April 6, 1937. H. W. H. WARREN ET AL 2,076,286

ELECTRIC GASEOUS DISCHARGE DEVICE

Filed Sept. 9, 1935

Fig. 1

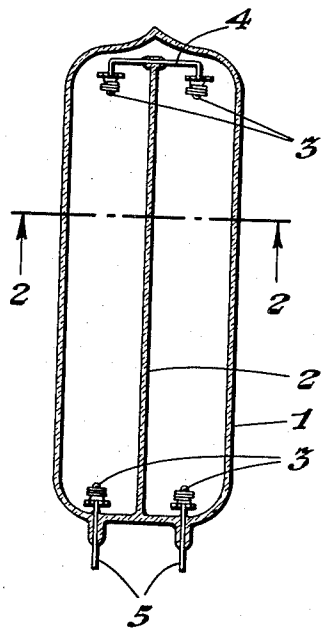


Fig. 3

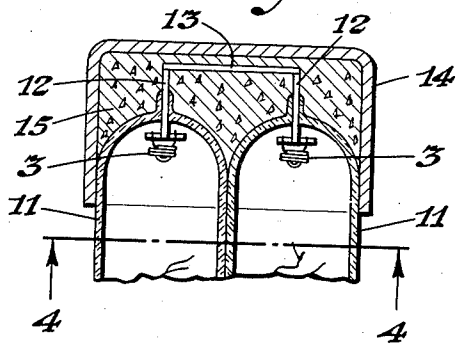


Fig. 4

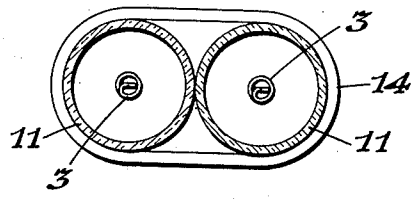


Fig. 2

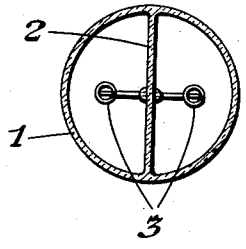


Fig. 5

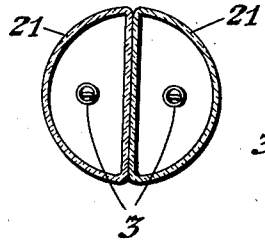
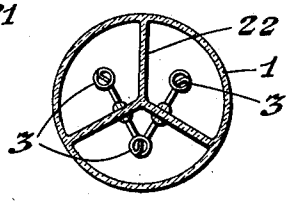


Fig. 6



INVENTORS

Henry William Hugh Warren

Leonard John Davies

John Henry Mitchell

BY Harry E. Dunham

ATTORNEY

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ELECTRIC GASEOUS DISCHARGE DEVICE

Henry W. H. Warren, Coventry, and Leonard J. Davies and John H. Mitchell, Rugby, England, assignors to General Electric Company, a corporation of New York

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3 Claims. (Cl. 176—122)

The present invention relates to electric gaseous discharge devices generally, and in particular to devices operating with a relatively high pressure metal vapor.

A particular object of the invention is to provide a gaseous discharge device of the high intensity type which will have both inleads at one end of the device. Another object of the invention is to provide a device of this type which will operate on polyphase current. Still other objects and advantages of the invention will appear from the following detailed specification or from an inspection of the accompanying drawing.

The invention consists in the new and novel structure hereinafter set forth and claimed.

The newly developed high intensity lamps which operate in a high pressure of metallic vapor, such as mercury, mercury and cadmium and the like usually have activated self-heated cathodes and a low pressure filling of rare gas. These lamps ordinarily consist of an inner lamp or tube which carries the discharge and an outer envelope in which the inner lamp is housed. The space between the outer envelope and the tube is usually either evacuated or filled with a low pressure gas, in which case the pressure is sufficiently high to prevent arcing across any of the leads within this envelope. In lamps of the foregoing design the tube is usually so constructed that the input leads to the cathodes are brought out at opposite extremities of the lamp. Moreover, in the case of a normal 400 watt lamp the arc length is some 16 cms. giving an overall length of lamp when mounted in the outer jacket and capped of about 32 to 33 cms. In many cases it is desirable to reduce this overall length of lamp by reducing the necessary length of the inner tube. Any shortening of the lamp in its existing condition, however, has been found to introduce many disadvantages, regardless of whether attempts are made to operate the resulting lamp at a lower voltage drop with a higher current, or at a higher pressure with a voltage drop equal to that of a lamp of usual length. It has likewise been found to be impractical to bend the present inner tube back on itself into the shape of a U so that the two cathodes effectively come at the same end of the lamp, and at the same time will give only one half of the present length, because with such a design the convection currents carry the arc against the wall of the tube itself and cause the glass to melt or break.

We have now found that these difficulties are overcome by operating in a suitably designed tube two parallel arcs or discharges maintained in series connection. This is preferably effected by taking a tube which is divided by a piece of glass or other suitable insulator into two compartments, or by using two parallel tubes in which the two discharges may be maintained. At the end of each of these compartments is placed an activated self-heated cathode. The cathodes at the end of the lamp remote from the cap are connected together, either externally or within the lamp itself, and may be held in position either by a support fused through the glass at this top end, or a support extending the whole way up the tube from the other end, or again, they may be attached to the barrier dividing the two compartments, or by any other suitable method. The cathodes at the other end of the lamp are supported by leads through the glass and these leads form the two input leads into the lamp.

It is not necessary, in carrying this invention into effect, to maintain the dividing barrier the whole length of the tube. It is only essential to take it as far into the tube as the extremity of the discharge path, or slightly beyond. In most cases, moreover, it is desirable that the path past this barrier should be relatively constricted. It is necessary that this spacer should, however, be continued to the end of the lamp at which the two input leads to the cathodes are brought through the glass so as to prevent arcing directly between these two cathodes. In order to obtain this, the spacer is either cemented, sealed to, or placed in very close contact with the glass at the end of the lamp and also with the wall along its entire length.

It is a great advantage in this design of lamp to carry out the heating of the cathodes necessary in the exhausting of the lamp according to the present technique by an induction method, which is well known to those skilled in the art. By this means there need be no leads brought out of the lamp from the two cathodes situated at the top, and which may then be joined within the lamp itself. The lamp thus has all input leads at one end. This not only simplifies manufacture, but also allows a cap to be mounted directly on to the lamp. In special cases in which the lamp as at present made has an outer jacket for the convenience of mounting only, this jacket is unnecessary for the above type of lamps and so may be omitted. Moreover, in lamps in which it is desired to conserve heat a Dewar flask of appropriate design is mounted over the lamp and so forms a separate unit which will not require replacement each time a new lamp is required.

This novel construction lends itself to the production of a polyphase lamp by simply providing three, instead of two parallel compartments with the three electrodes at one end all connected together in the manner previously described.

For the purpose of illustrating our invention we have shown several preferred embodiments thereof in the accompanying drawing, in which

Fig. 1 is a sectional elevation of a high intensity mercury vapor arc lamp,

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1,

Fig. 3 is a sectional view of a part of a lamp forming a modification of the structure of Fig. 1,

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3,

Fig. 5 is a similar sectional view of another modification of the structure of Fig. 1, and

Fig. 6 is a similar cross-sectional view of another modification of the structure of Fig. 1 which is especially designed for three phase operation.

As shown in Figs. 1 and 2 our novel lamp has a sealed tubular envelope 1 of glass or the like which is divided into two equal compartments by the barrier 2. As shown, said barrier is fused to said envelope at the lower end thereof and along each side to a point close to the other end of said envelope, although in case it is desired any suitable cement may be used, or this barrier can fit closely enough to avoid the occurrence of a discharge through the space between the barrier and the envelope. At the upper end of said barrier the space left is preferably rather small, although in some cases it is sufficient if this barrier extends beyond the electrodes 3 at that end of the envelope 1. Said electrodes are connected together by a wire 4 which is shown as fused to the barrier 2, although it is obvious that any other suitable means to retain these electrodes in position can be used if desired. A similar pair of electrodes 3 are supported at the lower end of said envelope on opposite sides of the barrier by means of the inleads 5. All of the electrodes 3 are preferably mounted quite close to the ends of the envelope 1 so as to avoid condensation of the metal vapor in any cool spots behind them. As shown said electrodes consist of a helically wound helix of tungsten wire which has its interstices filled with a good thermionic emitting substance such as barium oxide, although any other type of thermionic electrode may be used in place thereof, if desired. The envelope 1 contains in a preferred instance a filling of argon, together with a quantity of mercury which is completely vaporized during the operation of the lamp, although other metals such as zinc, cadmium, thallium, or the like may be used either in place thereof or in combination therewith.

In operation the inleads 5 are connected to a suitable source of current, preferably through a ballasting impedance, whereupon a discharge is produced between the electrodes 3 in each compartment, in series. Thus a given wattage may be used in a shorter space than has heretofore been possible with these lamps. This novel construction furthermore permits a simple base to be affixed to the lower end of the envelope 1 and eliminates the need of enclosing shields to protect against contact with live metal parts, all of which are here permanently enclosed.

In case it is desired to simplify the glass working operations the construction shown in Figs. 3 and 4 can be utilized. In this construction two separate tubular envelopes 11 are utilized, each of which has electrodes 3 sealed therein as in the structure of Fig. 1. At the upper end these electrodes are supported by a pair of inleads 12 which are connected together externally by the wire 13. A cap 14 of metal, "bakelite", or any other suitable substance encloses the upper ends of the envelopes 11, being affixed thereto by the cement 15, and provides protection from the live electrical connection, as well as maintaining said envelopes in the desired relative position. The operation of this structure is, of course, the same as that of Fig. 1.

With the structure of Fig. 5 the advantages of the device shown in Fig. 4 are retained in a device which closely resembles that of Fig. 1. In this case the two envelopes 21 are made with a flat side to form the complementary halves of a cylinder. The electrodes 3 are mounted at each end of these envelopes, as before, and a suitable cap is provided therefor, such as shown in Figs. 3 and 4.

The device of Fig. 6 is similar to that of Fig. 1, save that the barrier 22 in this case is Y shaped and divides the envelope 21 into three equal compartments, in each of which an electrode 3 is located near each end. At the end where this barrier 22 does not completely close off the envelope 21 these electrodes 3 are all connected together. When the three inleads 5 of this device are connected to the three wires of a three phase system a polyphase discharge is produced within this lamp, with the upper electrodes 3 serving as a neutral point. This discharge is especially advantageous since it completely eliminates any tendency of the device to produce a flickering light.

While we have illustrated our invention by reference to particular embodiments thereof it is to be understood that various changes, omissions and substitutions, within the scope of the appended claims, may be made therein without departing from the spirit of the invention.

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

1. An electric gaseous discharge device having a pair of elongated adjacent chambers connected together at one end and containing the same atmosphere, a thermionic electrode at each end of each of said chambers, means within said envelope to connect the electrodes at the connected ends of said chambers, and means to connect the remaining electrodes to a source of energy.

2. An electric gaseous discharge device comprising an elongated sealed envelope having a dividing barrier extending longitudinally therein to divide said envelope into a plurality of compartments with a gas passage therebetween at one end of said envelope, a gaseous atmosphere within said envelope, a thermionic electrode at each end of each of said compartments, means within said envelope to connect all of the electrodes at one end of said envelope together, and means to connect the remaining electrodes to a source of energy.

3. An electric gaseous discharge device comprising an elongated sealed envelope having a dividing barrier sealed longitudinally therein to divide said envelope into a plurality of compartments which are in communication at one end of said envelope, a thermionic electrode at each end of each of said compartments, said barrier extending beyond the electrodes at the end of said envelope where the compartments are connected, means to connect all the electrodes at the aforesaid end of said envelope together, and means to connect the remaining electrodes to a source of energy.

HENRY W. H. WARREN.
LEONARD J. DAVIES.
JOHN H. MITCHELL.