Jan. 15, 1924. 1,481,004

V. E. GOODWIN

PROTECTIVE DEVICE

Filed June 18, 1918

Fig. 1.

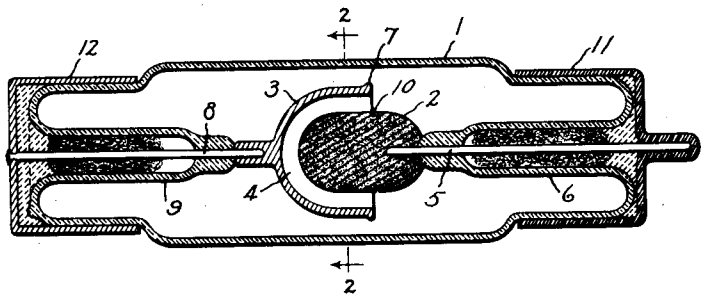


Fig. 2.

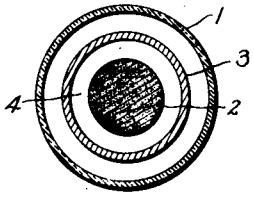
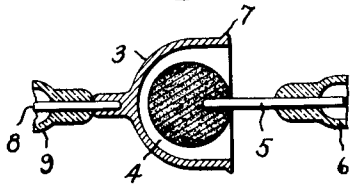


Fig. 3.



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UNITED STATES PATENT OFFICE.

VICTOR E. GOODWIN, OF PITTSFIELD, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

PROTECTIVE DEVICE.

Application filed June 18, 1918. Serial No. 240,647.

To all whom it may concern:

Be it known that I, VICTOR E. GOODWIN, a citizen of the United States, residing at Pittsfield, county of Berkshire, State of Massachusetts, have invented certain new and useful Improvements in Protective Devices, of which the following is a specification.

My invention relates to protective devices and more particularly to lightning arresters in which discharges occur in an evacuated container.

The object of my invention is to provide a novel and improved protective device and more specifically to provide an improved lightning arrester of the vacuum type in which the walls of the container are protected from the effect of spark discharge and in which the spark discharge takes place in a substantially uniform dielectric field.

In lightning arresters of the vacuum type in which a spark gap is provided between electrodes mounted within an evacuated container, if the container is made of a material, such as glass, so that the electrodes may be observed, it has been found that the effect of discharges across said gap causes discoloration of the walls of the container or vessel and the heat of the discharge often breaks the walls of the vessel. Furthermore, due to the relation of the cooperating electrodes, the spark discharge does not take place in a uniform field which introduces a time delay between the application of break down voltage and the discharge across the gap.

The novel features which I believe to be characteristic of my invention will be defined in the claims appended hereto while the features of construction and mode of operation will be understood by reference to the following description taken in connection with the accompanying drawing, in which—

Fig. 1 is a side elevation, partly in section, of an arrester embodying the novel features of my invention, Fig. 2 is a section of the arrester, shown in Fig. 1, taken along the line 2—2, and Fig. 3 is a modified form of my invention.

The protective device of my invention comprises an evacuated vessel or container 1 preferably of tubular configuration containing preferably, an atmosphere of a monatomic gas. Mounted within the vessel 1 are two cooperating electrodes 2 and 3 spaced apart to form therebetween a spark gap 4. In order to provide a spark gap in a uniform dielectric field and at the same time to protect the walls of the vessel 1 from discharges across the gap, the electrodes 2 and 3 are provided with proximal surfaces which are substantially spherical and are concentrically disposed within the vessel, so that one electrode substantially encloses the other. The inner electrode 2 may be spherical in shape, as shown in Fig. 3, but in the preferred form this electrode is elongated or more specifically cylindrical with substantially spherical end portions as shown in Fig. 1. This electrode is mounted upon or carried by a leading-in wire or conductor 5 which, in the construction shown, extends from one end of the vessel 1 through a suitable seal 6. The outer electrode 3 is preferably cup-shaped or substantially hemispherical in configuration with a rolled edge or lip 7, to eliminate sharp edges and prevent concentration of electrostatic stresses thereon. The electrode 3 is horizontally positioned within the vessel 1, equidistant from the walls of the vessel and intermediate the electrode 2 and the walls of the vessel. In this position, the cup-shaped electrode 3 surrounds or partially encloses the electrode 2 and is spaced away from electrode 2 in such a manner that all points between the cup-shaped electrode 3 and the enclosed portion of the inner electrode 2 are equidistant. The cup-shaped electrode 3 is similarly mounted upon a leading-in wire or conductor 8 extending from the end of the vessel 1 opposite conductor 5 through a seal 9 but it is understood that the mounting of the electrodes at opposite ends of the vessel 1 is only illustrative of one construction for the electrodes. Conductors 5 and 8 are preferably of the well known Dumet wire and the seals 6 and 9 are similar to those used for incandescent lamps.

The configuration described for electrodes 2 and 3 also enables a rapid and accurate setting of the electrodes to provide a uniform spark gap. With a spherical inner electrode, as shown in Fig. 3, the electrode is positioned equidistant from the outer walls of the cup-shaped electrode 3 and extends into the enclosure of the cup-shaped electrode until the electrode 2 is substantially tangent

to the plane through the rim 7. With an elongated inner electrode, as shown in Fig. 1, a suitable marking is placed upon the electrode, such as a circumferential line or crevice 10. When the electrode is positioned within the enclosure of the cup-shaped electrode so that the marking 10 is in the plane through the rim 7 the distance between the enclosed portion and all walls of the cup-shaped electrode is uniform.

Surrounding each end of the vessel 1 are metallic caps or contact members 11 and 12 which are in conductive relation with the conductors 5 and 8 respectively and serve as a means for connecting the electrodes 2 and 3 between a conductor to be protected and ground. I preferably arrange the electrodes so that, for direct current, the discharges take place from the outer or cup-shaped electrodes 3 to the inner or cylindrical electrode 2 hence the outer electrode 3 is adapted to be connected to the line and the inner electrode 2 is adapted to be connected to ground.

The inner electrode 2 extending within the enclosure provided by the cup-shaped electrode 3 and equidistant from the surrounding electrode 3 provides a uniform dielectric field between the electrodes across which the spark discharge may readily take place. At the same time, the configuration of the electrode 3 forms a protected spark gap and prevents the discharges which occur from affecting the walls of the vessel 1.

In accordance with the provisions of the Patent Statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

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

1. The combination of a transparent evacuated container and cooperating electrodes within said container spaced to form a spark gap which is visible through the walls of the container and which is so formed that the said walls are protected from a discharge across the gap.

2. A protective device comprising a tubular evacuated vessel, a cup-shaped electrode concentrically mounted within said vessel, and a cooperating electrode extending into the enclosure of said cup-shaped electrode and spaced apart from all sides thereof to form an enclosed spark gap whereby the walls of said vessel are protected from a discharge across said gap.

3. A protective device comprising an evacuated vessel, a cup-shaped electrode mounted at one end of said vessel, and a cooperating electrode mounted at the opposite end of said vessel and extending into the enclosure of said cup-shaped electrode, said cooperating electrode being positioned substantially equidistant from the walls of said cup-shaped electrode to provide therebetween an enclosed spark gap from which the walls of said vessel are protected.

4. A protective device comprising an evacuated vessel, an electrode within said vessel, and a cooperating electrode surrounding said first mentioned electrode but separated therefrom to form a spark gap, said first mentioned electrode having means whereby the electrode may be positioned relative to said cooperating electrode so that the space between the electrodes is uniform.

5. An enclosed spark gap, comprising an electrode having a substantially hemispherical cavity therein and a cooperating electrode having a discharge surface located within said cavity.

6. The combination with an evacuated container, of means within said container for forming a spark gap which is visible from the outside of said container, said means forming a protection for the walls of the container from a discharge across said gap.

In witness whereof, I have hereunto set my hand this 12th day of June, 1918.

VICTOR E. GOODWIN.