Oct. 10, 1933. M. REGER 1,930,132

GASEOUS ELECTRIC DISCHARGE DEVICE

Filed Dec. 16, 1930

Fig. 1

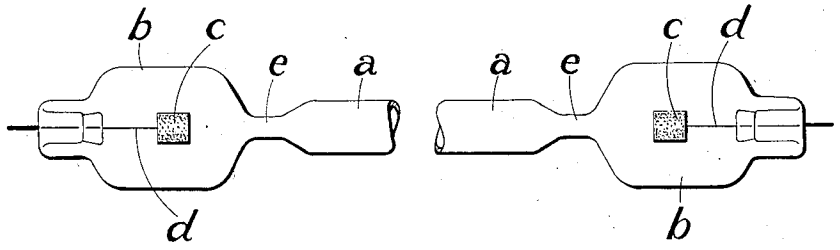


Fig 2

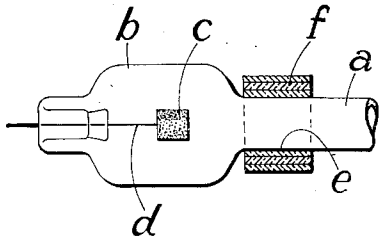
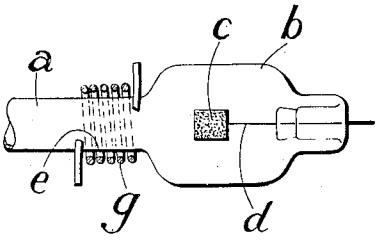


Fig. 3



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GASEOUS ELECTRIC DISCHARGE DEVICE

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9 Claims. (Cl. 176—122)

The present invention relates generally to gaseous electric discharge devices and more particularly the invention relates to such devices in which a metal vapor is used as the gaseous content, or as a component of the gaseous content.

It is well known in the art that metal vapors used in the conducting atmosphere of gaseous electric discharge devices condense very readily, this being especially true of those metal vapors whose natural state at normal temperatures is a solid such as, for example, sodium vapor. It is equally well known in the art that such condensation of metal vapor takes place in the electrode chambers since these are the coolest parts of such devices during operation thereof.

The object of this invention is to avoid condensation of metal vapor in the electrode chambers of such gaseous electric discharge devices during the operation of said devices.

The invention attains its object by maintaining those parts of the discharge container surrounding the positive column of the device and being adjacent the electrode chambers at a higher temperature than the remainder of said container and said electrode chambers. This heated passage adjacent the electrode chambers warms the gaseous filling at that part and in the electrode chambers and thus prevents the disadvantageous and disastrous condensation of the metal vapor in the electrode chambers as well as avoiding deleterious change of temperature and pressure of other discharge conducting gases present such as neon, argon, etc.

In the drawing accompanying and forming part of this specification three embodiments of the invention are shown in which,

Fig. 1 is a side elevational view of a gaseous electric discharge device illustrating one embodiment of the invention.

Fig. 2 is a side elevation view partly in section of one end of a gaseous electric discharge device illustrating another embodiment of the invention, and

Fig. 3 is a side elevational view partly in section of one end of a gaseous electric discharge device illustrating a still further embodiment of the invention.

Referring to Fig. 1 of the drawing the gaseous electric discharge device comprises a container *"a"* and electrode chambers *"b"*, said chambers *"b"* having electrode leads *"d"* sealed therein. Said device has a gaseous atmosphere consisting of a metal vapor or a mixture of a metal vapor and a discharge conducting gas or gases, said metal vapor being a solid at normal temperatures such as, for example, sodium. Any suitable electrodes may be used, the electron emitting hot electrodes of sintered oxides and metal, shown at *"c"*, being especially suitable, and said electrodes are provided with a heating element, if that well known method of starting is desired. Constricted parts *"e"* are provided between the container *"a"* surrounding the positive column and the electrode chambers *"b"* Said constricted parts *"e"* being of smaller diameter than the other portions of container *"a"*, are heated more by the passage of the discharge therethrough and affect a greater heating of the gaseous atmosphere to prevent condensation of the vapor thereof in the electrode chambers *"b"* during the operation of the device.

Referring to Fig. 2 of the drawing the part *"e"* between the container *"a"* and the electrode chambers *"b"* is maintained at a high temperature during the operation of the device by a heat insulation material *"f"* which may be, for example, of asbestos wrapped around said part *"e"* in several thicknesses so that there is less heat radiation from said part *"e"* than from the container *"a"* or the electrode chambers *"b"*.

Referring to Fig. 3 of the drawing the part *"e"* is maintained at a higher temperature than the other glass parts of the device by an electric resistance wire heater *"g"* and wound around the tube at *"e"*, which may be suitably connected to the current feeding circuit of the device.

While I have shown and described and have pointed out in the annexed claims certain novel features of the invention, it will be understood that various omissions, substitutions and changes in the forms and details of the devices illustrated and in its use and operation may be made by those skilled in the art without departing from the spirit of the invention, for example, any suitable heating or heat absorption means may be used such as a metal ring fused into and surrounding the part *"e"*, or a thick hollow ring of heat absorbing glass filled with heat absorbing gas may be fused to said part *"e"*, or said part *"e"* may be constricted by various means as by a disk or hollow plug, or any combination of the above may be used to maintain part *"e"* at a higher temperature than the container *"a"* and the electrode chambers *"b"*.

By virtue of the constructions above described, I am able, as stated above, to maintain the temperature of the gaseous filling, and particularly of the metal vapor, such as that of sodium, and

the other parts of the container by transfer of heat thereto at such temperature relative to each other that the tendency of the metal vapor to condense out of the positive column is overcome and thus undesired changes in the operating conditions of the device are avoided. The construction and method thus results in a self-regulating sodium lamp which readily adjusts itself to correct sudden changes of temperature at any part of the tube caused by cold drafts of air in the room in which the tube is operating; for example, the effect of such a draft on any part of the tube being promptly overcome by a rise in temperature of the gas in the tube to compensate for the drop in temperature on the part of the container affected by the draft to maintain stable operation of the lamp until the normal conditions of operation are resumed. This is particularly important in the case of sodium lamps, or those metals which are solid at normal temperatures, and results in keeping the metal vapor at all parts of the container under definite control which has not been the case with prior attempts to produce lamps having a vapor filling such as sodium.

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

1. In an electric discharge device, a container, electrodes sealed therein, a gas filling therein of a metal solid at normal temperatures, electrode chambers for said electrodes, and means for maintaining the parts of said container adjacent said electrode chambers at a higher temperature than other parts of said container and said electrode chambers during the operation of said device to keep the gaseous filling in all parts of said device at desired temperatures.

2. In an electric discharge device, a container, electrodes sealed therein, a gas filling therein of a metal solid at normal temperatures, electrode chambers for said electrodes, the parts of said container adjacent said electrode chambers being constricted to maintain a higher temperature thereat than at other parts of said container and said electrode chambers during the operation of said device to keep the gaseous filling in all parts of said device at desired temperature.

3. In an electric discharge device, a container, electrodes sealed therein, a gas filling therein comprising a vapor of a metal solid at normal temperatures, electrode chambers for said electrodes, the parts of said container adjacent said electrode chambers being constricted to maintain a higher temperature thereat than at other parts of said container and said electrode chambers during the operation of said device to keep the metal gas filling at a non-condensing temperature.

4. In an electric discharge device, a container, electrodes sealed therein, a gas filling therein comprising a mixture of a metal vapor of a metal solid at normal temperatures and a gas, electrode chambers for said electrodes, the parts of said container adjacent said electrode chambers being heat insulated to maintain a higher temperature thereat than at other parts of said container and said electrode chambers during the operation of said device to keep the metal gas filling at a non-condensing temperature.

5. In an electric discharge device, a container, electrodes sealed therein, a gas filling therein comprising a mixture of a vapor of a metal solid at normal temperatures and a gas, electrode chambers for said electrodes, and means for maintaining the parts of said container adjacent said electrode chambers at a higher temperature than other parts of said container and said electrode chambers during the operation of said device to keep the metal gas filling at a non-condensing temperature.

6. In an electric discharge device adapted for operation on direct current, a container, electrodes sealed therein, a gas filling therein comprising a gas mixture, electrode chambers for said electrodes, the part of said container adjacent one of said electrode chambers being at a higher temperature than other parts of said container and said electrode chambers during the operation of said device.

7. In an electric discharge device adapted for operation on direct current, a container, electrodes sealed therein, a gas filling therein comprising a gas mixture, electrode chambers for said electrodes, the part of said container adjacent one of said electrode chambers being constricted.

8. In an electric discharge device adapted for operation on direct current, a container, electrodes sealed therein, a gas filling therein comprising a gas mixture, electrode chambers for said electrodes, the part of said container adjacent one of said electrode chambers being heat insulated.

9. In an electric discharge device adapted for operation on direct current, a container, electrodes sealed therein, a gas filling therein comprising a gas mixture, electrode chambers for said electrodes, the part of said container adjacent one of said electrode chambers being heated.

MARTIN REGER.