United States Patent

[11] 3,614,536

[72] Inventors **Bengt Johansson;**
Erland Nilsson, both of Ludvika, Sweden

[21] Appl. No. **54,518**
[22] Filed **July 13, 1970**
[45] Patented **Oct. 19, 1971**

[73] Assignee **Allmanna Svenska Elektriska Aktiebolaget**
Vasteras, Sweden

[54] **SPARK GAP WITH MAGNETIC BLOWING OF THE ARC**
7 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **317/74,** 313/DIG. 5, 315/36
[51] **Int. Cl.** **H02h 9/06**
[50] **Field of Search** ..... 317/74, 73, 70, DIG. 5; 315/36

[56] **References Cited**

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Primary Examiner—James D. Trammell
Attorney—Jennings Bailey, Jr.

ABSTRACT: A spark gap is formed between two discs of insulating material resistant to the arc and with a space therebetween. Two outer electrodes extend through the space between the discs from one side almost to the other periphery.. These electrodes are insulated through most of their length on their outer faces. An intermediate electrode is arranged on the inner wall of the space facing the two outer electrodes and extending angularly a substantial distance around such inside wall. This electrode has a protrusion opposite the space between the outer electrode. The arcs are magnetically drawn into the portions of the space between the electrodes remote from the intermediate electrode and are there extinguished.

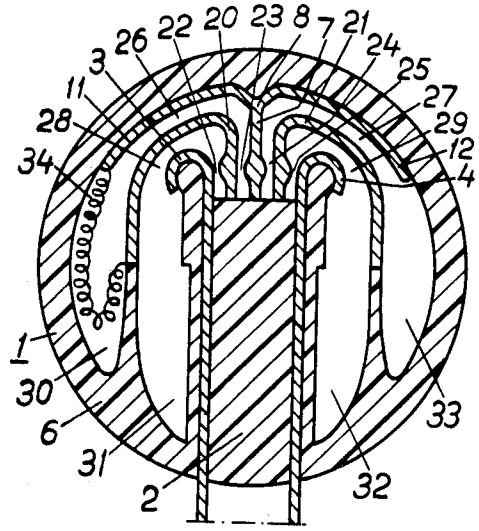


Fig. 1

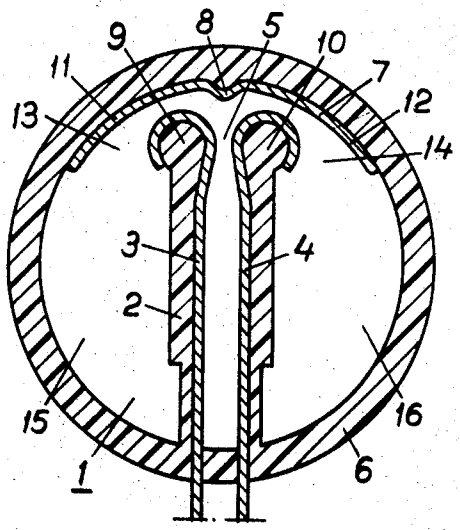


Fig. 2

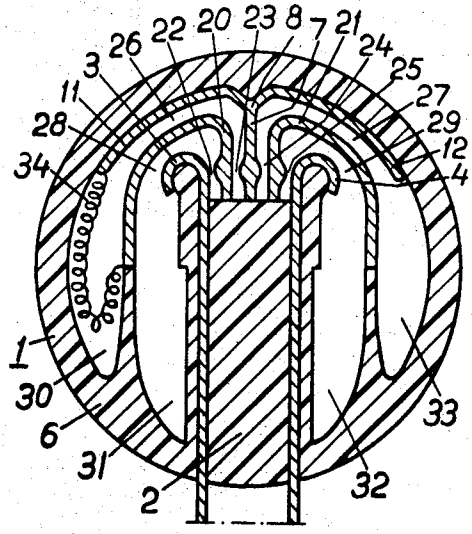


Fig. 4

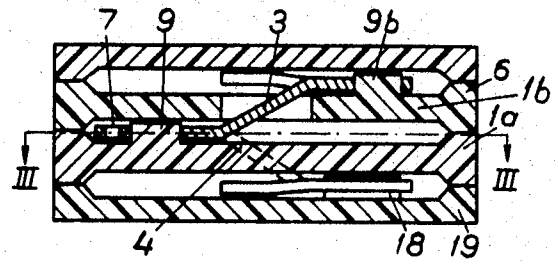
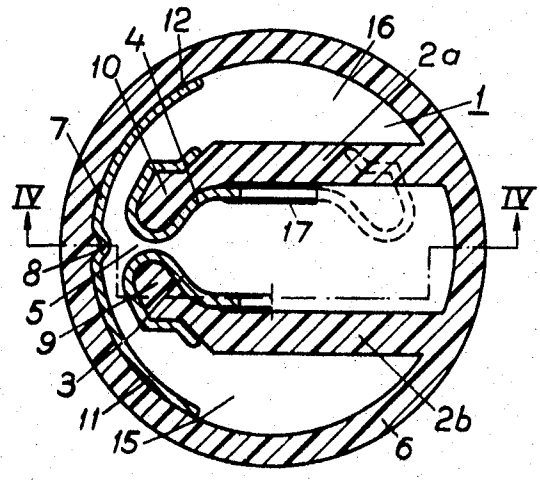


Fig. 3



INVENTORS
BENGT JOHANSSON
ERLAND NILSSON
BY
Jennings P. Bailey, Jr.

SPARK GAP WITH MAGNETIC BLOWING OF THE ARC

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a spark gap for surge diverters, preferably for lightning arresters having magnetic blowing of the arc arising between two electrodes. The device consists of at least two discs of insulating material resistant to the arc, having a space between the discs. The discs are provided with metal electrodes forming the spark gap.

SUMMARY OF THE INVENTION

According to the present invention, a spark gap is formed between two discs of insulating material resistant to the arc and with a space therebetween. Two outer electrodes extend through the space between the discs from one side almost to the other periphery. These electrodes are insulated through most of their length on their outer faces. An intermediate electrode is arranged on the inner wall of the space facing the two outer electrodes and extending angularly a substantial distance around such inside wall. This electrode has a protrusion opposite the space between the outer electrode. The arcs are magnetically drawn into the portions of the space between the electrodes remote from the intermediate electrode and are there extinguished.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:
FIGS. 1, 2 and 3 show three variations of the invention;
FIG. 4 is a section along the line IV—IV in FIG. 3, and
FIG. 3 is a section along the line III—III in FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows a disc 1 of arc-resistant insulating material on which the spark gap is arranged. A central part 2 of the disc carries the two outer electrodes 3 and 4 which at the upper part of the disc shown in the drawing are slightly bent towards each other so that a sparkover point 5 is formed. The disc is provided at its periphery with a raised edge 6 and along this edge an intermediate electrode 7 is arranged. The intermediate electrode is provided with a projection 8 which faces in towards the sparkover gap. The two outer electrodes are attached to the disc by their ends being bent to form eyes and each surrounds one projection 9, 10, respectively, on the central part 2 of the disc. From the projection 8 the intermediate electrode extends to the right and left with two electrode parts 11, 12, respectively, which run along the edge 6 of the disc. The spaces between the outer electrodes and the opposite parts of the intermediate electrode form paths for the arcs arising in the sparkover point 5 and which are blown out against the periphery of the disc by the magnetic flux. A path at 13 is thus formed between the outer electrode 3 and the electrode part 11 and a second path at 14 between the outer electrode 4 and the electrode part 12. The two paths, which may be said to coincide in the region just above the sparkover point, run first out towards the periphery of the disc, but as soon as the arc has come into contact with the intermediate electrode, it is divided into two parts and each part follows its own path which, from the region between the sparkover point and the projection 8, is deflected by an angle between 90° and 180°, expands and is extinguished in extinguishing chambers, 15, 16, respectively.

When an arc has arisen in the sparkover point 5, it is first directed upwards with the foot points remaining on the outer electrodes. When arc comes into contact with the projection 8 of the intermediate electrode it is divided and the two parts continue separately with one foot point remaining on an outer electrode and the other on one part of the intermediate electrode and are the forced in conventional manner into the extinguishing chambers. The advantage with this device is that it makes it possible to place a comparatively long total running path from the sparkover point to the extinguishing chamber within the limited area of the disc 1. Because of the long running path, and also because of its deflection, the sparkover gap is protected against the arc and is also given time for deionization. This means that the voltage drop in the arc can increase very rapidly without risk of reignition at the sparkover point. This is particularly so with large currents when the arc tends to jitter within the space, which means that the erosion is low. With small currents the arc extension will be long and reach the limits of the space. The superimposed current is thus throttled and the gap is well able to extinguish even after it has diverted a large current.

The embodiment of the invention shown in FIG. 2 has, as well as the two outer electrodes 3 and 4 and the intermediate electrode 7, two auxiliary intermediate electrodes 20 and 21. The electrode 20 is situated between the outer electrode 3 and the intermediate electrode 7, the projection 8 being extended to the central part 2 of the disc, where it is attached. The auxiliary intermediate electrode 21 is arranged between the outer electrode 4 and the intermediate electrode. The two auxiliary intermediate electrodes are attached in the central part 2 of the disc.

The arrangement with five electrodes gives four series-connected sparkover points 22, 23, 24 and 25, as can be seen from the drawings. In the same way as described in connection with FIG. 1, the spaces between the electrodes will form paths for the arcs arising at the four sparkover points. Between the auxiliary intermediate electrode 20 and the intermediate electrode 7 and its electrode part 11 a path is formed at 26 for the arc arising in the sparkover gap 23. In the same way a path is formed at 27 between the auxiliary intermediate electrode 21 and the intermediate electrode with its electrode part 12. A third path is formed at 28 between the outer electrode 3 and the auxiliary intermediate electrode 20 and a corresponding path exists at 29 between the second outer electrode 4 and the auxiliary intermediate electrode 21. All the paths run from a sparkover point upwards in the drawing out towards the outer edge of the disc and then turn an angle of between 90° and 180°, expand and end in extinguishing chambers 30, 31, 32 and 33. In the drawing it is seen that the arc 34 formed between the middle electrode 7 and the intermediate electrode 20 has been forced out into the extinguishing chamber 30 which may be said to be a continuation of the path 26. In the same way the path 28 finishes in the extinguishing chamber 31, the path 29 in the extinguishing chamber 32 and the path 27 in the extinguishing chamber 33.

The embodiment shown in FIG. 1 may be modified so that the projection 8 which projects somewhat towards the sparkover point 5 is extended as shown in FIG. 2 so that two series-connected spark gaps are obtained between the intermediate electrode and the two outer electrodes.

The outer electrode 4 shown in FIG. 3 is made of metal wire bent as shown in the figure with an open loop at each end. The upper loop surrounds the projection 10 in FIG. 3, note visible in FIG. 4. The electrode extends through a slot 17 down to the lower side of the disc 1*a* where the other loop surrounds a second projection 18 on a disc 19 situated below the disc 1*a* in FIG. 4. FIG. 4 shows how the outer electrode 3 encloses the projection 9 and extends through a slot 17 in the disc 1*b* situated above the disc 1*a* and there surrounds an upwardly directed projection 9*b* with its loop. Each outer electrode is thus held in position by one loop surrounding a projection on a disc and the other loop surrounding a projection on an adjacent disc.

FIG. 3 shows that the central part 2 of the disc consists of two parallel parts 2*a* and 2*b* which project from the edge 6 at the right-hand side of the disc and extend to the left, and end with the projections 9 and 10. When a second disc is placed above the disc, the space between the two parts 2*a* and 2*b* will be completely separated from the two extinguishing chambers 15 and 16. Furthermore, the magnetic field prevents the arc which arises when the spark gap sparks over from entering said space. There is thus no risk of flashover through the slots 17 from one side of the disc to the other.

The proposed spark gap has a number of advantages, such as a long arc path in the extinguishing chamber because the arc is divided. The sparkover point is protected from the arc in the extinguishing chamber, thus eliminating the risk of reignition of the arc.

Furthermore, an electrode can be easily and practically shaped so that it reaches from one sparkover point to the next even when the two sparkover points are in different spaces. The electrodes can be prefabricated and assembled on the disc simply by pressing them on to one of the projections. Both the electrodes of a spark gap are fixed to the same surface, thus giving the greatest possible security that the distance of the spark gap will be exactly that desired.

I claim:

1. Spark gap for surge diverters with magnetic blowing of the arc arising between electrodes comprising at least two discs of insulating material resistant to the arc and having a space between the discs, comprising first and second spaced outer electrodes and an intermediate electrode spaced from the outer electrodes and located adjacent the periphery of the discs, the outer electrodes being positioned closer to the intermediate electrode than the center of the discs, and the space comprising two parts extending in opposite directions from the gaps between the first and second outer electrodes to points adjacent the other side of the discs from the intermediate electrode, whereby the arc paths between the outer electrodes and the intermediate electrodes can form an angle of 90° to 180° within such spaces to expand and extinguish the arcs between the electrodes.

2. Spark gap as claimed in claim 1, in which the intermediate electrode has a projection opposite the space between the outer electrodes and extends on either side of such projection circumferentially of the discs.

3. Spark gap as claimed in claim 1 in which the outer electrodes have parts extending between the discs to the periphery thereof opposite the intermediate electrode and having means insulating such parts from said spaces.

4. Spark gap as claimed in claim 3, in which said parts are at least substantially parallel.

5. Spark gap as claimed in claim 1, in which one of the discs has projections thereon positioned in the space between the discs and the first and second electrodes include parts resiliently gripping said projections.

6. Spark gap as claimed in claim 5, in which the projection is located adjacent the sparkover point between the electrodes.

7. Spark gap as claimed in claim 1, having at least fourth and fifth electrodes between the first and second electrodes and the third electrode to form spark gaps with both the first and second electrodes and the third electrode.