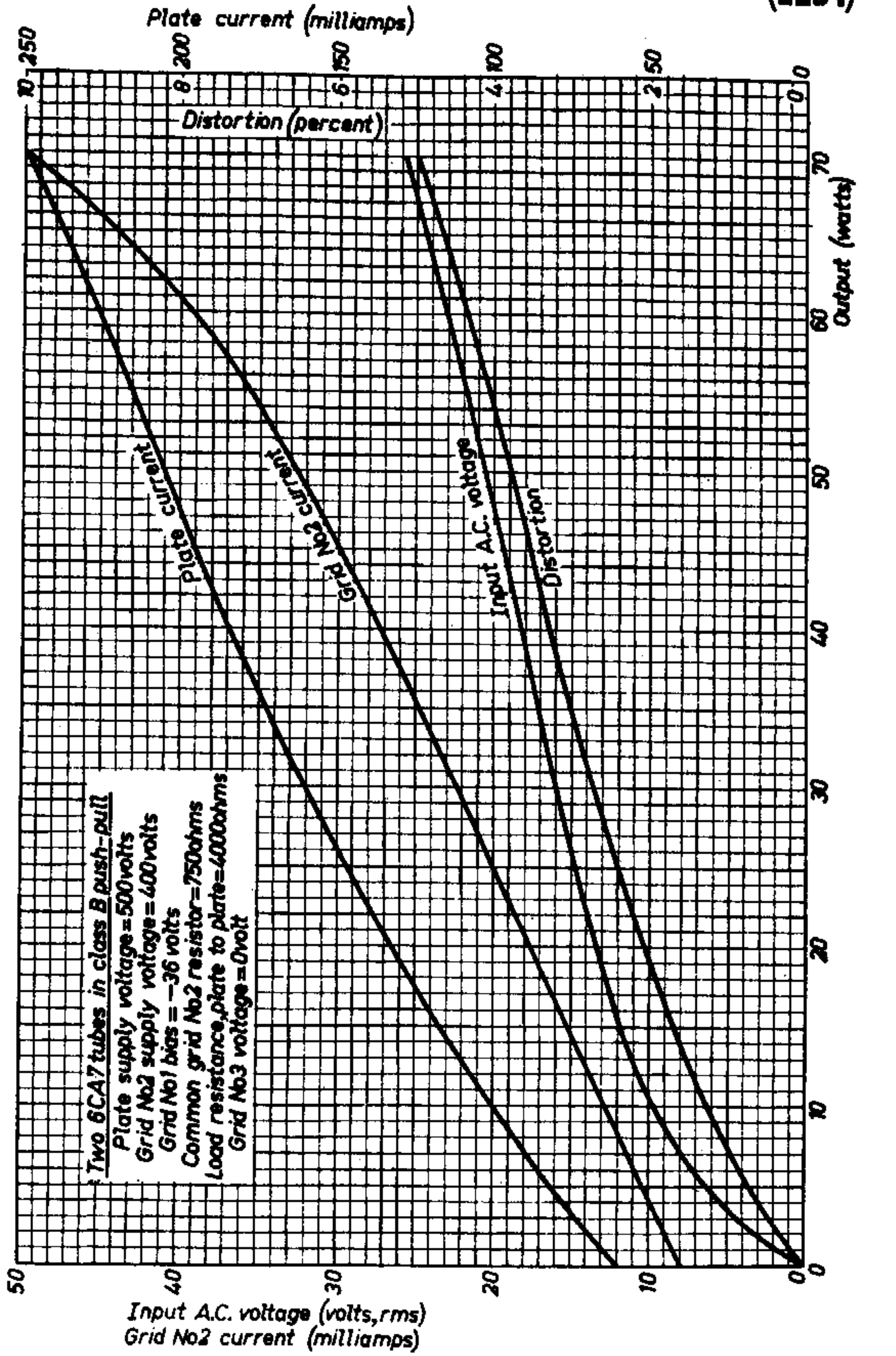


Plate current (milliamps)
250
200
150
100
50
0
Distortion (percent)
10
8
6
4
2
0
Output (watts)
70
60
50
40
30
20
10
0
Plate current
Grid No2 current
Input A.C. voltage
Distortion
Two 6CA7 tubes in class B push-pull
Plate supply voltage = 500 volts
Grid No2 supply voltage = 400 volts
Grid No1 bias = −36 volts
Common grid No2 resistor = 750 ohms
Load resistance, plate to plate = 4000 ohms
Grid No3 voltage = 0 volt
50
40
30
20
10
0
Input A.C. voltage (volts, rms)
Grid No2 current (milliamps)

6CA7 (EL34)

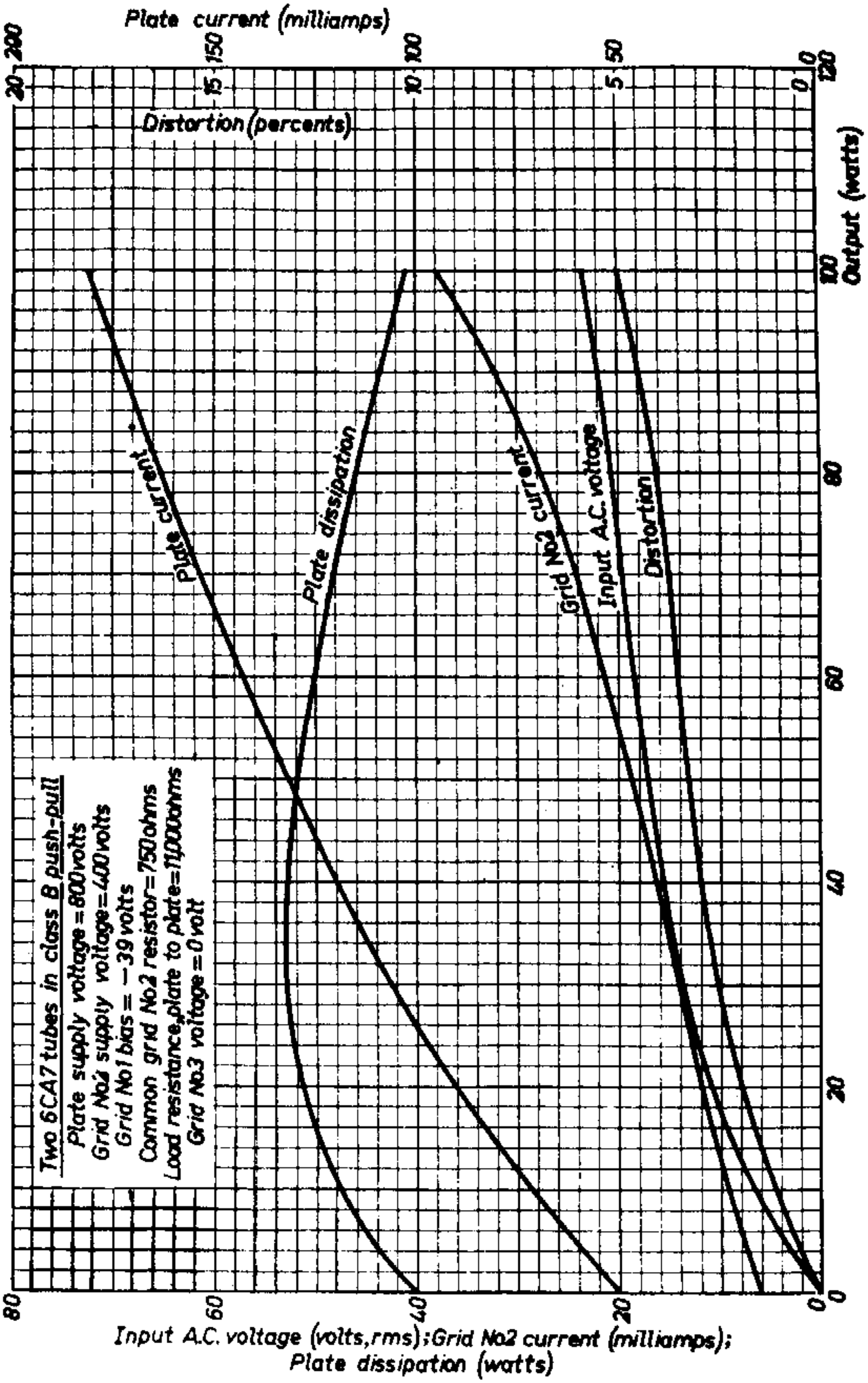


Plate current (milliamps)
200
150
100
50
0
120
20
15
10
5
0
Distortion (percents)
Output (watts)
Plate current
Plate dissipation
Grid No2 current
Input A.C. voltage
Distortion
80
60
40
20
0
Two 6CA7 tubes in class B push-pull
Plate supply voltage = 800 volts
Grid No2 supply voltage = 400 volts
Grid No1 bias = −39 volts
Common grid No2 resistor = 750 ohms
Load resistance, plate to plate = 11000 ohms
Grid No3 voltage = 0 volt
80
60
40
20
0
Input A.C. voltage (volts, rms); Grid No2 current (milliamps);
Plate dissipation (watts)

6CA7

(EL34)

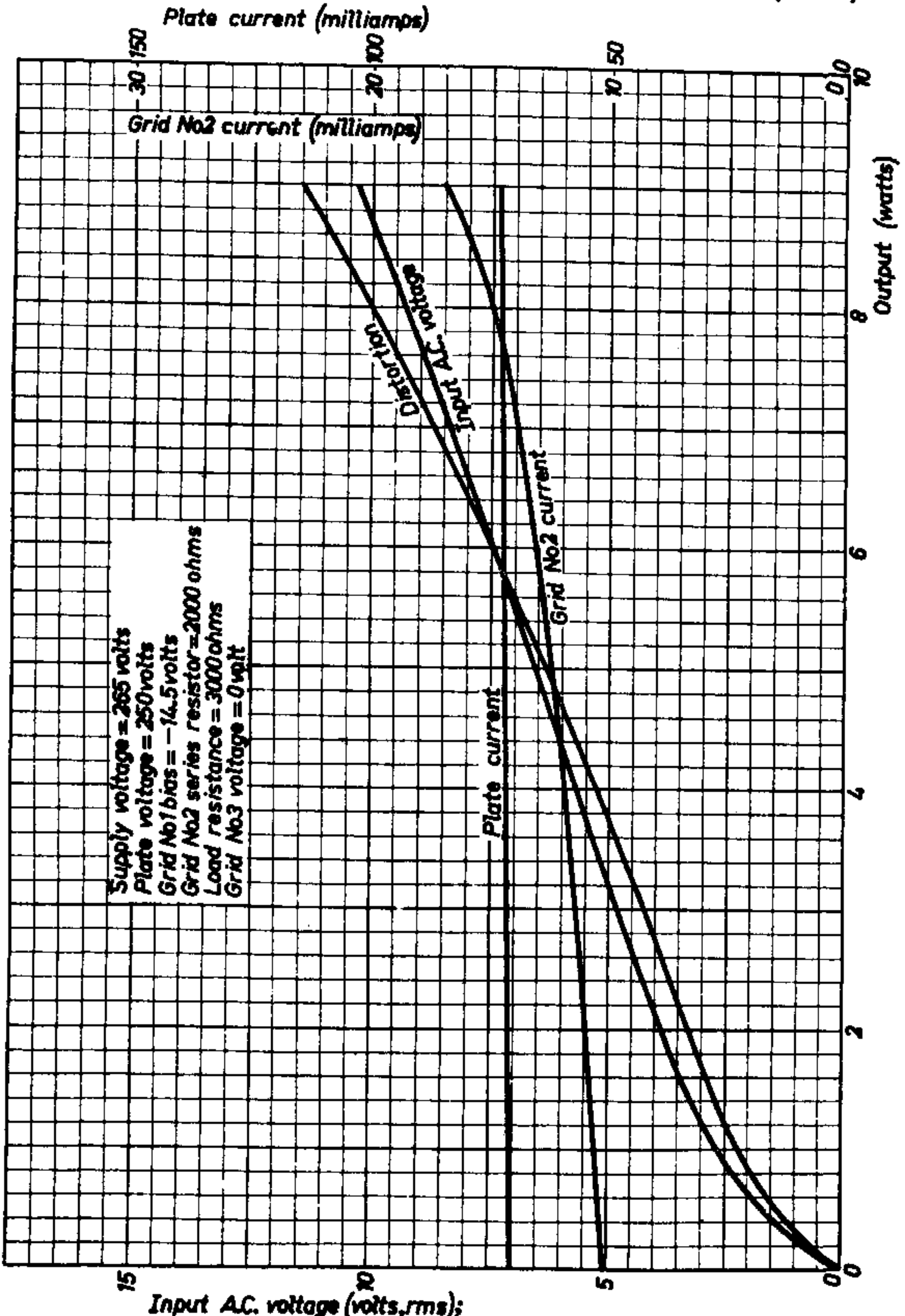
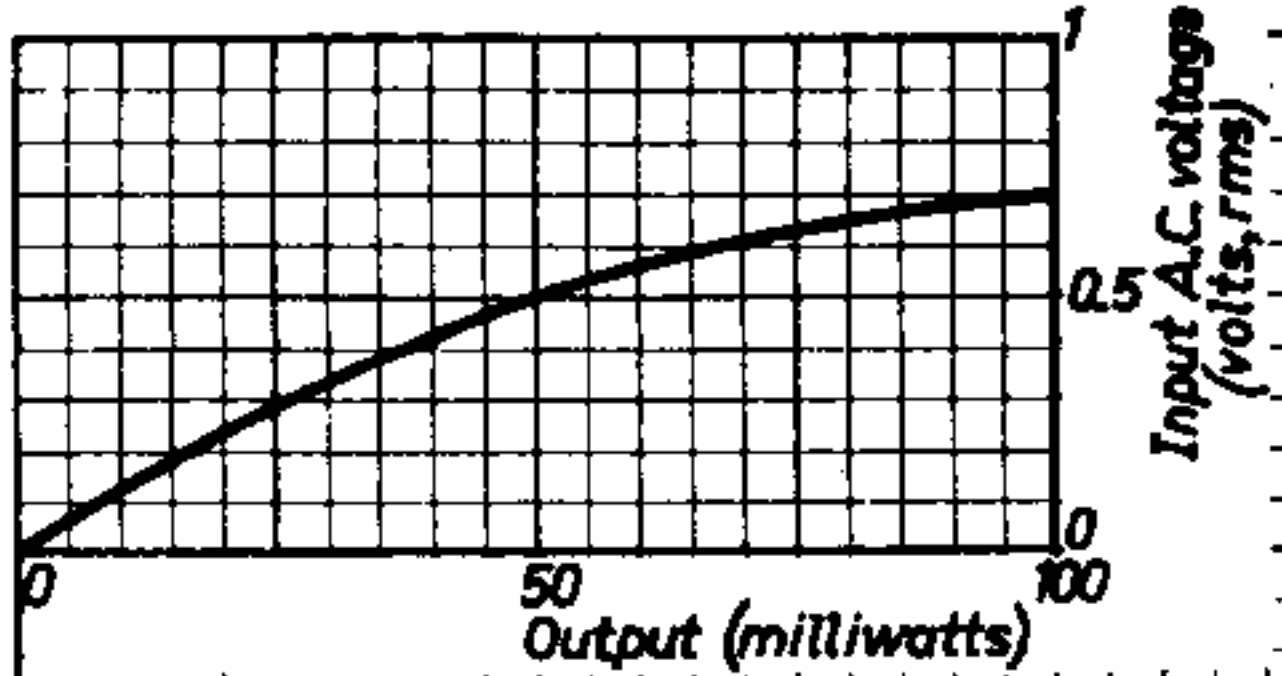


Plate current (milliamps)
150
100
50
0
30
20
10
0
Grid No2 current (milliamps)
8
6
4
2
0
Output (watts)
Distortion
Input A.C. voltage
Grid No2 current
Plate current
Supply voltage = 265 volts
Plate voltage = 250volts
Grid No1 bias = −14.5volts
Grid No2 series resistor=2000 ohms
Load resistance = 3000ohms
Grid No3 voltage = 0volt
15
10
5
0
Input A.C. voltage (volts,rms);
Distortion (percent)

6CA7 (EL34)



Supply voltage = 265 volts
Plate voltage = 250 volts
Grid No1 bias = −13.5 volts
Grid No2 series resistor = 0 ohm
Load resistance = 2000 ohms
Grid No3 voltage = 0 volt

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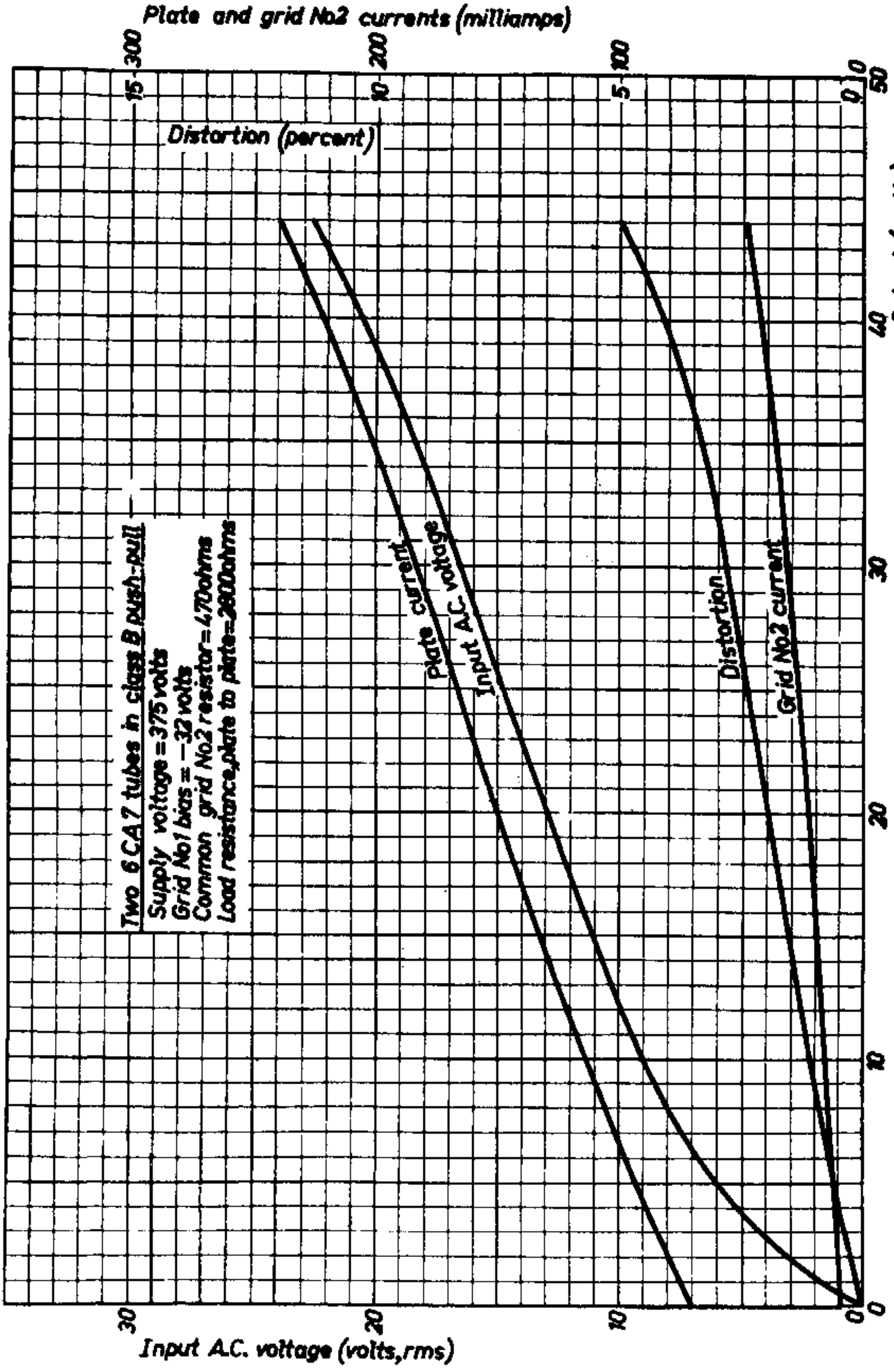
Plate and grid No2 currents (milliamps)
300
200
100
0
15
10
5
0
50
40
30
20
10
0
Distortion (percent)
Output (watts)
Two 6CA7 tubes in class B push-pull
Supply voltage = 375 volts
Grid No1 bias = −32 volts
Common grid No2 resistor = 470ohms
Load resistance, plate to plate = 2800ohms
Plate current
Input A.C. voltage
Distortion
Grid No2 current
30
20
10
0
Input A.C. voltage (volts, rms)

6CA7 (EL34)

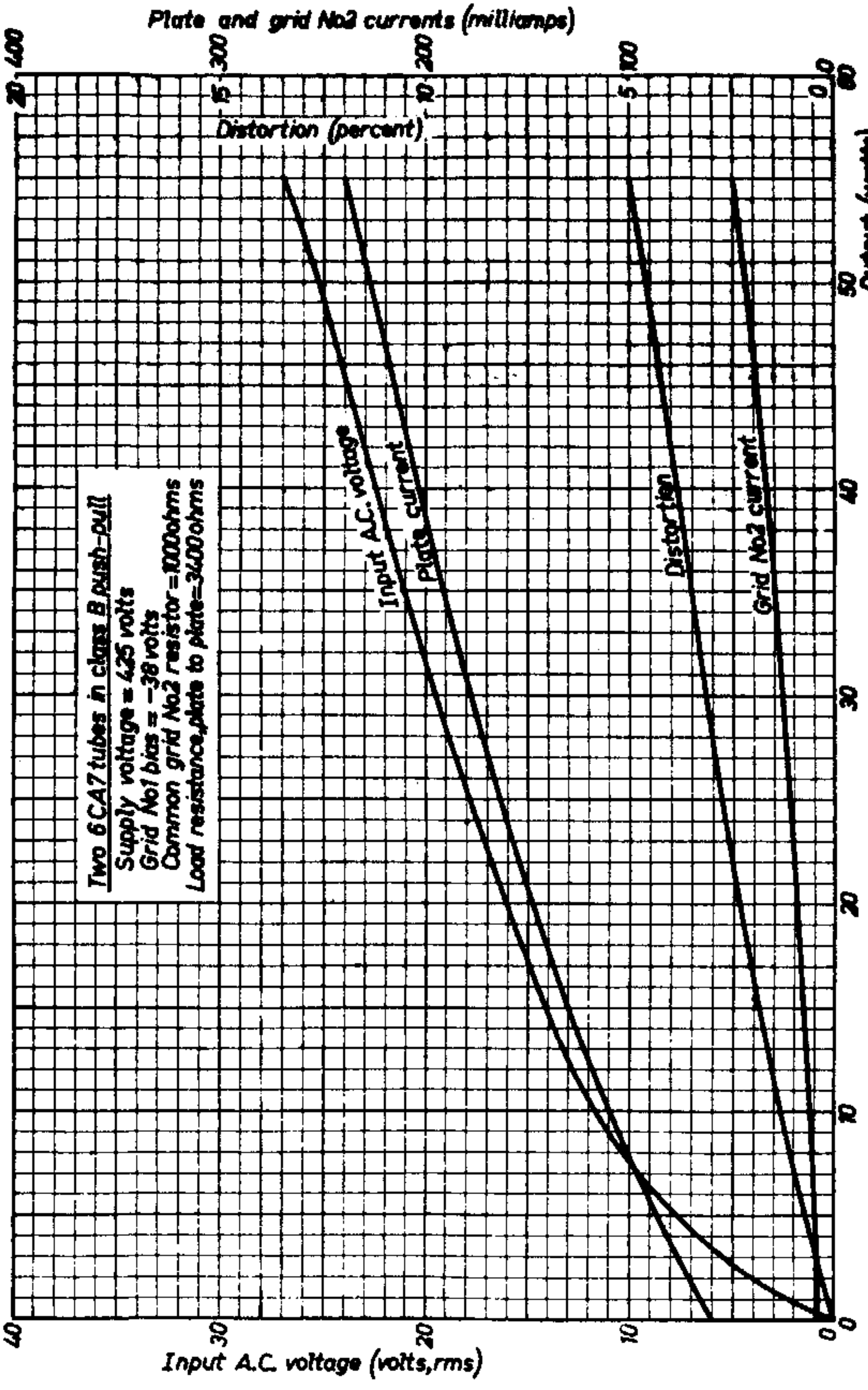
Plate and grid No2 currents (milliamps)
400
300
200
100
0
20
15
10
5
0
Distortion (percent)
Output (watts)
50
40
30
20
10
0
Two 6CA7 tubes in class B push-pull
Supply voltage = 425 volts
Grid No1 bias = −38 volts
Common grid No2 resistor=1000ohms
Load resistance, plate to plate=3400ohms
Input A.C. voltage
Plate current
Distortion
Grid No2 current
40
30
20
10
0
Input A.C. voltage (volts,rms)