

ELECTRIC DISCHARGE DEVICE

Filed July 27, 1929

Fig. 1

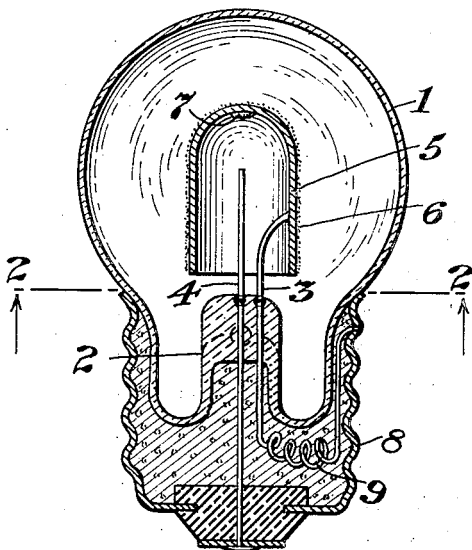
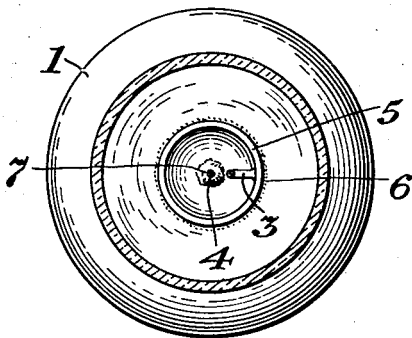


Fig. 2



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ELECTRIC DISCHARGE DEVICE

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The present invention relates to electric discharge devices, and particularly to gaseous discharge devices of the cathode glow type.

5 A particular object of the invention is to produce a gaseous discharge device which will have a uni-directional discharge characteristic for use in the arts generally, but particularly useful as a rectifier or as a polarity indicator. A further object of the invention is to conceal one of the electrodes from view, so that a slight glow thereon can not be observed. Other objects and advantages of the invention will be obvious from the following detailed specification, or from an inspection of the accompanying drawing.

The invention consists of a new and novel device as hereinafter set forth and claimed.

While cathode glow devices have occasionally been used to determine the polarity of a direct current source, it being well known that the glow surrounds the negative electrode, these devices as heretofore constructed have not been entirely suitable for use as polarity indicators since a glow was produced in the device regardless of polarity, it being necessary for the operator to remember which electrode was connected to a given lead. In many cases electrical apparatus must be connected to a current source with a definite polarity, in which case a device which will glow only if the polarity is correct is highly desirable. By the present invention I have provided a device which fulfills this condition, since the electrodes are so treated that a discharge is produced below line potential when connected with the desired polarity, whereas the potential which is required to cause a glow discharge when the polarity is the reverse of that desired is greater than that of the line on which it is designed to operate. As a precaution against any incorrect indication the electrode which would support the glow when connected with wrong polarity is made small and concealed, so that any slight glow thereon is invisible.

For purposes of illustration I have shown a gaseous discharge device embodying my invention in the accompanying drawing, in which

Fig. 1 is a vertical section of a cathode glow device particularly useful as a polarity indicator, and

Fig. 2 is a sectional view of the same device taken at the line 2—2 of Fig. 1, looking in the direction of the arrows.

In the drawing a sealed envelope 1 of glass or other suitable material and of a conventional shape has sealed thereinto through the reentrant stem 2 the inleads 3 and 4. The composition of the portion of said inleads in contact with the envelope is, of course, determined by the nature of said envelope, while the inner ends of said leads are of nickel or the like. The inlead 3 supports an inverted cup-like electrode 5 which serves as the luminous electrode, while the inlead 4, which extends within the electrode 5 and is substantially concealed thereby, serves as the non-luminous electrode. The electrode 5 is preferably formed of a metal such as nickel, iron, or the like, in some cases being formed of nickel plated iron. The visible surface of this electrode only is provided with a coating 6 of a material having a low work function, such as an alkaline or alkaline earth metal, or compound thereof, barium or potassium, for example. This coating performs the dual function of making the breakdown potential from the coated visible portion of electrode 5 to the electrode 4 less than that required for a discharge in the opposite direction, and of confining the discharge to the visible surface of the electrode 5. This coating may initially consist of barium carbonate or potassium hydroxide, for instance, and be applied and treated in any usual manner, and hence the process will not be described herein. It is, of course, obvious that if desired the electrode 5 could be wholly constructed of the material of low work function, but a coating thereof on a base metal as above described, is preferred. A small piece 7 of magnesium, aluminum, or the like is attached to the inner surface of the electrode 5 and serves to promote activation of the surface coating of the electrode and aids in clean-up of undesired gases. A conventional Edison base 8 is attached to the envelope 1 in the usual manner, the inlead

3 being connected to the sleeve thereof through a ballast resistance 9 of several thousand ohms, while the inlead 4 is connected directly to the tip of said base 8.

In the use and operation of this discharge device for indicating the polarity of a direct current source the device is preferably inserted in a socket which is permanently connected to the leads of the apparatus with which it is to be associated, with the sleeve of the base 8 connecting with the lead which is required to be at negative potential. Whenever the leads to the device are connected to a direct current source of proper polarity a discharge through the device is produced, the visible coated surface of electrode 5 being surrounded by a cathode glow indicating that the leads have the proper polarity and that it is safe to operate the associated apparatus. But if, on the contrary, the leads are connected to a direct current source with the wrong polarity, no discharge will be produced in the discharge device, due to the fact that the breakdown potential when the electrode 4 is negative is above line voltage. By virtue of this construction the electrode 5 very effectively shields the electrode 4 from particles sputtered from the coating 6 during operation of the device, and thus prevents any lowering of the work function of the surface of said electrode 4, which would tend to allow a slight glow on said electrode and thereby impair the value of the device. The electrode 4 is so concealed, moreover, by the electrode 5 and is also so small, that any glow which might occur due to increased line potential or lowering of the breakdown potential of the device would not be readily visible. Under certain conditions of service, due to the efficient concealment of the cathode, the material of both the electrodes could therefore be of material having the same work function characteristic. Hence the operator need know nothing of the connections of the discharge device, it being sufficient for him to know that if there is a visible glow the polarity is correct, while if there is no glow the polarity is reversed.

While I have described my invention in connection with a specific structure and a specific application thereof, it is obvious that my invention is not so limited, and that various changes, omissions and substitutions in the materials, size and shape of the discharge device may be without departing from the spirit thereof.

I claim:

1. In a polarity indicating electric discharge device of the cathode glow type, in combination, an envelope, a gaseous atmosphere therein, electrodes of materials of given work function characteristics sealed therein, one of said electrodes substantially concealing the other of said electrodes, a coating of a material having a lower work

function than that of either of said electrodes on the surface of said concealing electrode which is away from the concealed electrode, the breakdown potential when said concealed electrode is a cathode being greater than operating potential.

2. In a polarity indicating electric discharge device of the cathode glow type, in combination, an envelope, a gaseous atmosphere therein, electrodes of material having a definite work function characteristic sealed therein, and a coating of a material having a lower work function than said electrode material on the visible surface only of one of said electrodes, said coated electrode concealing the other electrode and shielding it from particles sputtered from said coating.

3. In a polarity indicating electric discharge device of the cathode glow type, in combination, an envelope, a gaseous atmosphere therein, electrodes of material having a definite work function characteristic sealed therein, and a coating of low work function on the visible surface only of first said electrode, said coated electrode concealing the other electrode and shielding it from particles sputtered from said coating, the potential required to produce a glow on said concealed electrode being greater than that required to produce a glow on the concealing electrode.

4. In a polarity indicating electric discharge device of the cathode glow type, in combination, an envelope, a gaseous atmosphere in said envelope, a cup shaped electrode of a material having a given work function sealed therein, a coating of a material having a lower work function on the exterior surface only of said electrode, and a second electrode of a material having a work function appreciably higher than that of said coating sealed into said envelope, said last mentioned electrode extending within said cup shaped electrode and being substantially shielded thereby from sputtered particles of said coating, the breakdown potential of said device being above operating potential when said shielded electrode is a cathode, and below operating potential when it is an anode.

Signed at Hoboken in the county of Hudson and State of New Jersey this 26th day of July, A. D. 1929.

TED E. FOULKE.