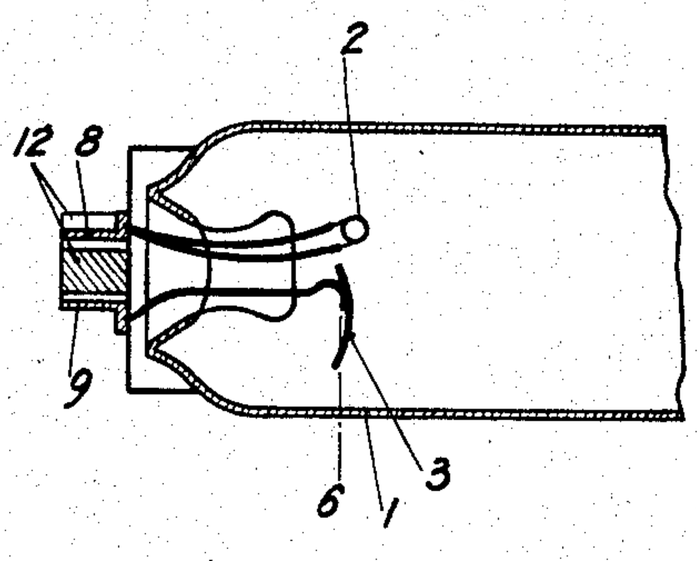
Nov. 17, 1953 P. LEMAIGRE-VOREAUX 2,659,834

ELECTRIC DISCHARGE DEVICE

Filed Oct. 25, 1949

Fig. 1



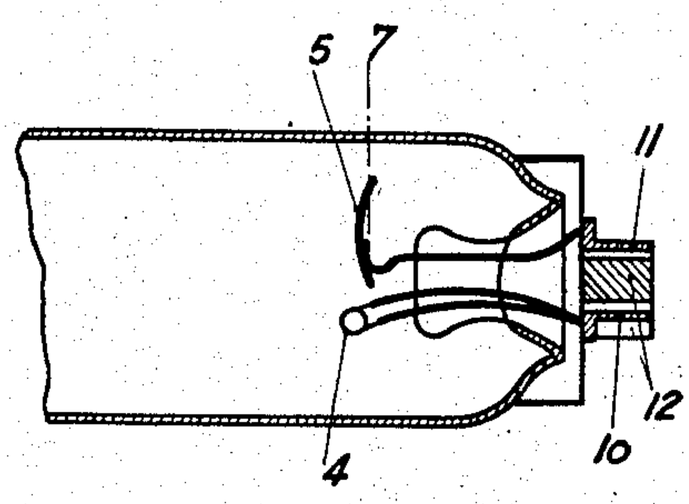


Fig. 2

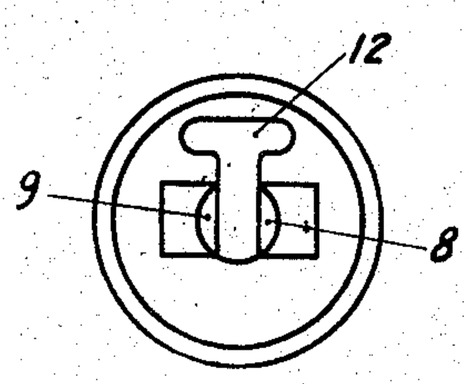


Fig. 3

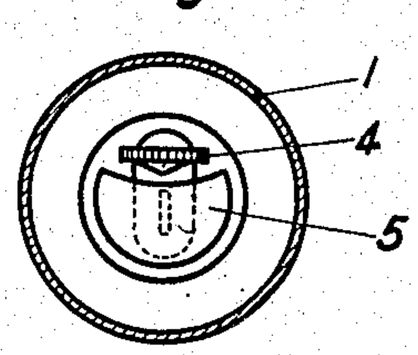
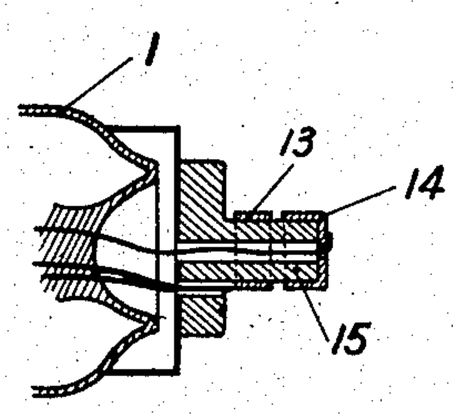


Fig. 4



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ELECTRIC DISCHARGE DEVICE

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2 Claims. (Cl. 313—188)

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My invention deals with an electric discharge tube which may be energized with either alternating or direct current and which is provided at each end with a cap which is of one of two types. A cap of the first type, which I shall name hereafter the "neutral" type, is such that when plugged into its corresponding socket the contacts of the cap continue to be connected to the same contacts of the socket irrespective of any turning movement of the tube around its longitudinal axis relative to the socket. A cap of the second type, which I shall name hereafter the "compulsory" type, is such that it can only be inserted into its corresponding socket in one particular way and when so inserted, the tube to which the cap is attached cannot be rotated about its longitudinal axis relative to the socket.

When direct current is used for energizing a usual type discharge tube provided with two thermo-emissive electrodes, for instance a low-voltage fluorescent lamp, the rapid formation of a black spot on the envelope of the tube, in the neighbourhood of the positive electrode is noted. This spot is brought about by the deposition of the thermo-emissive materials of which this electrode is composed. The materials are vaporized from the electrode as a consequence of the high temperature to which the latter is subjected when it functions continuously as an anode.

Discharge tubes have been made with a thermo-emissive cathode at one end and with a cold anode at the other end; these tubes do no exhibit the above-mentioned drawback but they may not be employed on alternating current and in use with direct current care must be paid to polarity when the tubes are connected up, since they may not be turned around end for end, as the reversing of the electrodes occasioned thereby, would prevent them from working.

It is an object of the present invention to devise a discharge tube which overcomes the drawbacks mentioned above. According to the present invention there is provided an electric discharge device comprising a gas-filled tube, a cap at each end of the tube, both of said caps being of one of the types specified and each being associated with a thermoemissive electrode and a cold electrode, said electrodes being disposed within the tube close to each other and being electrically connected to separate contacts of the associated cap, each of said contacts being arranged for co-operation with a particular contact of the sockets into which the caps are intended to be fitted.

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Preferably, each cold electrode is treated to remove gas therefrom prior to its being mounted in the tube. In this way treatment of the electrodes after mounting is avoided. This makes the manufacture of the tube appreciably easier and eliminates the necessity of having to use a high-frequency device for heating the cold electrodes during manufacture.

The cold electrode is located preferably substantially in a plane at right angles to the longitudinal axis of the tube and not further distant from the corresponding cap than the point of the neighbouring thermo-emissive electrode the farthest away from this cap. In this way, the cold electrodes shut out very little radiation and do not change the length of the discharge path.

For a better understanding of the nature of the invention and to show how the same may be carried into effect one constructional form thereof will now be described in greater detail with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal section of an electric discharge tube, provided at each end with a cap of the "compulsory" type,

Figure 2 is an end view of the tube, showing the cap utilized in this embodiment,

Figure 3 is a transverse section of the tube, showing the arrangement of the electrodes located at the left end.

Figure 4 is a longitudinal section through one end of an electric discharge tube provided with caps of the "neutral" type.

The discharge tube represented on Figures 1, 2, 3 is provided with an envelope 1 coated on the inside with fluorescent materials and containing argon under a pressure of several millimetres of mercury, together with a small quantity of mercury. At the left-hand of the envelope (as seen in Figure 1) are placed the thermo-emissive electrode, or cathode 2, connected to the cap contact 8, and the cold electrode, or anode 3, connected to the cap contact 9. Similarly, at the right-hand end are placed the thermo-emissive electrode 4 connected to the contact 10, and the cold electrode 5 connected to the contact 11. Each thermo-emissive electrode 2 or 4, is constituted by a spiral of tungsten wire coated, in the known way, with alkaline earth oxides. Each cold electrode 3 or 5 is a small metal plate in the form of a slightly curved segment. The plate is placed so that the chord thereof is near the neighbouring thermo-emissive electrode and approximately parallel to the axis of the latter (see Figure 3). The average plane 6 or 7 (Fig. 1), of each cold elec-

trode is at right angles to the longitudinal axis of the tube and a little nearer to its corresponding cap than the axis of the neighbouring thermo-emissive electrode. For a discharge tube in which the normal working current is 0.5 ampere, use may be made, for instance, of cold electrodes of which each face has a surface area of 1.5 sq. cm.

Each cap of the lamp is provided, in addition to the two contacts 8 and 9 or 10 and 11, with a small insulating piece 12 that separates and holds these contacts. The insulating piece 12 has a projecting portion which can co-operate with a corresponding recess in the socket into which the cap is intended to be plugged. This projection and the corresponding recess determine the correct manner in which the cap may be plugged into the corresponding socket. On account of this projection, it is not possible, for example after having withdrawn the tube from the sockets into which it was properly inserted, to turn the tube by a half-revolution about its longitudinal axis then to put it back into the sockets, an operation that would have the result of connecting the cathodes to the contacts of the sockets intended for the anodes and vice versa. On the other hand, the tube may be withdrawn, turned through a half-revolution about an axis through the centre of the tube and at right angles to the plane of Figure 1, whereafter the caps may be inserted into the sockets; this operation replaces one cathode by the other, and one anode by the other.

Use may be made of the same sockets for energizing by direct current and by alternating current but the conductors from the device feeding the tube (i. e. the current supply and the stabiliser) must not be connected to the same contacts of the socket in both cases. For the direct current, the socket contact corresponding to the contact 8 is connected, for instance, to the negative conductor and the contact corresponding to the contact 11 to the positive conductor. For energizing with alternating current, one of the conductors is connected to the socket contact corresponding to the contact 8, and the other to the contact corresponding to the contact 10.

Figure 4 represents the right end of an electric discharge tube provided with caps of the "neutral" type. The cap, the longitudinal section of which is shown on this figure, comprises an insulating piece 15 on the end of which is mounted a brass capsule 14, and between this capsule and the flange of piece 15, is fixed a brass ring 13 coaxial with capsule 14 and piece 15. These metal pieces 13 and 14 are the contacts of the cap. On both ends of the tube, the contact pieces of the same kind: capsule or ring, are connected to electrodes of the same type: cold or thermoemissive. This results in each contact of the sockets, in which are placed these caps, remaining connected to an electrode of the same type when the lamp is turned end for end; moreover, the form of the contacts allows the tube to be turned around its longitudinal axis while leaving the same cap contacts together with the same socket contacts.

With alternating current, the cold electrodes, of which use is not made as main electrodes, may be employed as auxiliary electrodes intended to facilitate the starting of the discharge.

Numerous changes may be made, of course, to the device as described without going outside the scope of the invention. More particularly, the cap as illustrated may be replaced by a cap of another pattern, of standard or new type, provided however that, on the one hand, the turning

of the tube round its longitudinal axis is not possible, or does not change the electrode connected to the socket contact in question, and that, on the other hand, the turning round of the tube end for end is possible, but may be executed only for the position that puts each electrode in the position of another electrode of the same type.

The invention applies equally to discharge tubes of which the envelope is not in the shape of an elongated cylinder, for instance when it is made of a long tube and bent in the shape of a U or as a spiral.

What I claim is:

1. An electric discharge device comprising, a rectilinear elongated gas filled tube provided at each end with an electrode of the thermoemissive kind and with an electrode of the cold kind disposed within the tube close to each other; two caps respectively fixed to the ends of said tube, each of said caps being provided with a plurality of contact surfaces having the form of surfaces of revolution having a common axis and being located in the prolongation of the tube in the axial direction of said tube; and at each end of the tube a connection between the thermoemissive electrode of that end and one contact surface of the cap of that end and a connection between the cold electrode of that end and another contact surface of said end, each of said electrodes being connected to only one of these contact surfaces, those contacts of the two caps which are placed in the same position relatively to the other parts of the corresponding cap being connected to an electrode of the same kind.

2. An electric discharge device comprising, a rectilinear elongated gas filled tube provided at each end with an electrode of the thermoemissive kind and with an electrode of the cold kind disposed within the tube close to each other; two caps respectively fixed to the ends of said tube, each of said caps being provided with a plurality of contact surfaces having the form of surfaces of revolution having a common axis and being located in the prolongation of the tube in the axial direction of said tube; at each end of the tube a connection between the thermoemissive electrode of that end and one contact surface of the cap of that end and a connection between the cold electrode of that end and another contact surface of said end, each of said electrodes being connected to only one of these contact surfaces, those contacts of the two caps which are placed in the same position relatively to the other parts of the corresponding cap being connected to an electrode of the same kind; and each cold electrode being substantially located in a plane at right angles to the longitudinal axis of the tube, that point of said cold electrode that is furthest from the cap provided with the contact connected with said electrode being not farther from the latter than that point of the thermoemissive electrode connected with another contact of the same cap which is furthest away from said cap.

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