

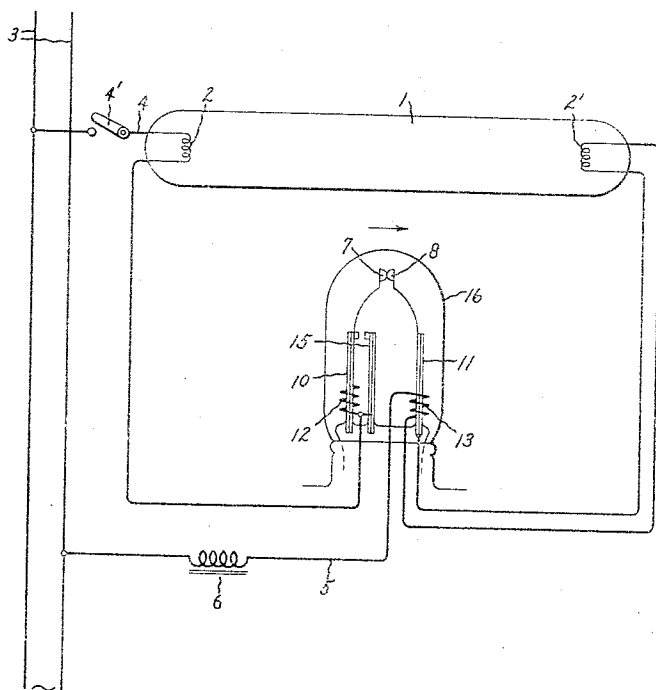
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ELECTRIC DISCHARGE APPARATUS

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ELECTRIC DISCHARGE APPARATUS

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Our invention relates to gaseous electric discharge devices such as electric discharge lamps having thermionic electrodes adapted to be preheated to an electron emitting temperature before the application of the starting voltage. More particularly our invention relates to the apparatus by which the electrodes at starting are given the desired preheat and by which the starting voltage is then applied to the device. One object of our apparatus is to provide improved apparatus of this character which will provide for the necessary time delay in the application of the starting voltage to insure an adequate initial heating of the electrodes and will also provide for a quick resetting of the apparatus in the event of a momentary interruption of the power supply. Other objects and advantages of our invention will appear as the description proceeds.

Our invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the single figure of the drawing which illustrates one embodiment of our invention, 1 is an electric discharge device such as a discharge lamp having the thermionic electrodes 2 and 2' at the ends thereof. These electrodes which are shown as filamentary require a preheating to an electron emitting temperature before the starting voltage is applied to the lamp. The lamp is connected for operation from the source 3 of alternating current supply which for example may be a 60 cycle lighting circuit. The connections of the lamp with the source of supply are shown as comprising the conductor 4 including the control switch 4' connected with one end (the upper end) of the electrode 2 and the conductor 5 which connects through the ballast reactor 6 and other apparatus to be described later, with one end (the upper end) of the electrode 2'.

For supplying the electrodes 2 and 2' with heating current to produce the initial or preheating thereof we connect together the opposite or lower ends of the electrodes with a short-circuiting switch having the two movable contacts 7 and 8. These contacts, as shown by the drawing, are carried by the free ends of the two bimetallic arms 10 and 11 respectively, the construction of the arms being such that at normal or room temperature the contacts 7 and 8 engage each other and when the two arms are heated they move in the same direction, namely to the right in the present example as indicated

by the arrow. The arm 10 is connected with the other end (the lower end) of the electrode 2 through the resistance heater 12 which is in thermal relation with the arm and preferably is in the form of a coil surrounding the arm as represented by the drawing. Likewise, in thermal relation to the arm 11 is the resistance heater 13 which also preferably is in the form of a coil surrounding that arm. The heater 13 is included in the connection 5 with the electrode 2', it being shown as arranged between the electrode and the ballast reactor 6. Spaced from the arm 10 is the contact stop 15 whose purpose is to limit the movement to the right of the arm 10 and contact 7 carried thereby. The stop 15 is adapted to make electrical contact with the arm 10 and is connected with that end of the heater 12 which connects with the electrode 2. The above described apparatus comprising the bimetallic arms, the contacts carried thereby, the two heaters and the stop preferably are enclosed in the sealed envelope 16 which may be evacuated or filled with a suitable gas, the arms, the stop and the electrical connections being anchored in the base thereof. The stop 15 may be bimetallic like the arms 10 and 11 whereby the limitation it imposes on the movement of 10 is substantially independent of the ambient temperatures.

When the switch 4' is closed to energize the apparatus from the source 3 the voltage of which is too low to start the discharge in the lamp heating current initially flows through the electrode 2, heater 12, arm 10, contacts 7, 8, arm 11, electrode 2', heater 13 and reactor 6. While the electrodes are heating, the arms 10 and 11 are both deflected to the right, the contacts 7 and 8 remaining in engagement with each other. By the time that the electrodes have reached approximately their desired temperature for the application of the starting voltage the arm 10 engages the stop 15 which limits its further movement while not preventing the continued movement of the arm 11. The contact thus made between the arm 10 and the stop 15 short-circuits the heater 12 whereupon the arm 10 begins to cool and to return toward its original position. Contacts 7 and 8 accordingly separate whereupon an inductive kick is applied across the lamp sufficient to start the discharge therein. Because of the separation of the contacts 7 and 8 the arm 10 continues to cool toward its normal temperature. The arm 11, however, still receives heat from its heater inasmuch as that heater is

traversed by the discharge current of the lamp during its operation. Contacts 7 and 8 therefore are maintained separated during the normal operation of the lamp.

Should an interruption of appreciable length of time occur in the supply voltage both bimetallic arms by cooling to room temperature will have returned to positions at which the contacts carried thereby again engage each other ready for a repetition of the above described starting operation. Should interruption in the supply voltage be only momentary although long enough for the lamp to have become deionized and hence to be unable to restart instantly, the arm 11 being no longer heated has merely to cool sufficiently to move its contact 8 into engagement with contact 7 to cause a repetition of the starting operation of the lamp.

An advantage obtained by the above described apparatus over previously constructed apparatus of this character is that the movement of the arm 11 which opens the switch, being fixed by the position of the stop 15, can be made much less than the maximum movement thereof. Hence, the parts can be so arranged that the contacts are kept separated by the smallest discharge current that is likely to occur without incurring the danger that should the supply voltage be abnormally high the contacts would open before the electrodes would become sufficiently heated. A further advantage is that the contacts once separated cannot meet again except in the normal starting position so long as the very short period required for arm 10 to cool down has elapsed since the previous separation. In certain other forms of switches of this character if the supply voltage is momentarily interrupted even after a long period of running the contacts, having separated, are apt to meet again in a position removed from the ordinary starting position whereby irregularities are caused in the operation.

In the above described apparatus the arm 10 may be slightly displaced from the cold position by the heat derived from the heater 13 but such displacement will never be sufficient to cause that arm to reach the stop 15 while the heater 12 is deenergized. Under certain circumstances the stop 15 may not be connected with the heater 12, satisfactory operation being obtained without short-circuiting that heater as long as the stop 15 is sufficiently rigid to limit the movement of the arm 10 when it is heated.

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

1. In electric discharge apparatus comprising an electric discharge device connected to be operated from a source of alternating current supply

and provided with thermionic electrodes, a resistance heater in said connection, a switch connected between said electrodes for controlling the flow of initial heating current therethrough, a resistance heater in series with said switch between said electrodes, a separate heat responsive device associated with each of said heaters for moving each contact of said switch in the same direction in response to heat and means for limiting the movement of that switch contact which is controlled by said last mentioned heater whereby the switch opens.

2. In electric discharge apparatus comprising an electric discharge device connected to be operated from a source of alternating current supply and provided with thermionic electrodes, a resistance heater in said connection, a switch having a separate bimetallic member for moving each contact thereof, the contacts being moved in the same direction by the heating of said members, said switch being connected between said electrodes for controlling the flow of initial heating current therethrough, a resistance heater in series with said switch between said electrodes and in heating relation with one of said members, the other of said members being in heating relation with said first mentioned heater, and a stop for limiting the movement of that switch contact controlled by the second mentioned heater whereby the switch is opened by the continued movement of the other contact and is held open during the operation of the device.

3. In electric discharge apparatus comprising an electric discharge device connected to be operated from a source of alternating current supply and provided with thermionic electrodes, a resistance heater in said connection, a switch having a separate bimetallic member for moving each contact thereof, the contacts being moved in the same direction by the heating of said members, said switch being connected between said electrodes for controlling the flow of initial heating current therethrough, a resistance heater in series with said switch between said electrodes and in heating relation with one of said members, the other of said members being in heating relation with said first mentioned member, a contact stop arranged to engage that switch contact which is controlled by the second mentioned heater and to limit the movement thereof and a connection between said contact stop and said second mentioned heater by which the latter is short-circuited by said engagement.

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