

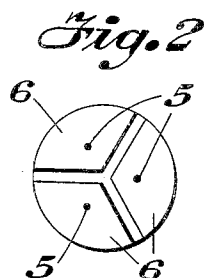
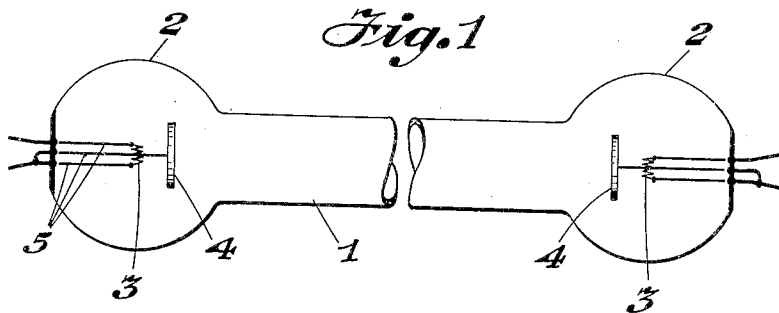
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GASEOUS ELECTRIC DISCHARGE DEVICE

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GASEOUS ELECTRIC DISCHARGE DEVICE

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3 Claims. (Cl. 176—126)

The present invention relates to gaseous electric discharge devices generally.

In gaseous electric discharge devices which operate on alternating current it is possible to use a thermionic electrode which serves both as cathode and as anode though the life of such electrode is relatively short due to the intense electron bombardment thereof when the electrode serves as the anode. A hollow, cylindrical cold electrode surrounding the thermionic electrode and which is electrically connected to the thermionic electrode to form an electrode unit is useful in reducing the intensity of the electron bombardment of the thermionic electrode. When the electrode unit acts as the anode, which it does for one-half of each cycle, a large part of the current flows through the cylindrical electrode element which substantially reduces the electron bombardment of the thermionic electrode element of the electrode unit and when the electrode unit acts as the cathode, which it does on the other half cycle, the greater part of the current flows through the thermionic electrode element. The life of the thermionic electrode element in such electrode unit though longer than when the thermionic electrode is used alone is not as long as could be desired. Another disadvantage of this electrode structure is that the cylindrical electrode must extend beyond the thermionic electrode in the direction of the discharge incident at the thermionic electrode in order to be effective in reducing the intensity of the electron bombardment of the thermionic electrode and when the electrode unit is charged negatively the extending part of the cylindrical electrode compresses the discharge to the thermionic electrode which increases the discharge voltage.

The object of the present invention is to provide means in a gaseous electric discharge lamp device having an electrode unit comprising a thermionic electrode element and a cold electrode element which electrode unit serves alternately as anode and as cathode whereby the intensity of the electron bombardment of the thermionic electrode element is substantially reduced without affecting the operating characteristics of the discharge in the device. Another object of the invention is to provide an efficient lamp of this type having a long operating life. Still further objects and advantages attaching to the device and to its use and operation will be apparent to those skilled in the art from the following particular description.

In accordance with these objects the inven-

tion comprises a plate electrode, such as a disc electrode the diameter of which is considerably smaller than the diameter of the part of the lamp container surrounding said disc electrode and which is mounted adjacent said thermionic electrode and in the path of the discharge incident at said thermionic electrode. Said disc electrode is electrically connected to said thermionic electrode and operates as described above in connection with the cylindrical electrode. I have demonstrated that an electrode of this type is effective in reducing the electron bombardment of the thermionic cathode to a minimum and does not compress the discharge nor increase the operating voltage of the discharge. When the electrode unit acts as the anode substantially all of the current flows through the disc electrode.

Low gas pressure, such as pressures lower than 1.5 mm., are successfully used in my new and novel lamp device without reducing the life of the thermionic electrode and the efficiency of the lamp unit is increased by using gas pressures of this order. The invention is particularly valuable in connection with gaseous electric discharge lamp devices using large currents, more than 1 ampere for example, since the thermionic electrode is protected from the intense electronic bombardment characteristic of such devices.

In the drawing accompanying and forming part of this specification an embodiment of the invention is shown in which,

Fig. 1 is a schematic view of a gaseous electric discharge lamp device embodying the invention and

Fig. 2 is a detail view of one of the elements of the device illustrated in Fig. 1.

Referring to the drawing the gaseous electric discharge lamp device comprises an elongated, tubular container 1 having a gas therein, such as neon. Said container 1 has a spherical electrode chamber 2 at each end thereof and a thermionic electrode 3 is mounted in each of said electrode chambers 2. Said electrodes 3 are electron emitting when heated and consist of a metal filament, such as a tungsten filament, having another filament, such as a nickel or a tungsten filament, wound around said first named filament and a coating of electron emitting material, such as barium oxide, is applied to said electrodes. Said electrodes 3 are wound in the form of a helix. A disc shaped electrode 4 is mounted in each of said electrode chambers 2 and in the discharge path between said electron emitting electrodes 3. The electrodes 4 are perpendicular to

the longitudinal axis of said container 1. The diameter of said disc electrodes 4 is considerably less than the diameter of the part of the electrode chamber 2 cut by the plane in which said disc electrode 4 is located and said disc electrode 4 is separated a considerable distance from the mouth of the elongated tubular part of the container 1. The discharge incident at said electrodes 3 during the operation of the device is not compressed by said electrodes 4.

Each of the current leads 5 of the electrodes 3 and 4 is connected to a segment 6 of a disc shaped element (Fig. 2) fused into said electrode chamber 2. The segments 6 of the disc shaped element are of electrically conducting material, such as chrome-iron, and are bound together and electrically insulated from each other by glass strips. The current lead of the electrode 4 is connected to one of the current leads of the electrode 3. In the drawing this connection is shown as being made outside the container 1 though it will be understood that this connection is made inside said container 1 when desired.

Take, for example, a gaseous electric discharge lamp device having the following dimensions:— diameter of tubular part of container 40 mm., length of said tubular part 100 cm., diameter of the electrode chambers 90 mm., diameter of the disc electrode 30 mm., diameter of the electron emitting electrode 6 mm., length of said electron emitting electrode 10 mm., distance between said disc electrode and said electron emitting electrode 12 mm., distance between the anode and the mouth of the tubular container part 15 mm. The lamp has a gas filling of neon at a pressure of 0.5 mm. When a current of 3 amperes is passed through the lamp device the efficiency is 2.1 International candles per watt. When the gas pressure is increased slightly, up to 0.7 mm. for example, the efficiency decreases slightly, 1.8 International candles per watt at this slightly increased pressure. The efficiency of the lamp is considerably greater at these gas pressures than at higher pressures. At a gas pressure of 1.8 mm., for example, the efficiency is 1.7 International candles per watt. The use of low gas pressures in the lamp gives higher efficiencies and the present invention makes the use of such pressures possible while still retaining a long useful life of the thermionic electrodes of the lamp device as pointed out above. Lamps having the above structure have an operating life of 2000 hours or more.

While we 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 device illustrated and in its use and operation may be made by those skilled in the art without departing from the spirit and scope of the invention, for example, other types of thermionic electrodes, such as a Hull cathode, well known in the art, are used when desired.

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

1. An electric discharge device comprising an elongated tubular container having a spherical electrode chamber at each end thereof, electrodes sealed therein, a gaseous atmosphere therein at a pressure less than 1.5 mm., one of said electrodes comprising a thermionic electrode and a disc

electrode electrically connected to said thermionic electrode and being mounted in one of said electrode chambers, said disc electrode being mounted adjacent said thermionic electrode, transverse to the longitudinal axis of the tubular part of said container and in the path of the discharge incident at said thermionic electrode, the diameter of said electrode chambers being more than twice that of the tubular part of said container, the diameter of said disc electrode being substantially less than that of said tubular container part and the distance between said disc electrode and the mouth of the tubular part of the container being at least one sixth the diameter of said spherical electrode chamber.

2. An alternating current electric discharge lamp device comprising an elongated tubular container having a spherical electrode chamber at each end thereof, a plurality of electrodes sealed therein, a fixed gaseous atmosphere therein at a pressure of less than 1.5 mm., said electrodes being mounted in pairs, one pair in each of said electrode chambers, each of said pairs of electrodes comprising a thermionic electrode and a disc electrode electrically connected to said thermionic electrode, said disc electrode being mounted adjacent said thermionic electrode, transverse to the longitudinal axis of the tubular part of said container and in the path of the discharge incident at said thermionic electrode, each of said pairs of electrodes serving alternately as anode and as cathode, the diameter of the tubular part of said container being 40 mm. and the length thereof being 100 cm., the diameter of said spherical electrode chambers being 90 mm., the diameter of said disc electrode being 30 mm., the diameter of said thermionic electrode being 6 mm. and the length thereof 10 mm., the distance between said disc electrode and said thermionic electrode being 12 mm. and the distance between said disc electrode and the mouth of the tubular part of said container being 15 mm.

3. An alternating current electric discharge lamp device comprising an elongated tubular container having a spherical electrode chamber at each end thereof, a plurality of electrodes sealed therein, a fixed gaseous atmosphere therein at a pressure of 0.5 mm., said electrodes being mounted in pairs, one pair in each of said electrode chambers, each of said pairs of electrodes comprising a thermionic electrode and a disc electrode electrically connected to said thermionic electrode, said disc electrode being mounted adjacent said thermionic electrode, transverse to the longitudinal axis of the tubular part of said container and in the path of the discharge incident at said thermionic electrode, each of said pairs of electrodes serving alternately as anode and as cathode, the diameter of the tubular part of said container being 40 mm. and the length thereof being 100 cm., the diameter of said spherical electrode chambers being 90 mm., the diameter of said disc electrode being 30 mm., the diameter of said thermionic electrode being 6 mm. and the length thereof 10 mm., the distance between said disc electrode and said thermionic electrode being 12 mm. and the distance between said disc electrode and the mouth of the tubular part of said container being 15 mm.

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