July 12, 1938. C. W. HANSELL 2,123,333

LIGHTNING ARRESTER

Original Filed June 21, 1935

Fig. 1

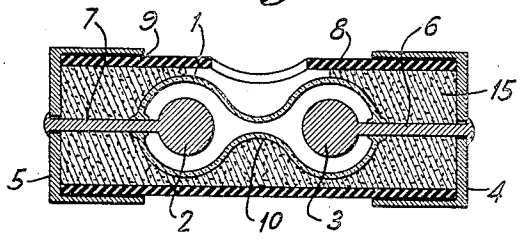


Fig. 2

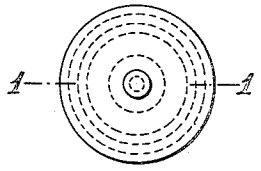


Fig. 3

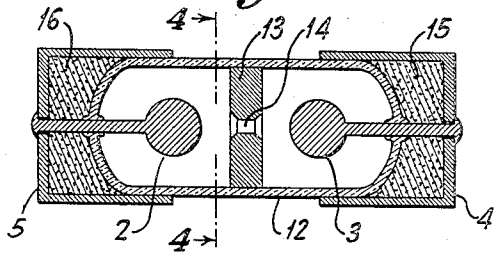
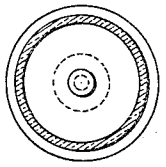


Fig. 4



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Patented July 12, 1938

2,123,333

UNITED STATES PATENT OFFICE

2,123,333

LIGHTNING ARRESTER

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Original application June 21, 1935, Serial No. 27,677. Divided and this application March 30, 1937, Serial No. 133,764

7 Claims. (Cl. 250—27.5)

This invention relates to an improved lightning arrester, and is a division of my copending application Serial No. 27,677, filed June 21, 1935.

An object of this invention is to simplify and improve lightning arresters of the gaseous discharge type.

Another object of this invention is to provide a lightning arrester which is particularly adapted for the protection of direct current circuits wherein it is necessary to limit the voltage peaks to as little as possible above the normal values.

Lightning arresters of the gaseous discharge type are well-known in the prior art for use in the protection of telephone and small power circuits; also for radio antennas. However, the lightning arresters known in the prior art depend upon the minimum voltage drop through them being greater than the normal voltage of the circuit to be protected so that the glow would extinguish itself after the disturbance has passed since the voltage required to start an arc was much higher than the minimum voltage drop. The circuit would then be protected only against voltages which were very much higher than normal, there being no protection against moderate voltage peaks.

To overcome this defect, I propose to provide an improved lightning arrester employing the principles disclosed in my Patent #2,022,465, issued Nov. 26, 1935, for an improved type of electrical vacuum pump for evacuating electron discharge devices which utilize electrical forces for effecting evacuation. The evacuation process is accomplished by producing a direct current discharge through a tube or orifice between a vessel to be exhausted and the inlet to a mechanical pump, the discharge consisting chiefly of a flow of electrons in one direction and a flow of glass ions and molecules in the other direction. By choosing the proper electrode materials, dimensions, gas and gas pressure, I am able to start a discharge in my improved lightning arrester at voltages slightly above the normal operating voltage. To extinguish the discharge after the disturbance is passed, the gas distribution in the arrester will be changed by providing two separate chambers joined by a suitable aperture. The direct current flowing through the aperture then pumps the gas out of one chamber into another. The hardening of the vacuum in one chamber then increases the voltage drop from the aperture to the electrode in another chamber to extinguish the discharge.

This invention will be more clearly understood by referring to the accompanying drawing, in which:

Fig. 1 shows a longitudinal sectional view of one modification of this invention;

Fig. 2 is an end view of Fig. 1;

Fig. 3 is a longitudinal cross-section of another modification of this invention; and

Fig. 4 is a cross-section of Fig. 3, the section being taken along lines 4—4.

Referring now in detail to Figs. 1 and 2 of the drawing, an hour-glass shaped envelope 1 contains two spherical electrodes 2 and 3, which are connected to end ferrules 4 and 5 by means of relatively stiff wires 6 and 7. The glass envelope is further protected by an outer cylinder 8 which is cemented to the end ferrules by any suitable cement 9. The outer casing 8 provides suitable protection against mechanical injury to the relatively fragile hour-glass 1 and the metallic end ferrules provide for clip mounting similar to the manner in which the ordinary fuse is retained. The envelope is filled with a suitable gas such as, for example, argon.

In the operation of this device, the pumping action is accomplished by a discharge occurring from electrode 2 and passing through the relatively narrow glass neck 10 of the glass envelope 1 to the electrode 3, or in the reverse direction depending upon the polarity of applied voltage.

In the other modification shown by Figs. 3 and 4, the outer casing 12 is provided with a metal plug 13 for separating the two chambers, the pumping between the two chambers being accomplished by means of an aperture 14 of a suitable size, the electrodes 2 and 3 being connected to the end ferrules 4 and 5 in a similar manner to that mentioned above, and the spaces 15 and 16 being filled with any suitable cementing compound.

This latter modification is suitable for protecting circuits where the strength and duration of the excess voltage is normally greater than the normal instantaneous breakdown voltage in the arrester, or that which can be handled satisfactorily by the type of arrester as shown in Figs. 1 and 2, for the reason that the metal plug 13 will withstand a much heavier and longer time duration of current discharge without being damaged or destroyed than will the glass neck 10. It might seem that the metal plug 13 would tend to divide the arrester into two separate discharge tubes or parallel paths; and that no voltage discharge would go through the aperture 14. However, I have found that this is

not the case, for ordinary conditions, in the absence of extremely high voltages. Also, as explained in connection with Fig. 2 of the above-mentioned patent wherein a hole through the metal will also function as an orifice for my vacuum pump, if desired, more than one orifice, in series, may be used in the arrester of Figs. 1 and 2 in order to increase the arc-quenching effect. Likewise, more than one plug and orifice may be used in the arrester of Figs. 3 and 4 in order to obtain a greater ratio of quenching voltage to break down voltage and greater heat storage capacity in the arrester.

Although only two modifications of this improved lightning arrester have been disclosed, it is to be distinctly understood that other modifications will readily present themselves to those skilled in the art. Therefore, this invention should not be limited to those shown except such limitations as are clearly imposed by the appended claims.

What is claimed is:

1. A lightning arrester for protecting circuits where the strength and duration of excess voltage is normally greater than the normal instantaneous breakdown voltage in the arrester comprising a tubular insulating housing, said housing being divided into two separate chambers by a metallic disc member, a spherical electrode within each chamber, a metallic closure member at each end of said housing, a connection between each of said electrodes and said metallic closure member, said metallic disc member located substantially central within said housing, and said metallic member having an aperture located on the same axis as said spherical electrodes for gaseous fluid communication between said electrodes.

2. A lightning arrester for protecting circuits where the strength and duration of excess voltage is normally greater than the normal instantaneous breakdown voltage in the arrester comprising a tubular insulating housing, said housing being divided into two separate chambers by a metallic disc member, a spherical electrode within each chamber, a metallic closure member at each end of said housing, a connection between each of said electrodes and said metallic closure member, said metallic disc member sealed by said housing and located substantially central within said housing, and said metallic member having an aperture located on the same axis as said spherical electrodes for gaseous fluid communication between said electrodes.

3. A lightning arrester for protecting circuits where the strength and duration of excess voltage is normally greater than the normal instantaneous breakdown voltage in the arrester comprising a tubular insulating housing, said housing being divided into two separate chambers by a metallic disc member, a gas within said chambers, a spherical electrode within each chamber, a metallic closure member at each end of said housing, a connection between each of said electrodes and said metallic closure member, said metallic disc member located substantially central within said housing, and said metallic member having an aperture located on the same axis as said spherical electrodes for gaseous fluid communication between said electrodes.

4. A lightning arrester for protecting circuits where the strength and duration of excess voltage is normally greater than the normal instantaneous breakdown voltage in the arrester comprising a tubular insulating housing, said housing being divided into two separate chambers by a metallic member, an electrode within each chamber, a metallic cap-like closure member cemented at each end of said housing, a connection between each of said electrodes and said metallic closure member, said metallic member located substantially central within said housing, and said metallic member having an aperture located on the same axis as said spherical electrodes for gaseous fluid communication between said electrodes.

5. A lightning arrester for protecting circuits where the strength and duration of excess voltage is normally greater than the normal instantaneous breakdown voltage in the arrester comprising a tubular insulating housing, said housing being divided into two separate chambers by a metallic member, an electrode within each chamber, a metallic cap-like closure member at each end of said housing, a connection between each of said electrodes and said metallic closure member, said metallic member located within said housing, and said metallic member having an aperture for gaseous fluid communication between said electrodes.

6. A lightning arrester for protecting circuits where the strength and duration of excess voltage is normally greater than the normal instantaneous breakdown voltage in the arrester comprising a tubular insulating housing, said housing being divided into two separate chambers by a metallic member, an electrode within each chamber, a metallic cap-like closure member at each end of said housing, a connection between each of said electrodes and said metallic closure member, said metallic member located substantially central within said housing, and said metallic member having a plurality of apertures for gaseous fluid communication between said electrodes.

7. A lightning arrester for protecting circuits where the strength and duration of excess voltage is normally greater than the normal instantaneous breakdown voltage in the arrester comprising a tubular insulating housing, said housing being divided into two separate chambers by a metallic member, a spherical electrode within each chamber, a metallic closure member at each end of said housing, a connection between each of said electrodes and said metallic closure member, said metallic member located within said housing, and said metallic member having a plurality of apertures for gaseous fluid communication between said electrodes.

CLARENCE W. HANSELL.