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GASEOUS ELECTRIC DISCHARGE DEVICE

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Fig. 1

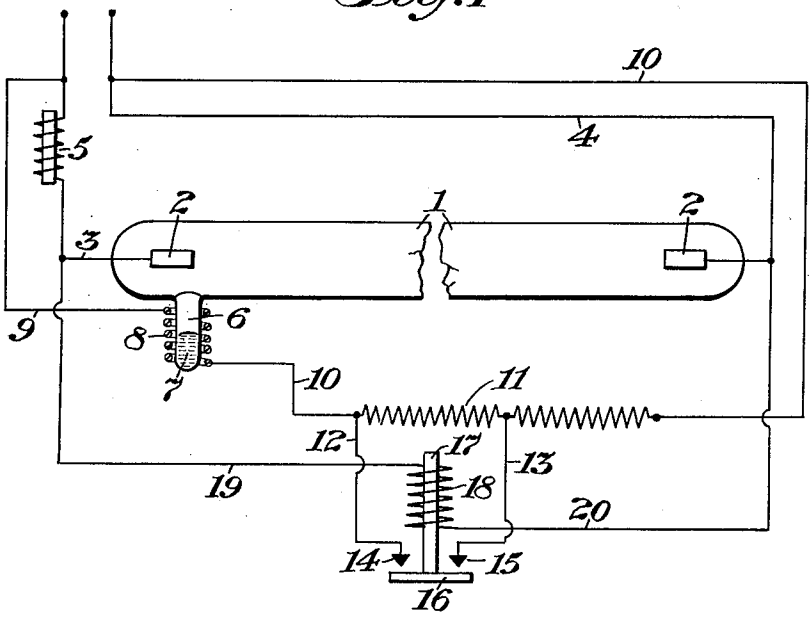
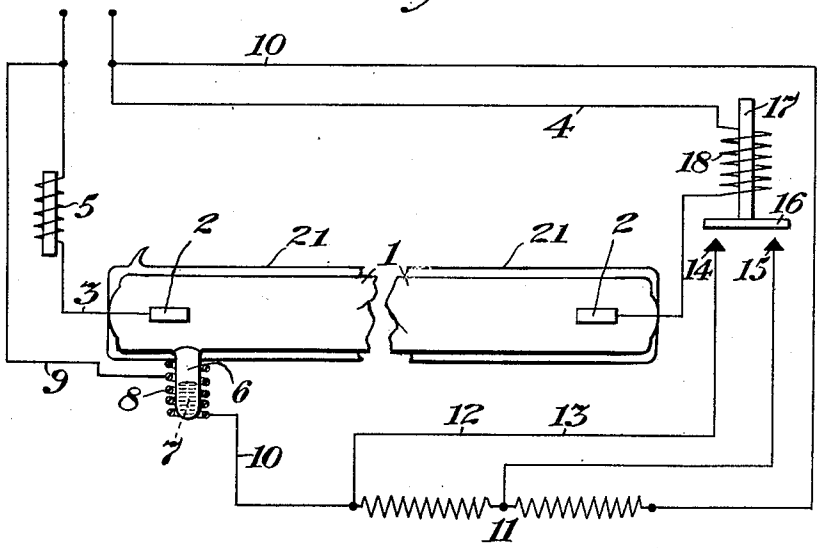


Fig. 2



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GASEOUS ELECTRIC DISCHARGE DEVICE

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10 Claims. (Cl. 176—125)

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

It is well known that electric discharge devices filled with sodium and caesium vapor have an extremely low operating factor and emit a light possessing a pleasing color. For example, an electric discharge in sodium vapor emits an intensive chrome yellow light which has hitherto been available only in minimum intensity by using a yellow glass container for an electric discharge white in color. It is equally well known that metal vapors whether used as the entire gaseous content or only as a component part thereof condense readily, lowering the vapor pressure in the discharge device with a consequent impairment of the efficiency of such device.

The object of this invention is to maintain a constant vapor pressure in an electric discharge device by controlling the condensation of the metal vapors present therein. Another object of the invention is to make such discharge devices operate efficiently independent of changes in the outside temperature. Still further objects and advantages will be apparent from the following particular description and from the claims.

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

Fig. 1 is a side elevational view of the new and novel electric discharge device with one embodiment of the heating circuit being shown schematically.

Fig. 2 is a side elevational view of the new and novel electric discharge device with an alternative embodiment of the heating circuit being shown schematically.

Like numbers denote like parts in both views of the device.

Referring to Fig. 1 the invention comprises a container 1 having electrodes 2, 2 sealed therein at each end thereof. Current leads 3, 4 of electrodes 2, 2 are connected either directly or through a transformer to a source of energy of desired potential and the usual choke coil 5 is connected in current lead 3. An offset chamber 6 is fused to container 1 at any convenient part thereof, said chamber 6 containing a quantity of vaporizable metal 7 such as mercury, sodium, potassium, cadmium, zinc, caesium or alloys of these metals. Container 1 may contain discharge conducting gases well known in the art, such as argon, krypton, neon, nitrogen, carbon dioxide, etc. or mixtures thereof. Said offset tube 6 is surrounded by a heating resistance 8 one part of which is connected by lead 9 to current lead 3, and the other part of which is connected by lead 10 to current lead 4. A resistance 11 is connected into said lead 10 having one part thereof connected to contacts 14, 15 by leads 12, 13. Said contacts are bridged by conducting plate 16 attached to core 17 of electro-magnet 17—18 the winding 18 of which is connected to current leads 3, 4 by leads 19, 20. With normal operating conditions present in container 1 the current flow through heater element 8 is so measured that offset tube 6 is maintained at a temperature of sufficient gradient to keep a constant metal vapor pressure present in the tube. In the case of a discharge device having a filling of helium and sodium with a sodium vapor pressure of 0.1 to 0.2 the offset chamber containing the sodium must be heated in the order of 350°–375° C. It is essential that the walls of container 1 be kept at a higher temperature than the offset chamber 6, in the above case, for example, in the order of 380°–450° C., in order that the sodium vapor pressure may be determined by the constantly controlled temperature of the offset chamber 6 rather than the temperature of the container walls to prevent a drop in the sodium vapor pressure which would be disastrous to the efficiency of operation and brightness of emitted light of the discharge device.

The walls of container 1 may be maintained at the necessary temperature by the use of sintered oxide electrodes disclosed in the application of Ewest and Pirani, Serial Number 377,044, instead of the usual metal electrodes, said oxide electrodes operate red hot and consist of a sintered mixture of finely divided tungsten or nickel and electron emitting oxides and permit the use of high current densities in the discharge device thus increasing the heat of the discharge. Hitherto it was thought impossible to use oxide electrodes in electric discharge devices containing alkali metal vapors, but we have proven by experiment that such thought is erroneous.

A still further manner in which the walls of container 1 may be maintained at the necessary temperature is by making said walls or desired portions thereof of a glass such as Schott glass BG 9 and BG 10 which will absorb the infra-red or heat rays, emitted by the discharge in the con-

tainer 1, and thus maintain the gaseous discharge even at very low outside temperature. Said glasses BG 9 and BG 10 are listed in Bulletin #4213 of the Jenaer Glaswerke Schott and Gen., the title of the bulletin being "Jenaer Color and Filter Glass for Scientific and Technical Uses," published in April, 1929. BG 10 glass has the following composition:

		Percent	
Silicic anhydride	(SiO_2)	66.12	
Boracic acid	(B_2O_3)	3.60	
Aluminum oxide	(Al_2O_3)	4.09	
Ferric oxide	(Fe_2O_3)	0.18	
Ferrous oxide	(FeO)	1.00	
Soda	(Na_2O)	9.95	10.24%
Potassium monoxide	(K_2O)	0.29	
Zinc oxide	(ZnO)	14.69	
		99.92	

Where desired said container is double-walled having walls 1 and 21 as shown in Fig. 2 and the space between the walls 1 and 21 is evacuated, or filled with a gas which absorbs the infra-red rays, such gas is, for example, nitrogen or argon and particularly carbon dioxide, or water vapor.

As the temperature of the offset chamber 6 determines the metal vapor pressure present in container 1 it follows that a drop in temperature of said chamber 6, caused by a change in the surrounding atmosphere, will result in a drop in vapor pressure and therewith a change in the potential and current intensity of the discharge device. Whereas in an electric discharge device with a filling consisting of a discharge conducting common gas a reduction in gas pressure causes a reduction in potential and an increase in current intensity, in electric discharge devices with a filling of a mixture of metal vapor and a rare gas a reduction in the metal vapor pressure causes an increase in potential and a decrease in current intensity. Thus the heating circuit shown in Fig. 1 is made dependent on changes in potential caused by changes in the outside temperature to increase or decrease the heating of offset chamber 6 by connecting the electro-magnet circuit 16, 17, 18 in parallel with electrodes 2, 2. A drop in metal vapor pressure, caused by a drop in the outside temperature, increases the potential. Due to the heavier current flowing through coil 18 the core 17 is raised and plate 16 bridges contacts 14, 15 short circuiting one side of resistance 11. With the heater element 8 then connected in series only with a part of resistance 11, chamber 6 is strongly heated and metal vapor is evolved more rapidly. As soon as normal metal vapor pressure is restored to the device the potential becomes normal and core 17 falls back to its original position putting back in the circuit the short circuited part of resistance 11. Heater element 8 is then only slightly energized and the evolution of vapor drops to normal. In the course of time should the vapor pressure drop again, the operation repeats itself.

In the embodiment shown in Fig. 2 the electromagnet 16, 17, 18 is connected in series with one of the electrodes 2 so that coil 18 is connected directly to current lead 4. One part of resistance 11 is again connected by leads 12, 13 to contacts 14, 15. In this case a decrease in vapor pressure causes a decrease in current intensity and core 17 drops until plate 16 bridges contacts 14, 15 short circuiting part of resistance 11 to cause a stronger heating of chamber 6 and a consequent increase in the rate of vapor evolution to restore normal vapor pressure to the device.

The important discovery set forth above that by virtue of the use of oxide electrodes in devices such as shown at 1, the tube can be run at higher current densities and the wall of the tube maintained at a temperature such that the metal vapor does not condense at the surrounding temperatures ordinarily met with in practice results in a new tube of simple construction comprising a sealed container, having oxide electrodes which are non-sputtering and non-disintegrating in the presence of the rare, or common, gas or metal vapor fillings of such tubes, used either alone or in combination, and thus the use of the offset chamber 6 and the attendant vapor pressure regulating mechanism can be dispensed with, although it will be understood that in extreme cases such an arrangement can be used with our new oxide electrode lamp or the heat absorbing glass wall of BG 9 glass, or the double walled container construction may be used therewith, or said constructions may be used alone or in combination with each other to meet the particular needs of the service of the lamp, in the lighting field, or the industrial use of the lamp in photochemistry, where operations are carried on at normal or extreme high or low temperatures and constant operation of the lamp is required.

While we have shown, described and have pointed out in the annexed claims certain new and novel features of the device it will be understood that various omissions, substitutions and changes in the forms and details of the device may be made by those skilled in the art without departing from the broad spirit and scope of the invention.

What we 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 gaseous atmosphere therein, an offset chamber fused to said container containing a material vaporizable by heat, heating means connected in parallel to said device for heating said chamber, a current limiting resistance connected in series with said heating means, and means controlled by current flowing in said device to cut into and out of circuit a part of said resistance.

2. In an electric discharge device, a container, electrodes sealed therein, an offset chamber fused to said container containing a material vaporizable by heat, heating means connected in parallel to said device for heating said chamber, a current limiting resistance connected in series with said heating means, and means controlled by current flowing in said device to cut into and out of circuit a part of said resistance.

3. In an electric discharge device, a container, electrodes sealed therein, an offset chamber fused to said container containing a material vaporizable by heat, heating means connected in parallel to said device for heating said chamber, a current limiting resistance connected in series with said heating means, and means connected in parallel with said device controlled by the potential of the current flowing in said device to cut into and out of circuit a part of said resistance.

4. In an electric discharge device, a container, electrodes sealed therein, an offset chamber fused to said container containing a material vaporizable by heat, heating means connected in parallel to said device for heating said chamber, a current limiting resistance connected in series with said heating means, and means connected in se-

ries with said device controlled by the intensity of the current flowing in said device to cut into and out of circuit a part of said resistance.

5. In an electric discharge device, a container, electrodes sealed therein, an offset chamber fused to said container containing a material vaporizable by heat, means to heat said chamber, and means to maintain said container at a higher temperature than said chamber.

6. In an electric discharge device, a container, electrodes sealed therein, an offset chamber fused to said container containing a material vaporizable by heat, means to heat said chamber, said electrodes comprise a sintered mixture of metal and oxide particles for maintaining said container at a higher temperature than said chamber.

7. In an electric discharge device, a container, electrodes sealed therein, an offset chamber fused to said container containing a material vaporizable by heat, means to heat said chamber, said container being of heat absorbing glass to maintain said container at a higher temperature than said chamber.

8. In an electric discharge device, a container, electrodes sealed therein, an offset chamber fused to said container containing a material vaporizable by heat, means to heat said chamber, said container being double walled, the space between said walls being evacuated to maintain said container at a higher temperature than said chamber.

9. In an electric discharge device, a container, electrodes sealed therein, an offset chamber fused to said container containing a material vaporizable by heat, means to heat said chamber, said container being double walled, the space between said walls being filled with a heat absorbing atmosphere to maintain said container at a higher temperature than said chamber.

10. The method of controlling the gas pressure of a gaseous electric discharge device having a container and a chamber fused to said container containing a material vaporizable by heat which consists in maintaining said container at a higher temperature than said chamber and in regulating the temperature of said chamber by means controlled by current flowing in said device.

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