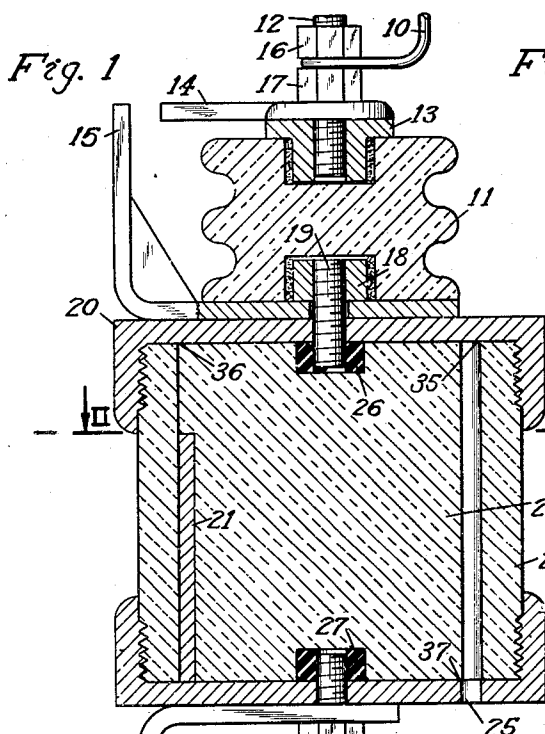
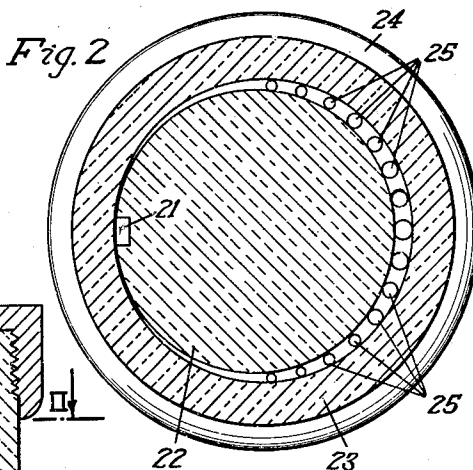
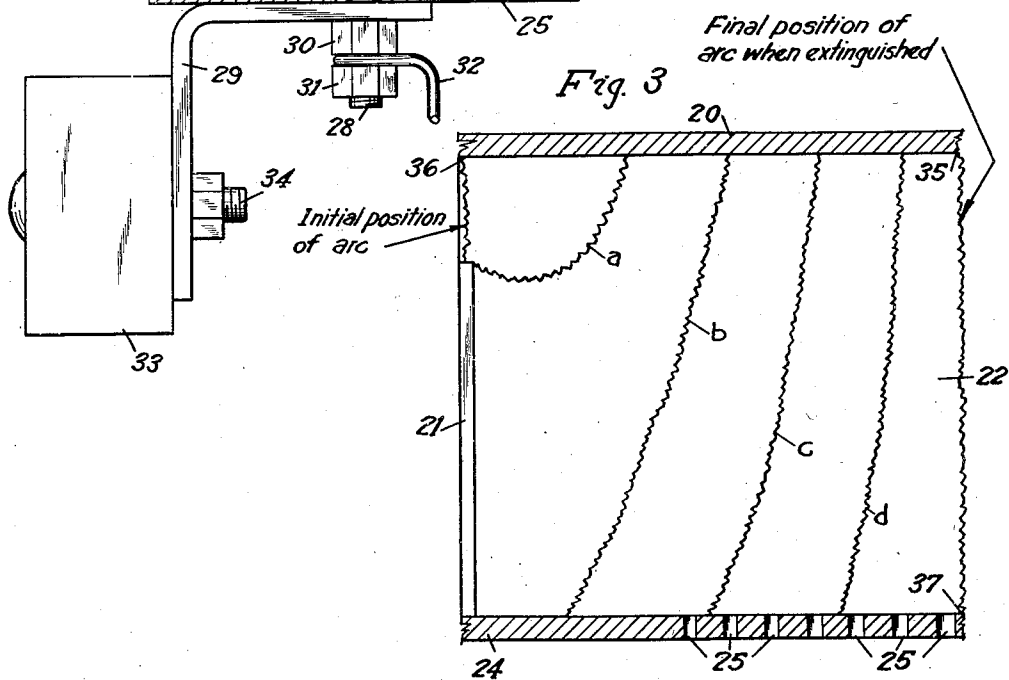


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R. R. PITTMAN
LIGHTNING ARRESTER
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LIGHTNING ARRESTER

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4 Claims. (Cl. 175—30)

This invention relates generally to lightning arresters of a character adapted for use with energized electrical circuits for limiting the voltage rise on a conductor by discharging abnormal or superimposed energy to ground and preventing the passage of energy through the arrester upon attainment of normal electrical conditions.

The present invention is an improvement on the structures described in Patents Nos. 2,002,042 and 2,034,204, issued to Ralph R. Pittman, and dated respectively May 21, 1935, and March 17, 1936.

The principal object of the present invention is the provision of a device having a low breakdown voltage and high current interrupting capacity, in which the current interruption is assisted by quickly moving the arc away from the initial sparkover path to a remote and relatively longer path, thereby reducing the arc energy expressed within the device.

Another object is to provide a structure embodying spaced electrodes, defining a spark gap within a vented arc chamber such that the spark gap will be positioned relatively distant from the vent, so that high pressures due to the heat of the arc will be generated immediately upon sparkover.

Another object is to provide a construction such that changes in humidity of the surrounding atmosphere will have a minimum effect upon the performance of the device.

With these and other objects in view which will appear from the description, my invention resides in the novel form, combination and construction of the parts of the device, and the scope of the invention will be indicated by the appended claims.

In the drawing: Fig. 1 is a side elevational view of the device, shown in section; Fig. 2 is a section along the line II—II of Fig. 1; and Fig. 3 is a fragmentary development of the inner bounding surface of the arc chamber, showing progressive positions taken by an imaginary arc from its inception to its extinguishment.

Referring in detail to the drawing, a tubular insulator 23 is closed at its upper end by a cap 20, of conducting material, by means of cooperating threads on the respective members. An insulator 11, having a cemented insert 13 at its lower end, is secured to the cap 20 by means of the stud 19, the respective ends of the latter threadedly entering centrally positioned openings in the insert 13 and the cap 20, and an outwardly and upwardly extending leakage gap electrode 15 is interposed between the insulator 11 and the

cap 20. At the upper end of the insulator 11, the insert 13 is cemented, and a stud 12 extends therein. A nut 17, fitted on the stud 12, holds the leakage gap electrode 14 in fixed spaced relationship with the electrode 15, and another nut 16, fitted on the stud 12, provides a terminal for a line conductor 10.

To the lower end of the tubular insulator 23 is fastened, by means of threads on the respective members, the lower cap 24. A threaded metal stud 28 extends upwardly into a central opening in the cap 24, and a mounting bracket 29 is rigidly held against the lower surface of the cap 24 by means of the clamping nut 30, the bracket 29 extending first outwardly and then downwardly, the downwardly extending portion being secured to a support 33 by means of the bolt 34. A nut 31, fitted on the lower end of the stud 28 provides a terminal for the ground conductor 32.

A cylindrical element of insulating material 22, having a diameter less than that of the hollow of the tubular insulator 23, is contained by the latter, the cylindrical element 22 being substantially the length of the tubular insulator 23, and being eccentrically positioned with respect to the axis of the latter. A pair of live rubber washers 26 and 27, at the respective ends of the element 22, are fitted into openings in the latter, and interposed between the studs 19 and 28 respectively, the arrangement being such that the rubber washers 26 and 27 continually bias the element 22 laterally against the inner vertical surface of the tubular insulator 23. Since the diameter of the element 22 is less than that of the insulator 23, the contact between these members is along a vertical line of abutment.

An internal electrode 21, in electrical contact with the lower cap 24, extends upwardly along the line of abutment between the element 22 and the insulator 23 toward but spaced from the upper electrode or cap 20, to provide a preferential sparkover path internally of the insulator 23 and externally of the element 22. At the other end of the tubular insulator 23, the lower cap is provided with a plurality of circumferentially spaced openings 25, in communication with the space between the insulator 23 and the element 22, for the purpose of venting the gaseous products attending an arc within the insulator 23.

The element 22, and the insulator 23, are preferably of hard fiber, because of its resistance to heat, and its ability to generate cooling gases in the presence of an arc. The weakest, or shortest, path through the device includes the gap from the upper end of the electrode 21 and the point

36 on the lower surface of the upper electrode or cap 20. This gap is relatively remote from the vent openings 25. Fig. 3 illustrates successive positions taken by the arc following sparkover, the intermediate positions being designated by the letters a, b, c, d, and the final position in which extinguishment occurs, between the points indicated at 35 and 37.

The arrangement herein described, embodying an electrode extending away from the vented cap, instead of toward the vented cap as in the structures shown in the patents mentioned above, has several distinct advantages. With the electrode extending toward the vented cap, or downwardly, arcs carrying currents less than about 400 amperes tend to remain in the initial path. With the upwardly extending internal electrode, shown herein, the gas attending the arc cannot move upwardly above the arc, as is possible in the structures previously mentioned. It must move either circumferentially and/or downwardly, and it does both, carrying the arc along with it. As a result, there is practically no pitting or burning of the electrodes at the terminals of the initial arc path from 1 ampere to 5000 amperes R. M. S. 60 cycle frequency.

In addition, the positioning of the initial breakdown path at the top of the insulator 23 greatly reduces the effect of atmospheric moisture conditions upon the performance of the device, particularly when hard fiber is used as the material for the element 22 and the tubular insulator 23. Hard fiber normally contains an amount of moisture which is dependent upon the humidity of the surrounding air. The moisture content of the fiber adjacent the vented end of the insulator 23 changes considerably more than that at the closed ends as the device "breathes" due to changes in temperature. The device may be designed to perform consistently for any given reasonable moisture content, but it will be obvious that the breakdown over the surface of the fiber will vary with the moisture content. Furthermore, if the fiber is too dry, its resistance to fracture due to impact resulting from sparkover is low; also under this condition the impact is high because a higher voltage is required to cause sparkover. It will be obvious that other insulating materials will be similarly affected, differing only in degree, by a variation of moisture along the surface of the weakest or preferred sparkover path.

I claim, as my invention:

1. A voltage limiting and arc extinguishing device comprising a hollow tubular insulator, a closure of conducting material at the upper end thereof and a vent at the lower end thereof, a substantially cylindrical element of insulating material having a diameter less than that of the hollow extending therein, means holding said element of insulating material in lateral abutting engagement with the inner surface of said tube, and structural means for causing sparkover to occur along the line of abutment of said tube with said element of insulating material,

said structural means including a conducting member extending upwardly along a portion of the length of said line of abutment and in spaced relationship with said conducting closure.

2. A voltage limiting and arc extinguishing device comprising a tubular insulator, a closure of conducting material secured to the upper end of said tubular insulator, a cylindrical element of insulating material having a diameter less than the internal diameter of said tubular insulator positioned within the latter, resilient means at the respective ends of said cylindrical element holding the latter in lateral abutting engagement with said tubular insulator, means including an internal conducting electrode extending upwardly along the line of abutment in spaced relationship with the upper conducting closure for causing sparkover to occur adjacent said line of abutment, said tubular insulator being vented only at the lower end.

3. An arc extinguishing device comprising a hollow tubular insulator, a conducting closure at the upper end thereof which also forms a first electrode at the upper end of said insulator, vent means at the lower end of said insulator, a cylindrical element of insulating material having a diameter less than the internal diameter of said tubular insulator within said insulator, means at the respective ends of said element for holding said element in lateral abutting engagement with said insulator, a second conducting electrode carried by said element and extending upwardly from the vented end of said insulator, said electrodes being normally insulated from each other and so related that the shortest path therebetween is along the line of abutment of said element of insulating material with the inner surface of said tubular insulator.

4. In a lightning arrester, a hollow tubular element of insulating material, a substantially cylindrical element of insulating material having a diameter less than the internal diameter of said tubular insulator positioned within said tubular element and arranged with its axis in parallel relation with that of said tubular element and resilient means of insulating material for maintaining said cylindrical element in lateral abutting engagement with the inner surface of said tubular element to provide a single vertically extending line of contact between these elements and a continuously widening arc space between said elements which extends circumferentially around said cylindrical element from said line of contact, a conducting closure secured at the upper end of said tubular element, said closure forming a first electrode extending over said arc space, a conducting terminal at the lower end of said tubular element, and structural means for causing sparkover to occur within said arc space, said means including a second conducting electrode electrically connected to said terminal and extending upwardly along a portion of the length of said line of contact and in spaced relationship with said conducting closure.

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