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ARC EXTINGUISHING DEVICE

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Fig. 1.

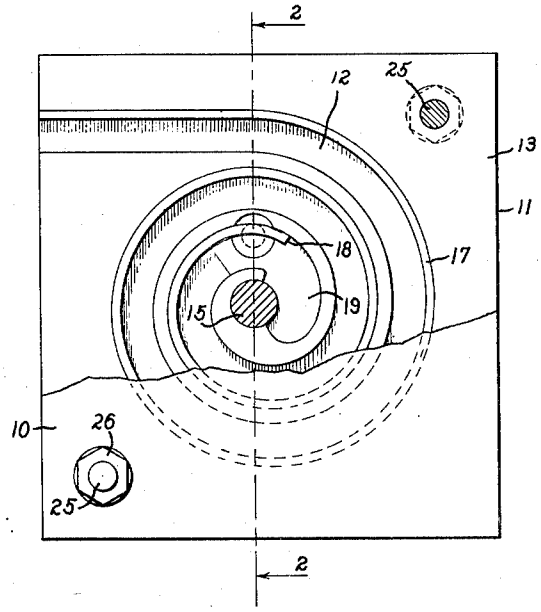
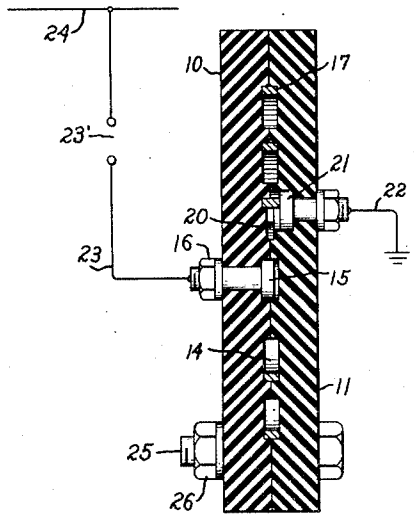


Fig. 2.



Inventor:
John W. Kalb,
by Ernest C. Britton
His Attorney.

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ARC EXTINGUISHING DEVICE

John W. Kalb, Barberton, Ohio, assignor to General Electric Company, a corporation of New York

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This invention relates to electric arc extinguishing devices for the protection of electric power circuits such as lightning arresters and the like.

Of the various devices which have been employed for the protection of such circuits against harmful over-voltages, the simple arc gap is particularly effective for initiating an arc and discharging the over-voltage to ground. However, once such an arc is established, the simple gap alone has a disadvantage in that it permits the dynamic voltage of the line to maintain the arc whereby power current is discharged after the surge or over-voltage has terminated. To limit such flow of power current, many elements have been employed in combination with an arc gap. For example, a coil or winding in series with an arc gap has been provided in some devices so that the magnetic flux from the winding will move the arc into a chamber where it will be elongated and thus more easily extinguished by an arc extinguishing gas given off from the walls of the chamber. In other devices, the expulsion action of a gas generated by the heat of an arc is utilized so as to elongate the arc. In the former case, however, the arc is usually elongated a maximum length limited by the confines of the chamber the size of which is in turn limited by practical considerations after which it is moved without any further increase in length so that thereafter extinguishment is entirely dependent upon the arc extinguishing gas which is not always effective. In the latter case, the length to which the arc can be elongated by the expulsion action of a gas is, like the former case, limited by practical considerations as to the permissible size of the device involved.

It is therefore an object of this invention to provide a compact arc extinguishing device which is practical in size but in which an arc may be elongated to a relatively great length to effect extinguishment thereof.

It is also an object of this invention to provide arc extinguishing devices of the expulsion type in which the gas blast given off upon the initiation of an arc moves one terminal of the arc, in the direction in which the gas is traveling, away from the other terminal.

It is a further object of this invention to provide an improved arc extinguishing device which comprises a minimum of elements compactly arranged and, therefore, can be produced at a relatively low cost.

In accordance with this invention I provide within a body of gas evolvable insulating material

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an arcing chamber having a spiral configuration which is completely enclosed with the exception of the outer end thereof which is vented to the atmosphere. To define an arc gap within the chamber an electrode is provided which is centrally positioned at the inner end of the chamber and spaced from the inner end of another and elongated electrode which extends spirally through the chamber to the vented end thereof whereby a terminal of an arc once established across the gap is moved by a gas blast resulting from the heat of the arc along the spiral electrode and thereby elongated to effect extinguishment thereof.

The invention will be better understood from the following description when taken in connection with the accompanying drawing and the scope of the invention will be pointed out in the appended claims. In the drawing, Fig. 1 represents a top or plan view of a device embodying my invention partly broken away and partly in section to better show the arrangement of a pair of electrodes and the configuration of an arcing chamber therein and Fig. 2 is a section taken on the line 2—2 of Fig. 1.

Referring now to the details of the device illustrated, a body of insulating material is provided comprising, in the particular embodiment shown, a pair of abutting blocks or slabs 10 and 11 formed of fiber or other similar material which is capable of evolving an arc extinguishing gas when subjected to the heat of an arc. A groove or slot 12 having a spiral configuration and extending to an edge of the block 11, is provided in the surface 13, while a similar groove is provided in the opposing and abutting surface of the block 10. Since corresponding raised portions of these opposing surfaces between the turns of the spiral grooves are in abutting engagement, the pair of opposed grooves define a chamber 14 within the blocks which has a spiral configuration and which is completely enclosed with the exception of the outer end thereof which is vented to the atmosphere. Centrally positioned at the inner end of spiral chamber 14 and in communication therewith, there is provided an electrode 15 which, as illustrated, may be the head of a bolt the threads of which are engageable with a nut 16. A second or elongated electrode 17 is provided within spiral chamber 14, preferably adjacent to the outer curved surface thereof, and extending spirally therethrough to the outer or vented end thereof. The inner end 18 of elongated or spiral electrode 17 is spaced a predetermined distance from and in communication with

centrally positioned electrode 15 to define an arc gap therebetween. Preferably the depth of a portion 19 between electrode 15 and the inner end of electrode 17, of either or both the spiral grooves in blocks 10 and 11, is made less than the depth of the balance of the grooves so as to define a constricted portion 20 at the inner end of spiral chamber 14. At a point adjacent the inner extremity thereof, elongated electrode 17 is electrically connected, as better illustrated in Fig. 2, to a terminal 21 which may be the head of another bolt similar to electrode 15 and which in turn is represented as being connected through conductor 22 to ground while electrode 15 is represented as being electrically connected through a conductor 23 to a power distribution line 24. To avoid subjecting the blocks 10 and 11 to continuous high voltage stresses under normal conditions, a series gap 23' is provided in conductor 23 between the line 24 and the device. Blocks 10 and 11 may be maintained in abutting engagement in any suitable manner such as by through bolts 25 and nuts 26 as illustrated. While I have shown and described an arc extinguishing device having a spiral arcing chamber defined by grooves in a pair of blocks of insulating material, it will, of course, be evident to those skilled in the art that so long as the walls of the spiral chamber are substantially defined by insulating material, whether in one piece or any number of pieces, my invention will not be departed from.

Under normal circuit conditions there will be no current across the gap 23' and between central electrode 15 and the inner end 18 of electrode 17. If a dangerously high transient or overvoltage appears on line 24 it will first break down both gaps and establish a current therethrough to ground. After the transient has been dissipated, a power current would tend to follow the same path except that the heat of the arc between the closely spaced surfaces in the chamber, especially at the constricted portion 20 where the arc must initially be established, will precipitate the evolution of a gas blast therefrom which must travel around and through the spiral chamber 14 to the atmosphere. In doing so the pressure of the blast will be effective to move the terminal of the arc on the electrode 17 with it whereby the length of the arc will be elongated to the extent that it will eventually be extinguished within the spiral chamber due to the resulting reduction in magnitude of the power current and high arc voltage. Although the movement of the arc terminal along electrode 17 is caused primarily by the gas blast the magnetic field resulting from the passage of current through this electrode will also tend to aid the blast in this movement.

Thus, an arc extinguishing device has been provided wherein an arc may be extinguished as a result of being elongated to an exceptionally and relatively great length while at the same time the dimensions and size of the device have been maintained within practical limitations. Moreover, since additional elements such as a resistor or a coil is unnecessary in that an arc is effectively extinguished primarily because of the elongation thereof, the device, as well as being compact, is relatively simple and, therefore, less costly than many prior arc extinguishing devices.

While I have, in accordance with the patent statutes, shown and described a particular embodiment of my invention, changes or modifications without departing from the invention will be obvious to those skilled in the art and I, therefore, aim in the appended claims to cover all such changes or modifications as fall within the true spirit and scope of my invention.

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

1. An arc extinguishing structure comprising a body of gas evolvable insulating material, a central electrode, an arcing chamber having a spiral configuration within said body, said chamber having a constricted portion at one end thereof in communication with a portion of said central electrode, the opposite end of said chamber being vented to the atmosphere, an elongated electrode having one end thereof spaced from and in communication through said constricted portion of said chamber with said central electrode, said elongated electrode extending spirally through said chamber to the vented end thereof.

2. An arc extinguishing structure comprising a body of gas evolvable insulating material, an arcing chamber having a spiral configuration within said body, an electrode centrally positioned within said body so as to be in communication with the inner end of said spiral chamber, the outer end of said chamber being vented to the atmosphere and an elongated electrode positioned within said chamber and extending spirally therethrough to said vented end thereof, the inner end of said elongated electrode being spaced from said centrally positioned electrode so as to define an arc gap therebetween.

3. An arc extinguishing device comprising a pair of abutting blocks of insulating material, grooves having a spiral configuration being respectively in the opposing surfaces of said blocks with the outer end of said grooves terminating respectively at edges thereof, said grooves being respectively opposed with the raised portions between the spiral turns in one block in abutting engagement with the corresponding raised portions between the spiral turns in the other block to define an enclosed spiral chamber having the outer end thereof vented to the atmosphere, an electrode centrally positioned and in communication with the inner end of said spiral chamber and an elongated electrode positioned within said chamber and extending spirally therethrough to said vented end thereof, the inner end of said elongated electrode being spaced from said centrally positioned electrode whereby an arc gap is defined therebetween.

4. An arc extinguishing device comprising a pair of abutting blocks of insulating material, grooves having a spiral configuration being respectively in opposing surfaces of said blocks with the outer end of said grooves terminating respectively at edges thereof, said grooves being respectively opposed with the raised portions between the spiral turns in one block in abutting engagement with the corresponding raised portions between the spiral turns in the other block to define an enclosed spiral chamber having the outer end thereof vented to the atmosphere, an electrode centrally positioned and in communication with the inner end of said spiral chamber and an elongated electrode positioned contiguous to the outer wall of said chamber and extending spirally therethrough to said vented end thereof, the inner end of said elongated electrode being spaced from said centrally positioned electrode so as to define an arc gap therebetween.

5. An arc extinguishing structure comprising a pair of blocks of insulating material, a groove having a spiral configuration in a surface of at

least one of said blocks with the outer end of said groove terminating at an edge thereof, a portion of said groove at the inner end thereof having a depth less than the balance of said groove and the raised portions of said surface between the spiral turns of said groove in abutting engagement with a surface of the other of said blocks to define an enclosed spiral chamber having a constricted portion at the inner end thereof and the outer end vented to the atmosphere, an electrode centrally disposed and in communication with said constricted portion of said spiral chamber, an elongated electrode positioned within said chamber and extending spirally therethrough to said vented end thereof, the inner end of said elongated electrode being spaced from said centrally disposed electrode and in communication therewith through said constricted portion of said chamber to define an arc gap therebetween whereby one end of an arc established between said electrodes will be moved by the gas given off from said blocks outwardly along said elongated electrode and thereby extinguished and means for maintaining said blocks in engagement.

JOHN W. KALB.

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