

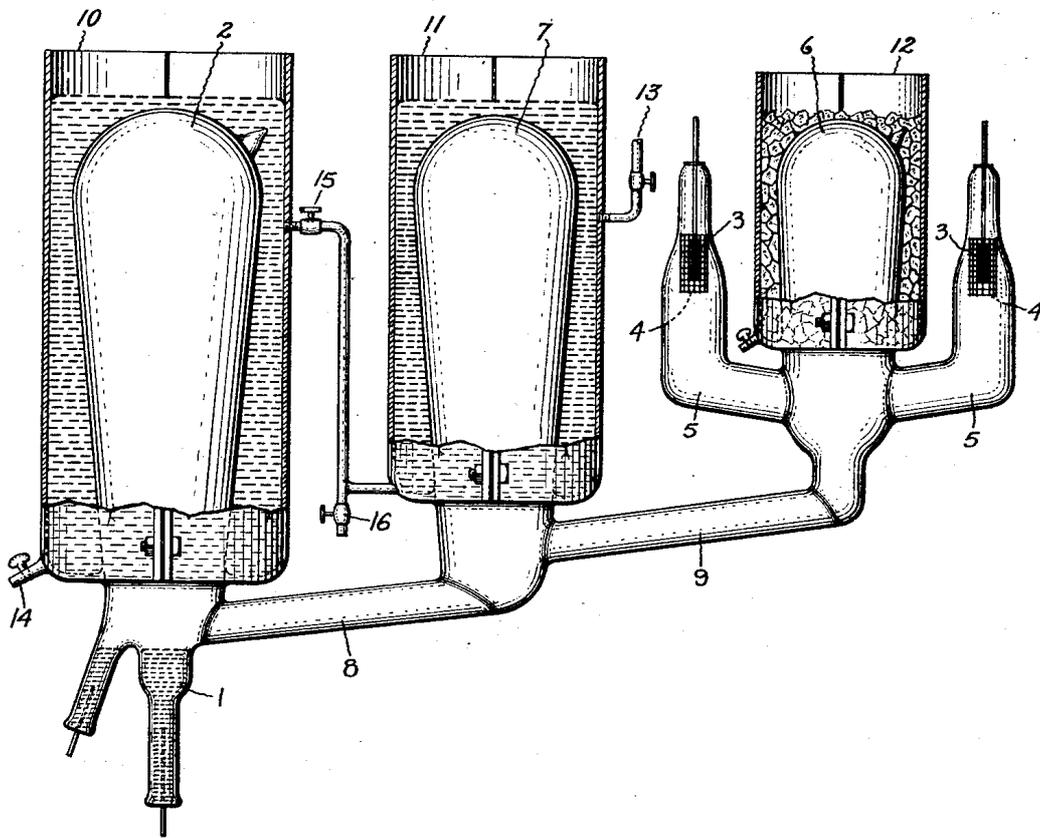
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I. LANGMUIR

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VAPOR ELECTRIC DEVICE

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Inventor:  
Irving Langmuir;

by *Alexander S. Langmuir*  
His Attorney.

## UNITED STATES PATENT OFFICE

IRVING LANGMUIR, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

## VAPOR ELECTRIC DEVICE

Application filed July 12, 1926. Serial No. 121,891.

My invention relates to vapor electric devices, and has for its principal object the provision of an improved device which is so constructed as to obviate arc back between its electrodes and to facilitate the control of its load current by means of a grid or control electrode.

In the operation of vapor electric devices, such as the mercury rectifier, load current is transmitted between a positively charged anode and a cathode through an electric arc which carries a multitude of electrons and positive ions. When the anode is positively charged and is transmitting current, the presence of these positive ions in the vicinity of the anode is not objectionable because they reduce space charge and facilitate the transmission of current through the device. When the anode is negatively charged and is not transmitting current, however, the presence of positive ions in the vicinity of the anode is undesirable because the positive ion bombardment is likely to lead to arc back between the anodes or between the cathode and a negatively charged anode.

It has been proposed to provide vapor electric devices with a grid or control electrode which is utilized not only to prevent arc back, but also to control the transmission of load current through the device. If a vapor electric device of the usual construction is provided with a grid, the grid will prevent starting of the current when charged to a negative potential but is usually incapable of interrupting the current when it has once started.

In order both to prevent reverse arcs between the electrodes of the device and to facilitate control of the load current by means of the grid, it is desirable that the vapor pressure in the vicinity of the anodes and grids be maintained at a comparatively low value. In accordance with my invention, this pressure is maintained at a low value by interposing between the cathode and anodes one or more condensing chambers which may have their temperatures regulated to different values.

My invention will be better understood from the following description when con-

sidered in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

The drawing illustrates a vapor electric device constructed in accordance with my invention. 55

This device comprises a cathode 1 located within a high pressure condensing chamber 2, anodes 3 and grids 4 mounted within recesses 5 formed in the wall of a low pressure condensing chamber 6, and an intermediate pressure chamber 7 which is connected to the high pressure chamber 2 through a pipe 8 and to the low pressure chamber 6 through a pipe 9. 65

The walls of the chambers 2, 6 and 7 are shown as surrounded by cooling chambers 10, 11 and 12 respectively. The outside walls of these chambers may be made of metal or other suitable material. Parts of these walls have been shown as cut away to facilitate an understanding of the construction. Any suitable cooling medium may be utilized to maintain the proper vapor pressure within the chambers 2, 6 and 7. For purposes of illustration, the chamber 6 has been shown as surrounded by ice and the chambers 2 and 7 have been shown as surrounded by a cooling medium, such as water, which is introduced through a pipe 13 and is discharged through a pipe 14. Valves 15 and 16 are provided for permitting the temperatures of the chambers 2 and 7 to be varied with respect to one another. 75

With this construction, the arc between the cathode 1 and the anodes 3 and 4 supplies current at the anodes without the blast of mercury vapor ordinarily inseparable from a mercury cathode, and any vapor that is not condensed in the chambers 2 and 7 is condensed in the chamber 6. The vapor pressure in the vicinity of the anodes 3 is thus independent of the arc current and can be maintained at any desired value by regulation of cooling mediums surrounding the various chambers. When this pressure is maintained at a sufficiently low value, the danger of arc back between the electrodes of the device is greatly reduced and the control of the cur- 85 90 95 100

rent by means of the grids is facilitated to such an extent that the current may be interrupted by means of the grids if desired.

The embodiment of the invention illustrated and described herein has been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the invention is susceptible of being modified to meet the different conditions encountered in its use and I therefore aim to cover by the appended claims all modifications within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A vapor electric device comprising a condensing chamber having a vaporizable cathode mounted therein, another condensing chamber, means to conduct vapor from said first-named chamber to said second-named chamber, said second-named chamber having an anode mounted therein and independently variable temperature controlling means associated with said condensing chambers, said temperature controlling means being arranged to reduce the temperature of the vapor from said cathode a predetermined amount in said first-named chamber and to reduce the temperature of said vapor a further predetermined amount in said second-named chamber, whereby the vapor pressure in the region of said anode is reduced to a predetermined low value.

2. A vapor electric device comprising a condensing chamber having a vaporizable cathode mounted therein, another condensing chamber, means to conduct vapor from said first-named chamber to said second-named chamber, said second-named chamber having an anode mounted therein, temperature controlling means associated with said condensing chambers, said temperature controlling means being arranged to maintain the vapor in said first-named condensing chamber at a predetermined temperature and to maintain the vapor in said second-named condensing chamber at a temperature lower by a predetermined amount than that of the vapor in said first-named chamber, whereby the vapor in the region of said anode is maintained at a predetermined low pressure.

3. A vapor electric device comprising a condensing chamber having a vaporizable cathode mounted therein, a second condensing chamber, a third condensing chamber having an anode mounted therein, means to conduct vapor from said first-named condensing chamber to said second chamber and from said second chamber to said third chamber, and independently variable temperature controlling means associated with said condensing chambers, said temperature controlling means being arranged to reduce the temperature of the vapor from said cathode a predetermined amount in said first-named chamber

and to reduce the temperature of said vapor further predetermined amounts in said second and third chambers respectively, whereby the vapor pressure in the region of said anode is reduced to a predetermined low value.

4. A vapor electric device comprising a condensing chamber having a vaporizable cathode mounted therein, a second condensing chamber, a third condensing chamber having an anode mounted therein, means to conduct vapor from said first-named condensing chamber to said second chamber and from said second chamber to said third chamber, and temperature controlling means associated with said condensing chambers, said temperature controlling means being arranged to maintain the vapor in said first condensing chamber at a predetermined temperature and to maintain the vapor in said second and third condensing chambers respectively at temperatures lower by predetermined amounts than that of the vapor in the next preceding chamber, whereby the vapor in the region of said anode is maintained at a predetermined low pressure.

In witness whereof, I have hereunto set my hand this 8th day of July 1926.

IRVING LANGMUIR.