

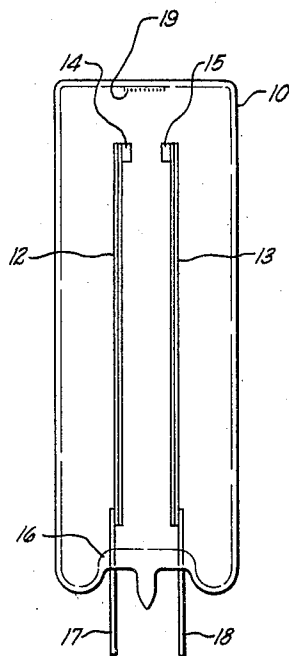
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THERMAL SWITCH

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THERMAL SWITCH

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New York

Application July 22, 1941, Serial No. 403,572
In Great Britain August 22, 1940

1-Claim. (Cl. 250—27.5)

My invention relates to thermally operated switches of the type wherein a thermally sensitive element, for example a bimetal, is heated by a glow discharge. Such switches are now used for controlling the starting of fluorescent discharge lamps having electrodes which require heating before starting a discharge therebetween. When a suitable potential is first applied to the switch, the glow discharge starts therein which heats the bimetal and causes it to flex. The flexing of the bimetal brings the switch contacts into engagement to extinguish the discharge in the switch. Current flows through the electrodes of the lamp which are connected in series across the terminals of a current source by the switch. After a time sufficient to raise the lamp electrodes to their operating temperature, the series connection therebetween is broken by the opening of the switch contacts, due to the cooling and consequent flexing of the bimetal, but the glow discharge does not start again in the switch if the lamp has started because the voltage then across the switch is not the full supply voltage, but the operating voltage of the lamp. It is necessary, therefore, that the starting potential of the switch should be less than the voltage of the current source, but greater than the operating voltage of the lamp.

I have observed that switches of the kind described above, which are perfectly satisfactory when exposed to light, have higher starting potentials than the voltage of the current source when they have been in the dark for some time and, thus, are useless for starting discharge lamps when the switch is in the dark.

The object of my invention is to provide a glow-type thermal switch having approximately the same starting potential in the dark and in the light. Other objects and advantages of my invention will be apparent to those skilled in the art from the following description and from the appended claim.

I have discovered that an exceedingly small quantity of radioactive material capable of emitting alpha-rays is effective for maintaining the starting potential of thermal switches of the glow discharge type substantially the same in the dark and in the light when said material is mounted in such position within the switch envelope that the alpha-rays can reach the discharge path between the electrodes.

While I prefer to use radioactive uranium and thorium compounds for the purposes of my invention, this preference is based largely on the availability and comparatively low cost of these ma-

terials and I contemplate that other alpha-ray emitting materials, such as radium chloride, or other suitable compound of radium, may be used for attaining the desired result. If the envelope is made of uranium glass, such as that disclosed in my copending application Serial No. 385,003, filed March 24, 1941, of which this application is a continuation in part, the uranium in the layer of the glass next to the interior of the envelope is sufficient. Accordingly, the radioactive material is said to be contained in the envelope if it is so located that its distance from the discharge path is less than the range of the alpha-rays in the intervening material. I prefer to place a few milligrams of uranium oxide in the envelope in such position that the alpha-rays emitted thereby have access to the discharge path without passing through a solid substance.

In the drawing accompanying and forming part of this specification, a species of thermal switch of the glow discharge type is shown in a side elevational view.

Referring to the drawing, the glow-type thermal switch illustrated comprises a sealed, tubular envelope 10 of glass having a glass stem 16 fused thereto. Said envelope 10 is about 50 mm. in length and about 18 mm. in internal diameter and has a gaseous atmosphere therein consisting of helium mixed with approximately 0.15 per cent of argon at a pressure of approximately 45 mm. mercury column. Two bimetallic strips 12 and 13, having contacts 14 and 15 attached to the end thereof remote from the stem 16, are mounted in parallel positions in said envelope 10. Said strip 12 is fastened, as by welding, to the current inlead wire 17 and the strip 13 is similarly mounted on the current inlead wire 18. Said wires 17 and 18 pass through and make a hermetic joint with the stem 16. The contacts 14 and 15 are separated a distance of approximately 5 mm. when the strips 12 and 13 are cold and engage each other when the strips are heated by a glow discharge therebetween. When the contacts 14 and 15 are thus engaged, the discharge in the switch is extinguished and after a lapse of a short interval of time, depending on the thermal capacity of the bimetallic strips 12 and 13, the contacts are moved away from each other by the flexing of the strips due to the cooling thereof.

When switches having this structure contain no radioactive material, the starting potential thereof in the light is approximately 160 volts. The starting potential rises considerably in the dark and is frequently higher than the voltage of the current source which is usually approxi-

mately 220 volts. When a small quantity of an alpha-ray emitting material, such as approximately 20 milligrams of uranium oxide, is distributed on the interior surface of the envelope, the starting potential is about 160 volts in the dark even after the switch has been in complete darkness for a week. The starting potential of the switch in the light is the same whether it contains radioactive material or not. The switch is thus highly useful for starting discharge lamps of the type having electrodes which require preheating.

I prefer to apply the uranium oxide to the inner surface of the envelope directly above the contacts 14 and 15 as indicated at 19 in the drawing. Known methods of applying materials to glass surfaces are used. A satisfactory method comprises the steps of mixing fine particles of uranium oxide with a solution of nitrocellulose in amyl-acetate and applying the suspension thus produced to the desired area of the envelope 10. The nitrocellulose and amyl-acetate are then removed from the envelope 10 in the usual manner during the manufacture of the switch to leave the uranium oxide on the surface of the glass above the contacts 14 and 15.

While I have shown and described my invention in connection with one species of a glow-type thermal switch, I contemplate the use thereof in switches of different structure. For example, radioactive material may be used for the purposes of the invention in switches of the type disclosed in the copending application of Wayne C. Smitley, Serial No. 289,897, filed August 12, 1939, comprising a stationary electrode and a bimetallic electrode constructed and arranged to extinguish the discharge therebetween when said electrodes are heated by said discharge. The above applications are assigned to

the assignee of the present application. I contemplate, further, that the invention is useful in conjunction with switches having other ionizable gases therein, such as neon, argon, xenon, or krypton, or mixtures of such gases, at suitable pressures; and in conjunction with switches having electrodes comprising a metal support and material of lower work function, such as magnesium, zinc, or alkaline earth compounds, on said support to obtain a desired starting potential.

In accordance with my copending application Serial No. 385,003, filed March 24, 1941, the envelope 10 may consist of uranium glass or the envelope is made of any of the uranium-free glasses used commercially for discharge devices, when desired, and the uranium glass is mounted in said envelope 10. In such a structure the uranium glass is preferably in the form of a sleeve mounted about the electrodes thereof. It may also be in a finely divided state and applied as a coating to the inner surface of the switch envelope. When desired, the stem 16 of the envelope 10 consists of one of the non-uranium containing glasses, such as "Nonex," used commercially for such parts and the envelope 10 consists in whole, or in part, of uranium glass, or the envelope 10 consists of a uranium-free glass and the stem 16 of uranium glass.

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

A glow-type thermal switch comprising a sealed envelope containing helium mixed with 0.15 per cent argon at a pressure of about 45 mm., electrical contacts and radioactive material.

BASIL NOEL CLACK.