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VAPOR OR GASEOUS ARC DISCHARGE LAMP

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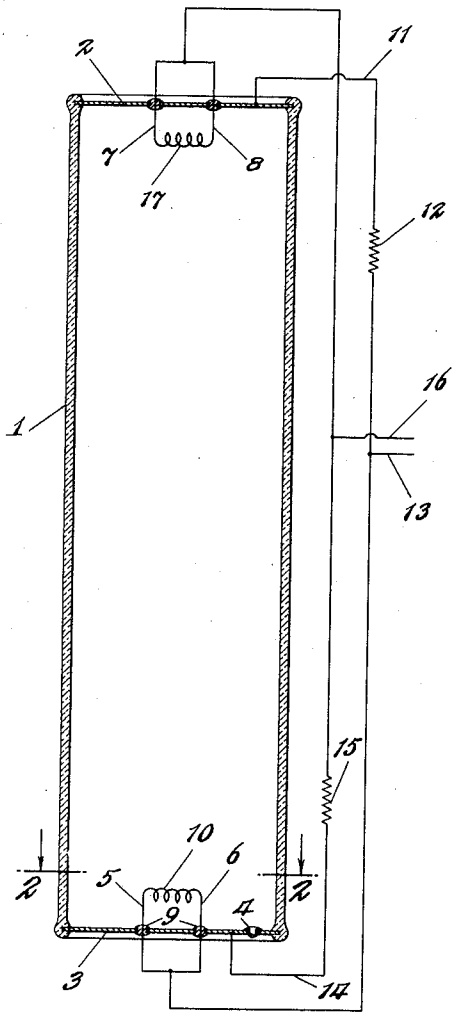


Fig. 1.

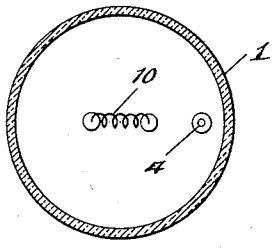


Fig. 2.

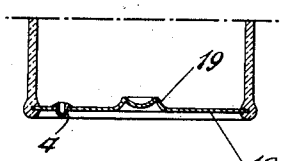


Fig. 3.

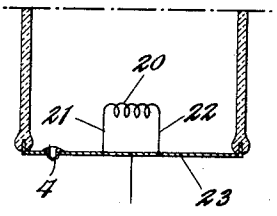


Fig. 4.

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VAPOR OR GASEOUS ARC DISCHARGE LAMP

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7 Claims. (Cl. 176—122)

This invention relates to electric lamps and more particularly to lamps of the gaseous or vapor arc discharge type.

An object of the invention is to provide an improved form of arc discharge lamp of the type employing an ionizable medium at relatively high pressure.

Another object is to provide an improved form of arc discharge lamp whereby the starting and restarting time of the lamp is materially reduced.

A feature of the invention relates to a closure member for a high pressure vapor or arc discharge lamp, which closure member is adapted to act also as a starting electrode.

Another feature of the invention relates to an improved type of tubular arc discharge lamp which is substantially free interiorly from pockets where the condensed vapor filling of the lamp can be trapped.

Another feature relates to a high pressure vapor arc discharge lamp which is designed to withstand very high temperatures without the necessity of employing graded seals between the lead-in wires and the enclosing envelope.

A further feature relates to an improved form of electrode structure for high pressure vapor arc discharge lamps.

A still further feature relates to the novel organization, arrangement and relative location of parts which go to make up an efficient lamp of the high pressure vapor arc discharge type.

Other features and advantages not specifically enumerated will become apparent after a consideration of the following descriptions and the appended claims.

While the invention will be described herein as embodied in one particular type of vapor arc lamp it will be understood that the invention in certain of its aspects is equally well applicable to other types of gas or vapor lamps. Furthermore while the drawing is essentially diagrammatic and only those parts of an arc lamp are shown to enable the inventive concept to be understood, this is done merely for explanatory purposes and not by way of limitation. Accordingly in the drawing:

Fig. 1 is a diagrammatic view partly in section, of an arc lamp embodying features of the invention.

Fig. 2 is a sectional view of Fig. 1 taken along line 2—2.

Fig. 3 is a sectional view of a modification of the invention.

Fig. 4 is a sectional view of a further modification of the invention.

Referring more particularly to Fig. 1 of the drawing, the numeral 1 designates any well known kind of enclosing envelope such as is ordinarily employed in arc discharge lamps. Preferably, and in accordance with the invention the envelope 1 is tubular in shape and is of refractory glass such as "combustion" or 172AJ glass tubing of the required inside diameter which of course will vary with the particular power for which the lamp is designed. 172AJ is a brosilicate glass which softens at 920° C. The end of the tubular envelope is closed by discs 2, 3 of a metal or metals having substantially the same coefficient of expansion as that of the glass 1. Thus for example if the glass 1 is of that variety which is known as 705AJ, which is a glass having a softening point of 700° C. and a coefficient of expansion of 46×10^{-7} per degree centigrade the discs 2, 3 may be of an alloy containing approximately 54% iron, 28% nickel and 18% cobalt, sold under the name "Fernico". While any well known method of sealing the metal disc to the glass tube may be employed, it is preferred to first raise the disc to a sufficiently high temperature so that when the glass tube is placed in contact with the disc, either the weight of the tube itself or a separate weight, presses the tube into contact with the heated disc which causes the wall of the tube to flow and wet the disc. Preferably the seal is subjected to an annealing operation at a suitable temperature. The disc 3 is also provided with an opening 4 into which is sealed a glass tubulation by means of which the lamp may be exhausted and filled with the desired vapors and gases. After the evacuation and filling of the lamp, preferably the exhaust tubulation is tipped off as closely as possible to the disc 3 so that it is as nearly as possible flush with the surface of the disc. Each of the metal discs is provided with a pair of perforations into which are insulatingly sealed the electrode lead-in and support wires 5, 6 as for example by means of glass beads 9. Supported on the wires 5, 6 is an electrode 10 of any well known form such as is ordinarily used in vapor or gaseous arc lamps. Preferably electrode 10 consists of a refractory metal wire such as tungsten or the like provided over its entire surface or a part thereof with an electron emissive coating containing for example an oxide or mixture of oxides of the alkaline earth metals.

If desired the lamp may be enclosed within a suitable heat conserving envelope and may be provided with any well known type of contact base whereby it may be inserted in circuit. For a detailed description of these latter features refer-

ence may be had to application Serial No. 758,405 filed December 20th, 1934. Preferably the envelope 1 is provided with a filling of an ionizable medium which at the normal operating temperature of the lamp is at a relatively high pressure for example between 0.5 and 1.5 atmospheres so that the discharge between the electrodes assumes the characteristics of an arc discharge. One kind of ionizable medium that has been found practical for this purpose is mercury vapor which, after the lamp is exhausted, may be introduced into the envelope in any well known manner either in the form of mercury vapor or in the form of liquid mercury it being understood that just the right amount of mercury is introduced so that at the designed operating temperature of the lamp a predetermined vapor pressure is produced. If desired a small quantity of an inert gas or mixture of gases such as argon, neon and the like may be introduced into the envelope to facilitate starting of the lamp. One of the serious limitations of lamps of the high pressure vapor or gaseous arc type, particularly where the electrodes are not brought to emitting temperature by separate heater means but are rendered emissive by the passage therethrough of the discharge current itself, is the time required to start and restart the arc. In this latter type of lamp, when a voltage is impressed across the electrodes, the high pressure arc discharge does not occur immediately but is preceded by a low pressure positive column glow discharge. During this warming up period the droplets of condensed mercury on the glass walls evaporate from one spot after another as the glass walls come up to temperature. When this condition is reached the arc is confined to a restricted area of each electrode. In restarting we have almost the reverse condition, we have to wait for the mercury to condense from atmospheric down to a few mm. In either case, however, the metal end caps aid as they will heat and cool more quickly and will distribute the temperature over their surface more uniformly eliminating the cool pockets. I have found that one of the important causes of increase of starting and restarting time for lamps of this type is that with the usual type of electrode chamber which is generally hemispherical, there exist pockets in back of each electrode where the mercury vapor condenses, thus preventing the attainment of the proper or steady vapor pressure within the lamp. Furthermore in those lamps employing graded seals between the electrode lead-in wires and the lamp envelope it is usually necessary to protect the softer glasses of the seal from the heat of the arc and from the heat of the electrode thus tending to facilitate the condensation of mercury in back of the electrode unless the electrode chamber is very carefully and accurately designed with respect to the position and design of the electrode itself. By employing the flat metal end caps such as those disclosed in the drawing the tendency of the mercury vapor to condense in back of the electrode is very substantially reduced with the result that the lamp is more uniform in operation and the chance of lamp failure due to broken seals is also materially reduced. This is probably due to the fact that the metal end caps being of good heat conductive material and being substantially flat, maintain the end portions of the lamp at a substantially uniform temperature. Furthermore with the flat end caps there are no crevices or pockets wherein condensed vapor can be trapped.

While the above-described lamp may be used in any well known circuit preferably, although not necessarily, the end caps may be connected in circuit so that each cap acts as an auxiliary starting electrode to quicken even further, the starting and restarting of the arc discharge. Thus as indicated diagrammatically in Fig. 1 the cap 2 is connected by wire 11 through a resistance or impedance 12 to one side 13 of a suitable current supply source, and likewise cap 3 is connected by wire 14 through a resistance or impedance 15 to the other side 16 of the supply source. The electrodes 10 and 17 however may be connected directly across the supply wires 13 and 16. With this arrangement an initial discharge is produced between electrode 10 and cap 3, and also between electrode 17 and cap 2, which discharges act in conjunction with the usual glow discharge between the electrodes 10 and 17 to accelerate the starting and restarting of the arc discharge between the electrodes. When the arc is struck between the electrodes, because of the relatively low impedance of the arc path between the electrodes the initial or auxiliary discharges between the electrodes and their respective end caps may be extinguished.

Instead of insulating the electrodes from the end caps as described, these electrodes may be conductively connected to the end caps. Thus as shown in Fig. 3 the end cap 18 corresponding to the end cap 3 of Fig. 1 is provided with a central embossed or struck-up cup-shaped portion 19 which is provided with a coating or filling of the electronically emissive material such as a mixture of the alkaline earth metal oxides. It will be understood of course that if desired a similar end cap with a central integral cup-shaped portion may be provided at the other end of the lamp corresponding to the cap 2 and electrode 17 of Fig. 1.

Instead of making the electrode integral with the end cap as in Fig. 3, the electrode may be in the form of a wire similar to the electrode of Fig. 1 but conductively connected to the end cap. Thus as shown diagrammatically in Fig. 4 the electrode 20 corresponding to the electrode 19 of Fig. 3 and to electrode 10 of Fig. 1 is fastened as for example by having its free ends welded to the flat metal end cap 23, it being understood that if desired a similar electrode conductively connected to a corresponding end cap may be provided for the opposite end of the lamp. In order to conserve heat the outer surfaces of the end caps shown in Figs. 1 to 4 may be silver plated, if desired.

While specific structures and embodiments have been disclosed herein it will be understood that various changes may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In combination a lamp of the gaseous discharge type, comprising an enclosing envelope of glass, said envelope containing a condensible ionizable vapor, a substantially flat metal disc sealed directly to each end of the envelope to close the same, an electrode mounted on each disc but insulated therefrom, and an electrical connection for causing the disc at one end to act as a starting electrode with the adjacent electrode on which it is mounted.

2. In a lamp of the vapor arc discharge type, the combination of an enclosing envelope of combustion glass tubing, said envelope containing a condensible conductive vapor, closure members for the ends of said envelope, said members being

in the form of flat metal discs directly sealed to the ends of the envelope, an exhaust tubulation passing through one of said discs and tipped off substantially flush with the surface of said disc, and an electrode carried by said disc.

3. In a lamp of the high pressure vapor arc discharge type, the combination of an enclosing envelope of hard glass, closure members for each end of the envelope said members being in the form of substantially flat metal alloy discs directly sealed to the ends of the envelope said disc containing approximately 54% iron, 28% nickel and 18% cobalt, an exhaust tubulation passing through one of said discs and tipped off substantially flush with the surface thereof, and an electrode carried by each of said discs.

4. In combination a lamp of the high pressure vapor arc discharge type, comprising an enclosing envelope of glass tubing, substantially flat metal caps sealed directly to the ends of the envelope, main arc sustaining electrodes carried by said caps but insulated therefrom, and circuit arrangements for causing each of said caps to serve as an auxiliary starting electrode with the adjacent main electrode.

5. An electric lamp of the gaseous discharge type comprising an enclosing envelope containing a condensible ionizable medium for sustaining a discharge and having sealed into opposite ends metal end caps extending across substantially the entire width of the envelope to close off the same, a pair of main discharge-sustaining electrodes at least one of said electrodes having an electrical connecting wire insulatingly sealed through an adjacent one of said end caps, and a connection for causing said one of said end caps acting as an auxiliary starting electrode with said one of said main electrodes.

6. An electric lamp of the gaseous discharge type comprising an elongated tubular envelope containing a condensible ionizable medium for sustaining a discharge and having substantially flat metal end caps sealed into opposite ends thereof and extending across the entire width of the envelope to close off the same a pair of electrodes, each of said electrodes comprising a coiled tungsten wire coated with at least one of the alkaline earth oxides, means to support said electrodes from said end caps, at least one of said electrodes being electrically connected to an associated end cap.

7. In a lamp of the vapor arc discharge type, the combination of an enclosing envelope of glass tubing, said envelope containing a condensible conductive vapor, closure members for the ends of said envelope, said members being in the form of substantially flat metal discs directly sealed to the ends of the envelope, an exhaust tubulation passing through one of said discs and tipped off substantially flush with the surface of said disc, and an electrode carried by said disc.

JAMES L. COX.