

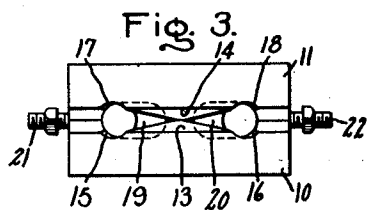
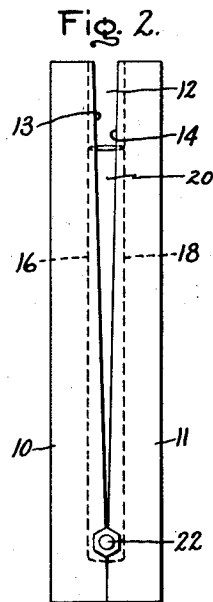
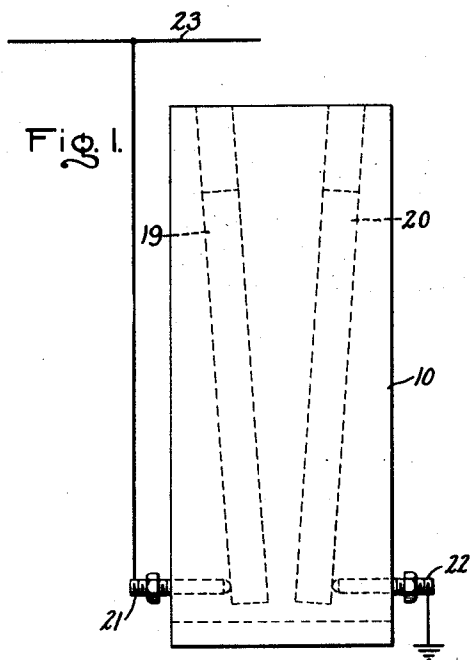
Aug. 26, 1952

J. W. KALB

2,608,599

ARC EXTINGUISHING DEVICE

Filed Sept. 21, 1949



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

UNITED STATES PATENT OFFICE

2,608,599

ARC EXTINGUISHING DEVICE

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

Application September 21, 1949, Serial No. 116,938

5 Claims. (Cl. 175—30)

1

This invention relates to electric arc extinguishing devices having particular application to lightning arresters and the like.

In the distribution and utilization of electric current, particularly at high voltages, it is customary to protect distribution lines and apparatus connected thereto with various kinds of over-voltage protective devices. Of the various devices which have been employed, the simple arc gap is particularly effective for initiating and discharging the over-voltage. However, after break-down, the simple gap has a disadvantage in that it permits the dynamic voltage of the line to maintain the arc whereby power current is discharged by the device after the surge or over-voltage has terminated. To limit the flow of power current, conventional devices have been in use in which a resistance is arranged in series with a spark gap. To also aid in the extinguishment of an arc following discharge of the surge, devices have been employed wherein the arc is elongated while others employ the expulsion action of gas given off by material in close proximity to the arc while still others employ both the idea of elongation and expulsion action. None of these prior art devices, however, have been found completely effective under all the conditions of service usually encountered. For example, the conventional combination of a resistor in series with a spark gap has the disadvantage that the resistor is permanently in series with the gap and there is, therefore, an impulse voltage drop across the resistor whereas, insofar as an impulse or over-voltage is concerned, it is desirable that there be a minimum or no voltage drop.

It is, therefore, an object of my invention to provide an arc extinguishing device employing a resistance element through which an impulse does not flow but is nevertheless effective to limit and aid in the extinguishment of power follow current.

It is also an object of my invention to provide an expulsion type protective device in which the gas blast given off upon the initiation of an arc moves the arc so as to progressively insert more resistance in the circuit and thereby diminish the current in the arc to effect extinguishment thereof.

It is a further object of my invention to provide an arc extinguishing device of the expulsion type in which the structural arrangement is such that a gas blast will move an arc toward the more remotely spaced ends of a pair of spaced and divergently disposed sticks of resistance material

2

whereby the arc is elongated to aid in its extinguishment.

It is still a further object of my invention to provide an improved and exceptionally effective arc extinguishing device which is simple and, consequently, can be produced at a relatively low cost.

In accordance with this invention, I provide an arc initiating gap defined by the more closely positioned ends of a pair of spaced and divergently disposed resistor sticks confined between spaced surfaces of gas evolving material the spacing of which terminates adjacent the gap to form, together with the resistors, an arcing chamber enclosed with the exception of a vent opening adjacent the more remotely spaced ends of the resistor sticks so that an arc once established across the gap will be forced by the gas blast given off from the gas evolving surfaces toward the opposite end of the resistors and thereby extinguished.

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 side elevation view of a device incorporating my invention, together with a diagrammatic representation of a circuit connected thereto; Fig. 2 is an edge or side view of the Fig. 1 device as viewed looking toward the right hand side thereof; and Fig. 3 is a plan view as seen when looking down toward the top of the device shown in Fig. 1.

Referring now to the details of the device illustrated, a body of insulating material is provided comprising, in the particular illustration shown, a pair of abutting blocks or slabs 10 and 11 formed of fiber or other similar material so as to be capable of evolving an arc extinguishing gas when subjected to the heat of an arc.

Between the blocks is provided an arcing chamber 12 defined by opposing surfaces 13 and 14 of blocks 10 and 11, respectively, sloping divergently from the abutting portions thereof upwardly to the upper edges of each block. Arcuately shaped and spaced grooves 15 and 16 are provided in surface 13 of block 10 and extend convergently from the upper edge of this block downwardly to the intersection of surface 13 with surface 14. A pair of similar and oppositely disposed grooves 17 and 18 are likewise provided in surface 14 of block 11. Oppositely disposed grooves 15 and 17 serve to hold a cylindrical stick

19 of electrical resistance material between surfaces 13 and 14 while oppositely disposed grooves 16 and 18 serve to hold another and similar stick 20 between these surfaces. Any suitable clamping means such as through bolts, not shown, may be employed to maintain blocks 10 and 11 together and the abutting surfaces thereof below arcing chamber 12 in tight engagement. Screws 21 and 22 threaded into opposite sides of the blocks and in electric contact engagement with resistor sticks 19 and 20, respectively, adjacent the ends thereof having the minimum spacing serve as terminals, one of which 19 is represented as being connected to a power distribution line 23 while the other terminal 22 is represented as being connected to ground. Thus, the spacing between the adjacently disposed lower ends of resistor sticks 19 and 20, as distinguished from the more remotely disposed upper ends thereof, defines a protective gap which will break down and carry a surge or impulse from line 23 to ground dependent, of course, upon the voltage characteristic of the surge or impulse. Although the resistance presented by resistors 19 and 20 to the flow of such an impulse to ground is negligible, it will be apparent that a short portion at the lower end of each resistor may be suitably wrapped with a band of material having little or no resistance such as copper so that insofar as an impulse or overvoltage is concerned the resistors would play no part whatever in interfering with the passage of such an impulse to ground.

Under normal conditions, there is no current across this gap and the voltage is that from line 23 to ground. If a dangerously high transient appears on line 23, it will first break down the gap between the lower adjacently disposed ends of resistors 19 and 20 and establish a current through the resulting arc from line 23 to ground. After the transient has been dissipated, a power current from line 23 may follow the same path. However, the heat of the arc between the closely spaced surfaces 13 and 14 will precipitate the evolution of a gas blast therefrom which must travel toward the wide end of the resistors to vent. Since the previously described structural arrangement is such that the arc path is thus always perpendicular to and directly in the path of the stream of discharge gases, the arc will be moved upwardly thereby between the divergently disposed resistors, which thus also serve as arc runners, whereupon it is elongated. At the same time, more and more resistance is inserted in the circuit during this upward movement whereby the current in the arc is gradually and continually decreased until eventually the arc is extinguished as a result of its elongation, the diminishing of the current therein and the arc extinguishing gas given off by the gas evolving surfaces 13 and 14.

Thus, an arc extinguishing device is provided which will be exceptionally effective regardless of the service conditions encountered but which nevertheless can be produced at a relatively low cost in contrast to the cost of known prior art devices.

While I have, in accordance with the patent statutes, shown a particular embodiment of my invention, other changes or modifications 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 device comprising a body of gas evolving insulating material, an arcing chamber within said body a pair of opposite walls of which are defined by a pair of converging surfaces spaced at one edge of said body and intersecting at a distance from the opposite edge thereof and a pair of elongated resistors defining continuous arc runners confined between said walls, said resistors spaced at one end thereof to define an arc gap therebetween and diverging toward said one edge of said body whereby an arc established across said gap will be moved by gas given off from said gas evolving body toward the diverging ends of said resistors and thereby elongated and extinguished.

2. An arc extinguishing device comprising a pair of slabs of gas evolving insulating material, said slabs having surfaces respectively opposed with portions adjacent respective edges thereof in abutting engagement the balance of said surfaces sloping apart and to the opposite edges respectively of said slabs to form a V-shaped space therebetween, a pair of elongated and spaced notches in the sloping portion of one of said opposed surfaces extending convergently from one of said opposite edges and terminating adjacent said abutting portion, a pair of similar notches in the sloping portion of the other of said surfaces oppositely disposed respectively with respect to said first mentioned pair of notches, a pair of elongated sticks of resistance material defining continuous arc runners confined between said surfaces in said notches and a pair of terminals electrically connected respectively to the ends of said sticks adjacent the abutting portion of said faces.

3. An arc extinguishing device comprising a pair of abutting blocks of gas evolving insulating material and a pair of elongated sticks of resistance material defining continuous arc runners, said resistor sticks being disposed between said blocks with an end of one of said sticks spaced a predetermined distance from a corresponding end of the other of said sticks and the opposite ends thereof spaced a greater distance, said blocks having opposed and sloping surfaces extending respectively from edges thereof adjacent the ends of said resistors having said greater spacing and intersecting adjacent the ends of said resistors having said predetermined spacing to define an arcing chamber open adjacent the ends of said resistors having the greater spacing and otherwise enclosed by said resistors and the abutment of said blocks.

4. An arc extinguishing device comprising a pair of abutting slabs of gas evolving insulating material having an arcing chamber therebetween and a pair of elongated sticks of resistance material defining continuous arc runners in said arcing chamber, opposite walls of said chamber being defined by respective surfaces of said slabs spaced at adjacent edges thereof and sloping convergently to an intersection at a distance from the opposite edges of said slabs, said sticks being spaced and divergently disposed in said chamber with the respective corresponding ends having the greater spacing positioned adjacent the portion of said chamber having the greatest wall spacing and the opposite ends having the lesser spacing positioned adjacent said intersection of said surfaces whereby an arc established between said opposite ends of said resistor sticks will be moved by gas given off from said slabs toward

5

the ends thereof having the greater spacing and the current therein thereby diminished to effect extinguishment thereof.

5. An arc extinguishing device comprising a body of gas evolving insulating material having an arcing chamber formed therein and a pair of spaced and elongated sticks of resistance material defining continuous arc runners longitudinally juxtaposed within said chamber, opposite walls of said chamber being defined by a pair of converging surfaces of said body spaced apart at and extending from an edge thereof adjacent one pair of proximate ends of said resistor sticks and intersecting adjacent the opposite pair of proximate ends thereof.

JOHN W. KALB.

6

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,298,726	Jackson -----	Apr. 1, 1919
1,944,402	Clerc -----	Jan. 23, 1934
2,315,618	Huffstutter -----	Apr. 6, 1943
2,349,681	Slepian -----	May 23, 1944

FOREIGN PATENTS

Number	Country	Date
548,810	Great Britain -----	Oct. 26, 1942