Western Electric

310A Vacuum Tube

Classification—Voltage-amplifier, suppressor-grid pentode with indirectly heated cathode

This tube is intended primarily for use as an audio, or carrier and radio-frequency voltage amplifier, oscillator or modulator. The connection for the suppressor grid has been brought out to an external terminal, thus making the tube more flexible in its applications.

Dimensions—Dimensions, outline diagrams of the tube and base, and the arrangement of the electrode connections to the base terminals are shown in Figures 1 and 2.

Base—Small, six-pin type with pins silver-plated. Small, metal cap control-grid terminal at the top of the bulb.

Socket—Standard, six-contact type, preferably provided with silver-plated contacts such as the Western Electric 144B socket.

Mounting Positions—The 310A tube may be mounted in any position.

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Average Direct Interelectrode Capacitances

	A	B
Control grid to plate	0.025	0.007 μμf.
Suppressor grid to plate	12.5	12.5 μμf.
Plate to heater, cathode and screen grid	2.2	3.2 μμf.
Control grid to suppressor grid	1.8	1.3 μμf.
Control grid to heater, cathode and screen grid	4.0	6.5 μμf.
Suppressor grid to heater, cathode and screen grid	7.5	14.5 μμf.

Column A—Without shield.

Column B—With close-fitting metal shield connected to cathode.

Heater Rating

Heater voltage	10.0 volts, a.c. or d.c.
Nominal heater current	0.32 ampere

The heater element of this tube is designed to operate on a voltage basis and should be operated at as near the rated voltage as is practicable.

Cathode Connection—Preferably direct to the heater. If voltage must be applied between the cathode and heater, it should not exceed 150 volts.

Characteristics—Plate current and screen-grid current characteristics of a typical 310A tube are shown in Figures 3 and 4, respectively, as functions of control-grid voltage for several values of screen-grid and plate voltage and zero suppressor-grid voltage. The screen-grid voltage for these characteristics is equal to the plate voltage. Corresponding amplification factor, plate resistance, and transconductance characteristics are given in Figures 5, 6 and 7. Plate current and screen-grid current characteristics as functions of plate voltage are given in Figures 8 and 9, respectively, for several values of control-grid voltage, a screen-grid voltage of 135 volts, and zero suppressor-grid voltage. Corresponding amplification factor, plate resistance, and transconductance characteristics are shown in Figures 10, 11 and 12. Plate current, screen-grid current, plate resistance, and transconductance characteristics are shown in Figures 13, 14, 15 and 16 as functions of plate voltage for several values of suppressor-grid voltage, a screen-grid voltage of 135 volts, and a control-grid voltage of −3 volts. These last characteristics are of particular interest in modulator applications where separate inputs are applied to the control and suppressor grids.

Limiting Conditions for Safe Operation

Maximum plate voltage	250 volts
Maximum screen-grid voltage	180 volts
Maximum cathode current (screen-grid current plus plate current)	10 milliamperes
Maximum screen-grid current	2.5 milliamperes

Operating Conditions and Output—Nominal performance data are given in the table below for a number of typical operating conditions. Less severe operating conditions should be selected in preference to maximum operating conditions wherever possible. The life of the tube at maximum conditions may be shorter than at less severe conditions.

The performance data include the fundamental voltage or power output for the indicated values of load resistance and input voltage, and the maximum second and third harmonic levels for input voltages no greater than the indicated values. The voltage output is given in peak volts, the power output in milliwatts, and the harmonic levels in decibels below the fundamental.

TABLE

Plate Voltage	Screen-Grid Voltage	Control-Grid Bias	Suppressor-Grid Voltage	Plate Current	Load Resistance	Input Voltage	Output Voltage	Output Power	Second Harmonic	Third Harmonic
Volts	Volts	Volts	Volts	Milliamperes	Ohms	Peak Volts	Peak Volts	Milliwatts	db	db
135	135	−3	0	5.4	20,000	3.00		250	22	30
					60,000	1.60		130	26	28
					60,000	0.95		60	35	45
					60,000	1.15	100		33	39
					100,000	0.57	75		35	50
					100,000	0.40	50		40	55
180	135	−3	0	5.4	40,000	2.70		340	26	28
					100,000	1.50	175		26	30
225	135	−3	0	5.5	60,000	2.70		425	27	27
					100,000	1.80	220		27	31
*250	135	−3	0	5.5	60,000	2.70		480	26	30
					60,000	1.20		110	30	55
					100,000	2.10	250		26	29
					100,000	1.50	200		30	43

*Maximum operating conditions.

Curves showing the fundamental power and voltage output and the second and third harmonic levels as functions of input voltage for a number of values of load resistance and a typical operating condition are given in Figures 17, 18, 19 and 20.

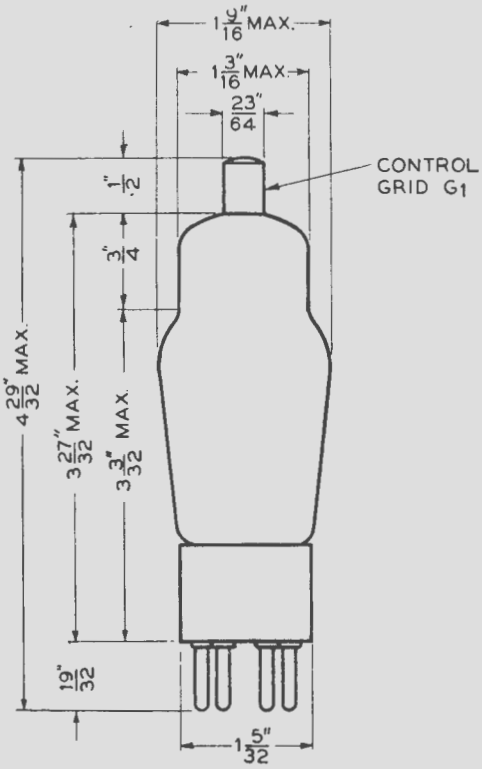

FIG. 1

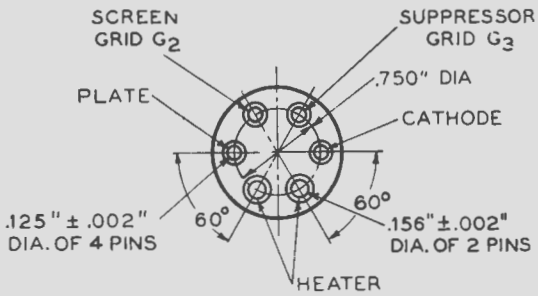

FIG. 2

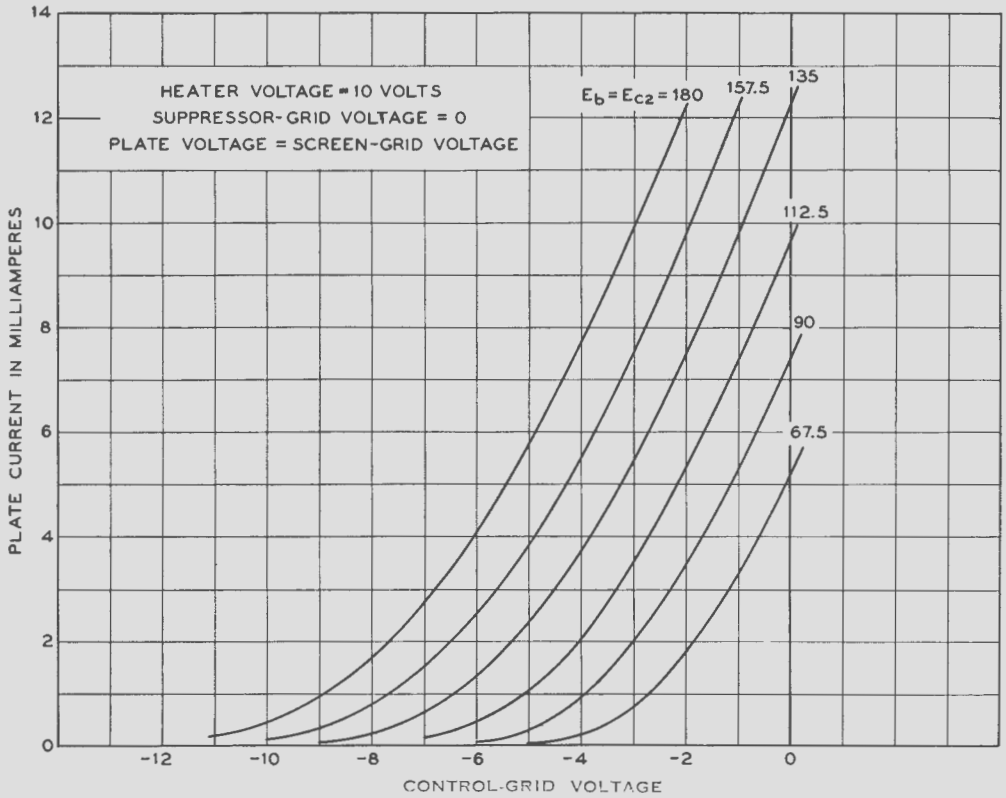
HEATER VOLTAGE = 10 VOLTS
SUPPRESSOR-GRID VOLTAGE = 0
PLATE VOLTAGE = SCREEN-GRID VOLTAGE
$E_b = E_{c2} = 180$
157.5
135
112.5
90
67.5
PLATE CURRENT IN MILLIAMPERES
CONTROL-GRID VOLTAGE
14
12
10
8
6
4
2
0
-12
-10
-8
-6
-4
-2
0

FIG. 3

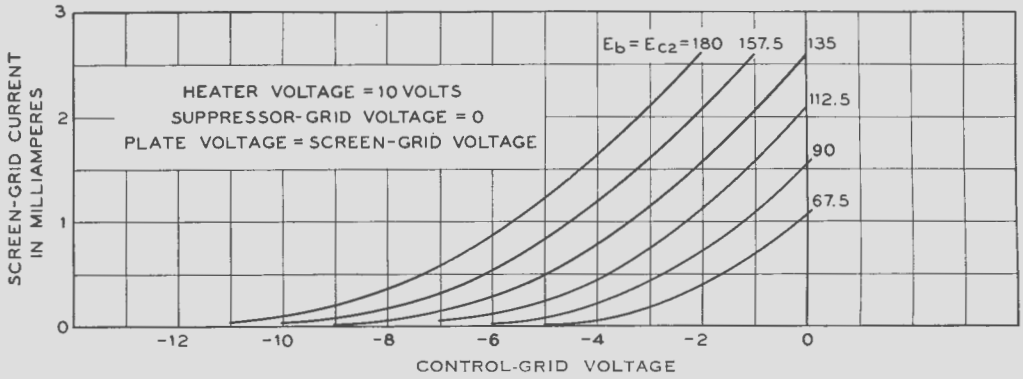
HEATER VOLTAGE = 10 VOLTS
SUPPRESSOR-GRID VOLTAGE = 0
PLATE VOLTAGE = SCREEN-GRID VOLTAGE
$E_b = E_{c2} = 180$
157.5
135
112.5
90
67.5
SCREEN-GRID CURRENT IN MILLIAMPERES
CONTROL-GRID VOLTAGE
3
2
1
0
-12
-10
-8
-6
-4
-2
0

FIG. 4

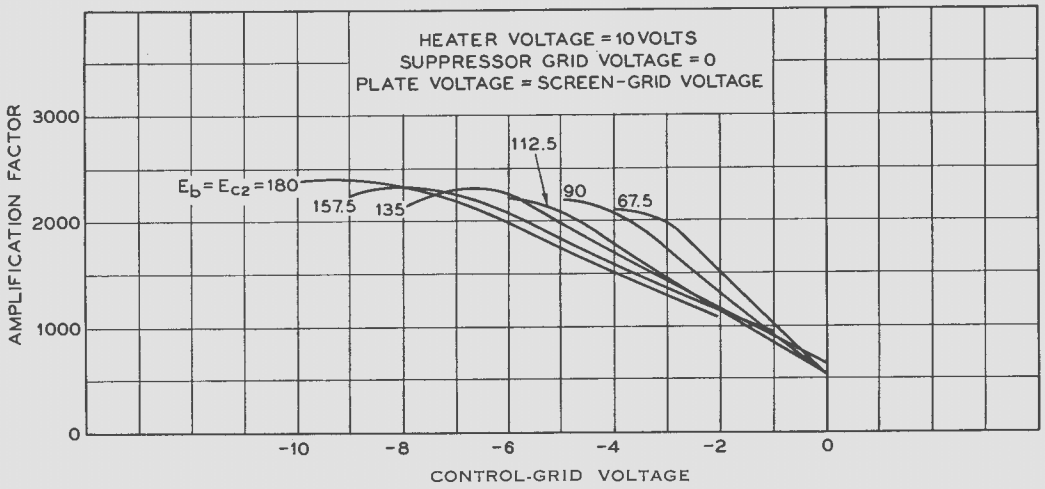

FIG. 5

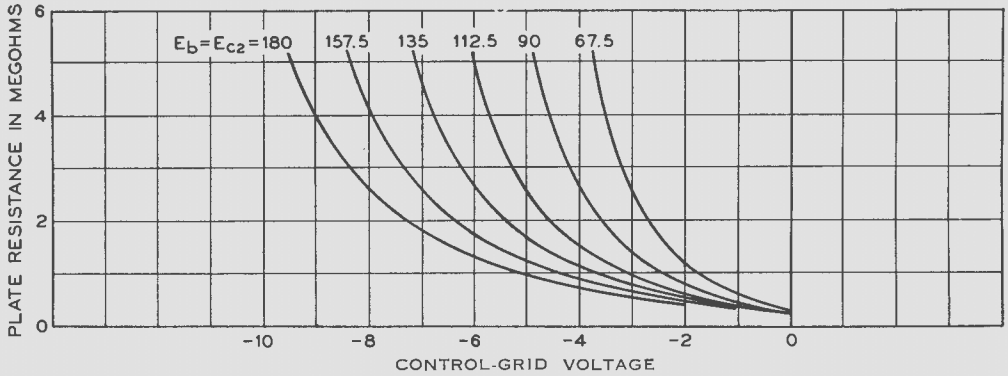

FIG. 6

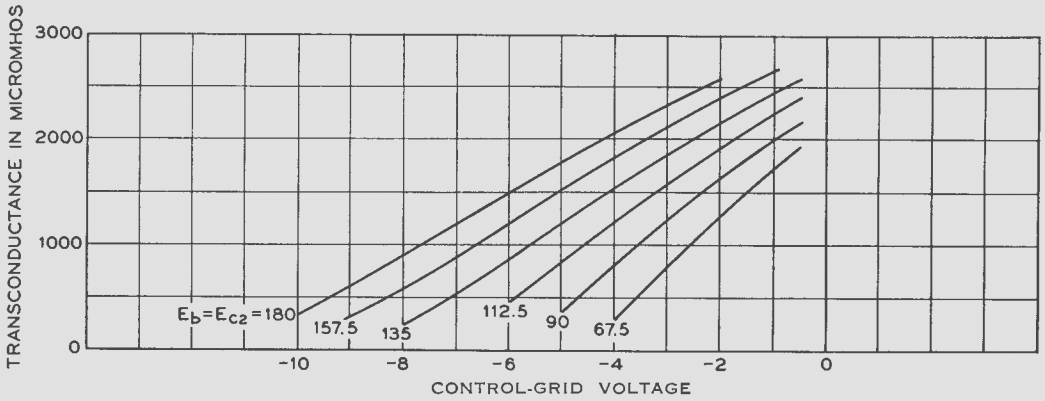

FIG. 7

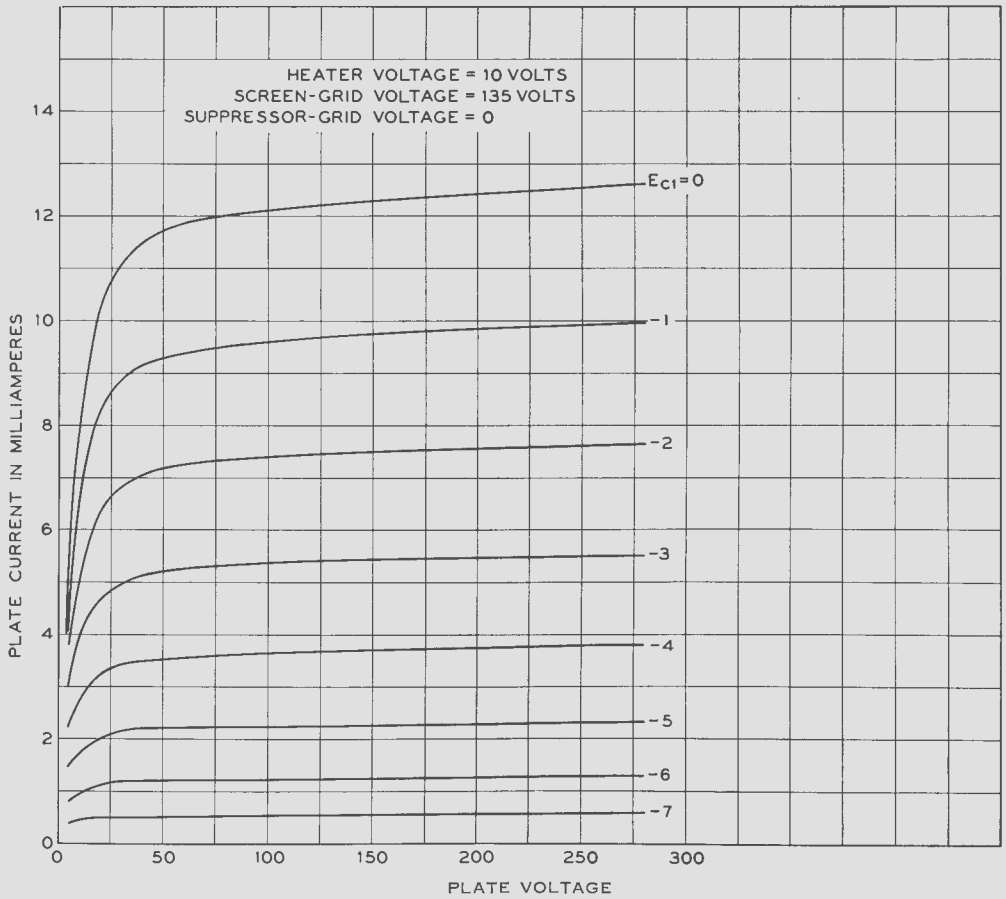
HEATER VOLTAGE = 10 VOLTS
SCREEN-GRID VOLTAGE = 135 VOLTS
SUPPRESSOR-GRID VOLTAGE = 0
PLATE CURRENT IN MILLIAMPERES
PLATE VOLTAGE
0
2
4
6
8
10
12
14
0
50
100
150
200
250
300
$E_{C1}=0$
-1
-2
-3
-4
-5
-6
-7

FIG. 8

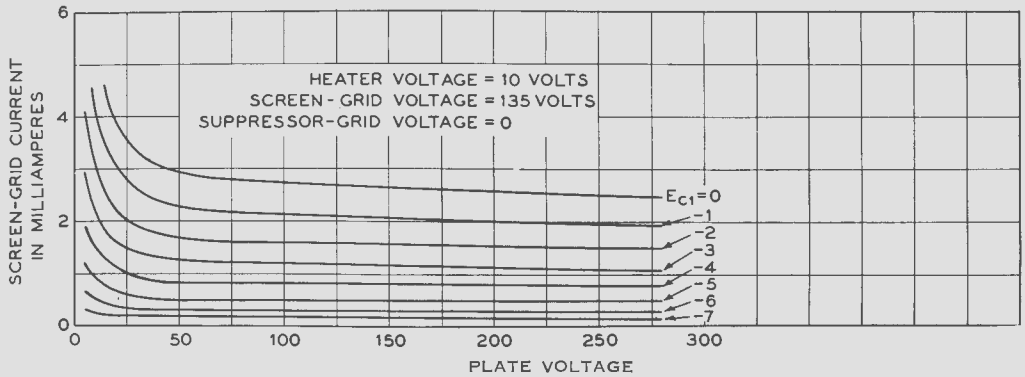
HEATER VOLTAGE = 10 VOLTS
SCREEN-GRID VOLTAGE = 135 VOLTS
SUPPRESSOR-GRID VOLTAGE = 0
SCREEN-GRID CURRENT IN MILLIAMPERES
PLATE VOLTAGE
0
2
4
6
0
50
100
150
200
250
300
$E_{C1}=0$
-1
-2
-3
-4
-5
-6
-7

FIG. 9

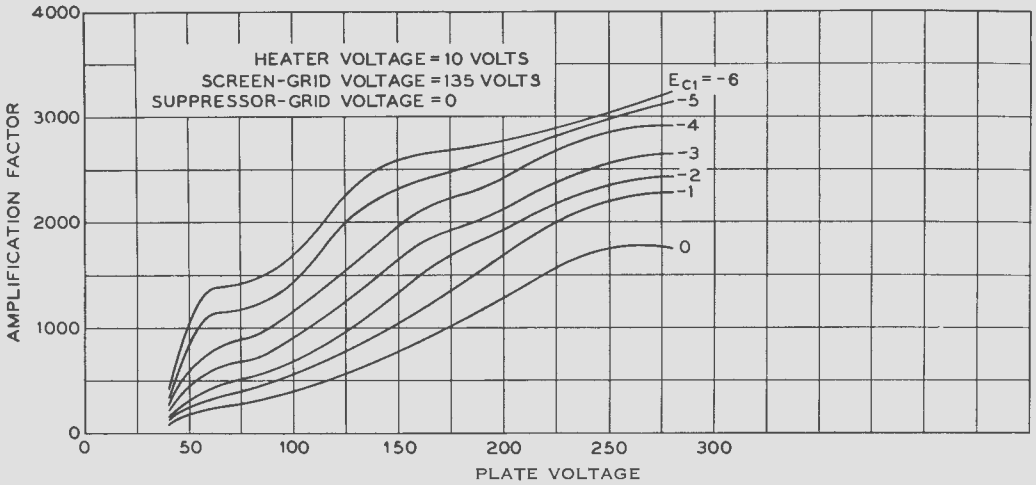

FIG. 10

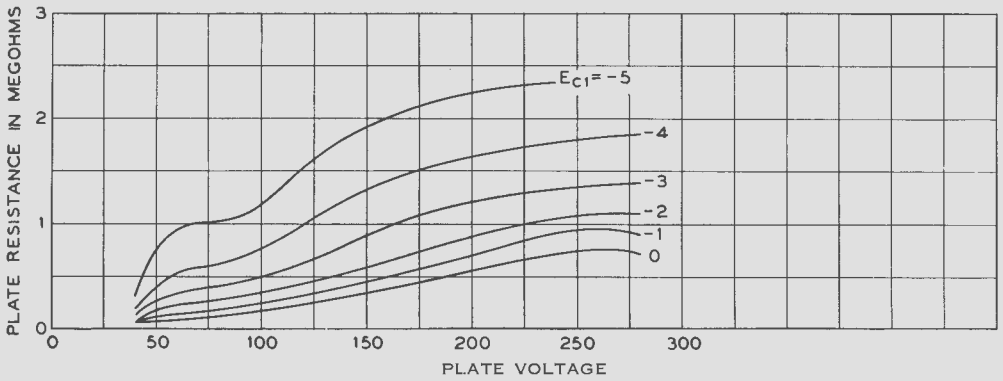

FIG. 11

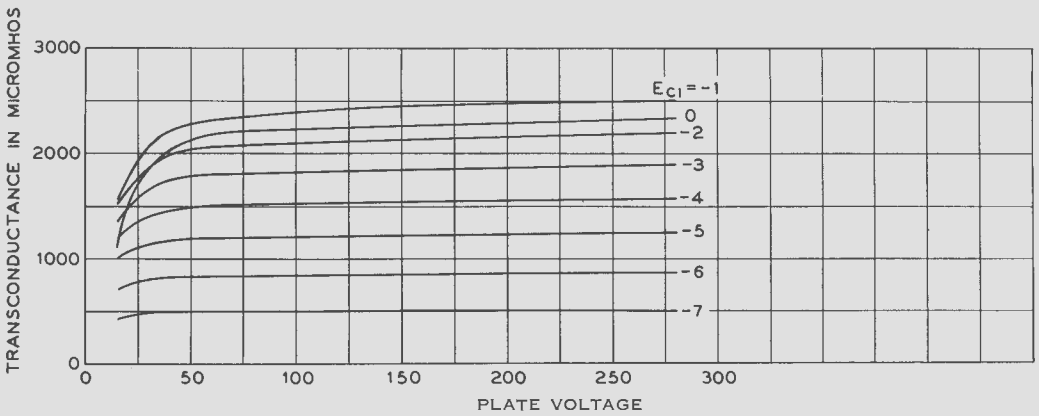

FIG. 12

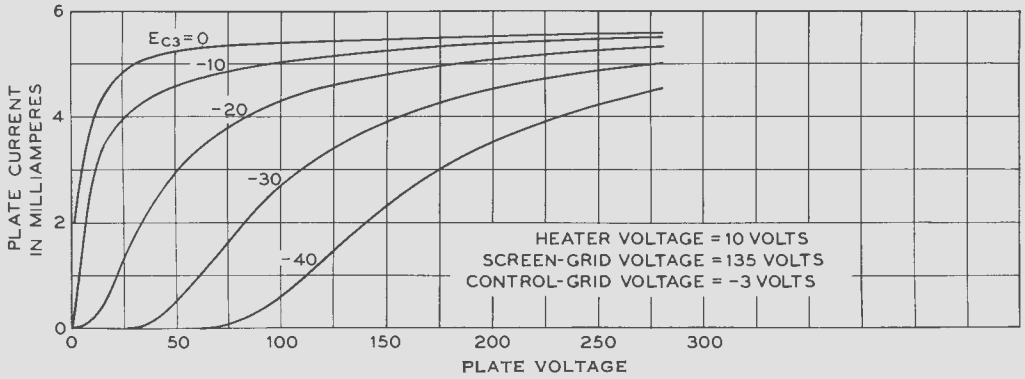

FIG. 13

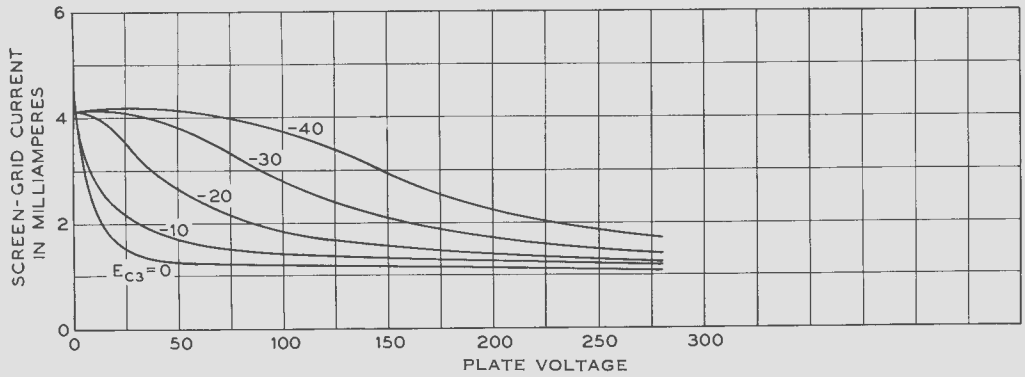

FIG. 14

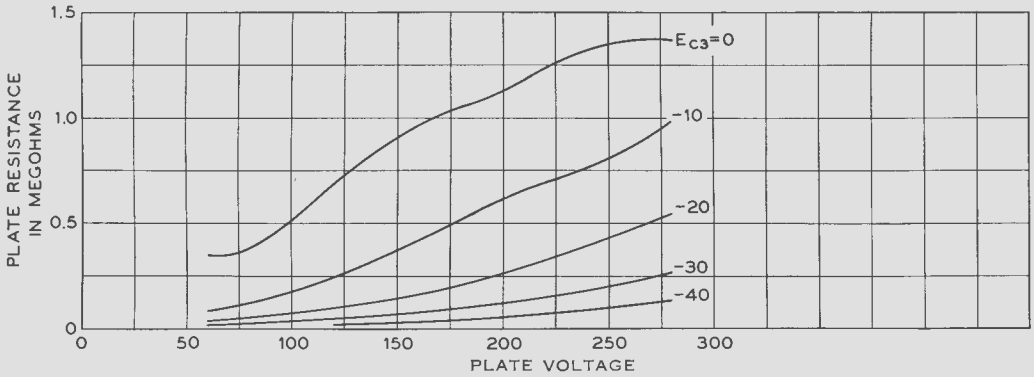

FIG. 15

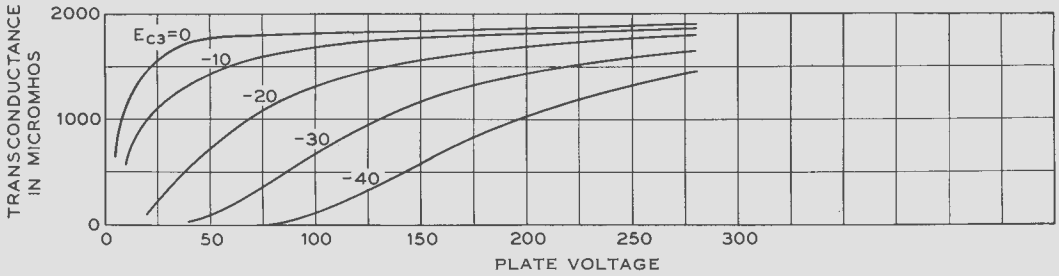

FIG. 16

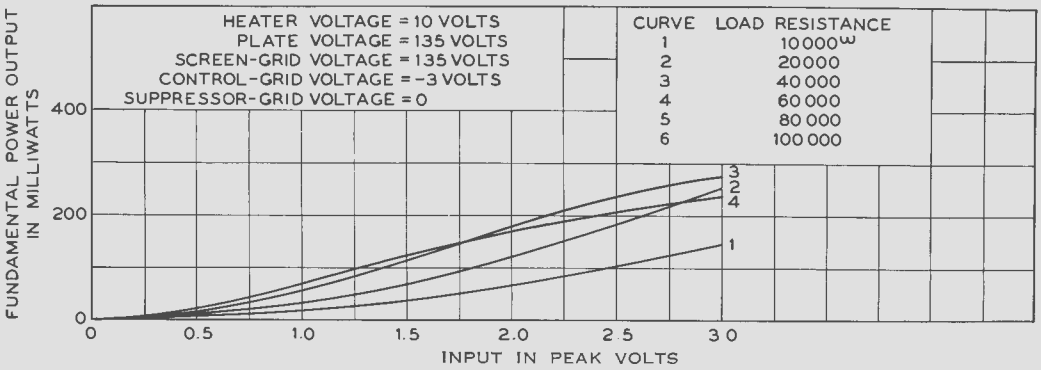

FIG. 17

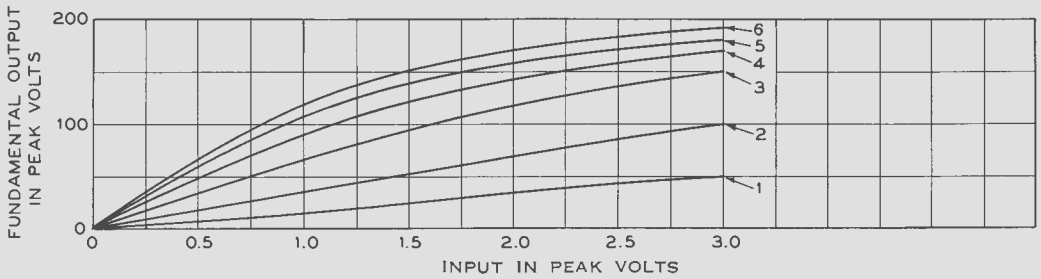

FIG. 18

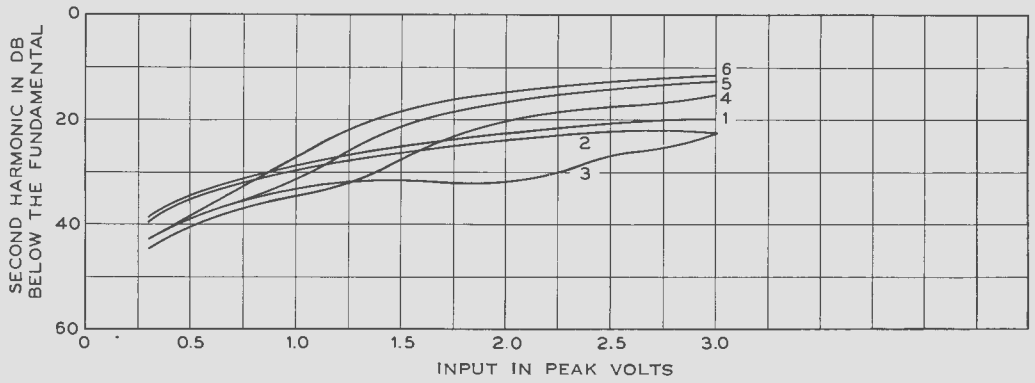

FIG. 19

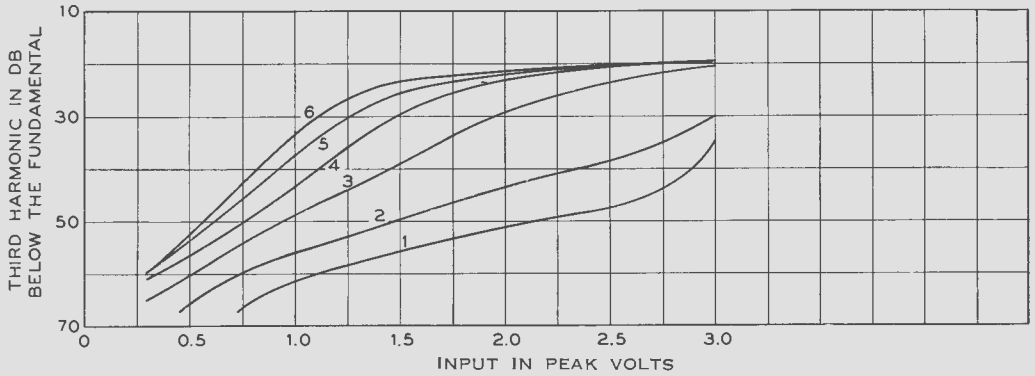

FIG. 20

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