United States Patent

[11] 3,585,437

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[21] Appl. No. **779,455**
[22] Filed **Nov. 27, 1968**
[45] Patented **June 15, 1971**

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[32] Priority **Dec. 6, 1967**
[33] **Sweden**
[31] **16,780/67**

[54] **SPARK GAP HAVING TWO ELECTRODES FORMED OF SPACED BARS ENCLOSED IN A CASING**
9 Claims, 1 Drawing Fig.

[52] **U.S. Cl.** **313/307,** 313/325
[51] **Int. Cl.** **H01j 1/46**
[50] **Field of Search** 313/325, 306, 307, 62, 349, 350

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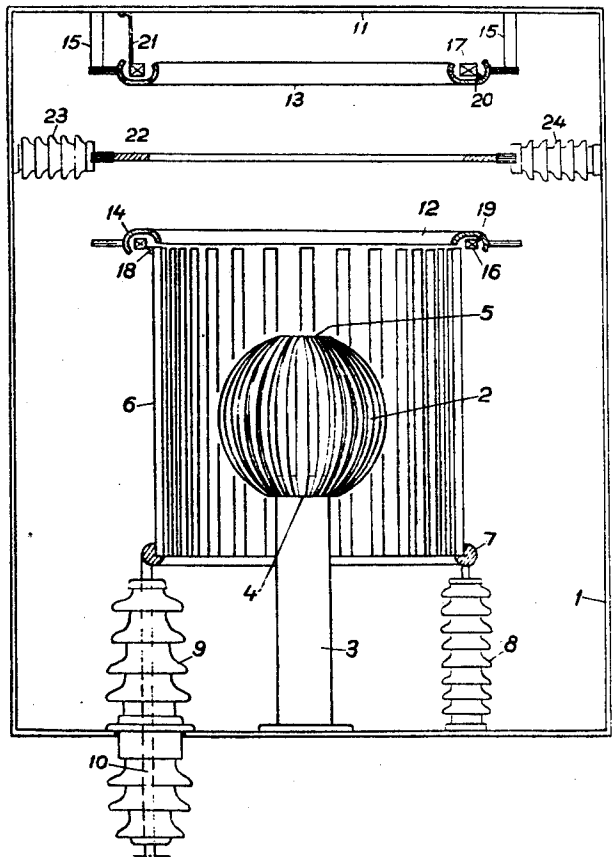
ABSTRACT: A spark gap is composed of inner and outer electrodes enclosed in a casing. The inner electrode is formed of spaced bars shaped as circular arcs and the outer electrodes of straight parallel bars. The bars of each of the electrodes are electrically connected to each other at one end and spaced apart at the other end.



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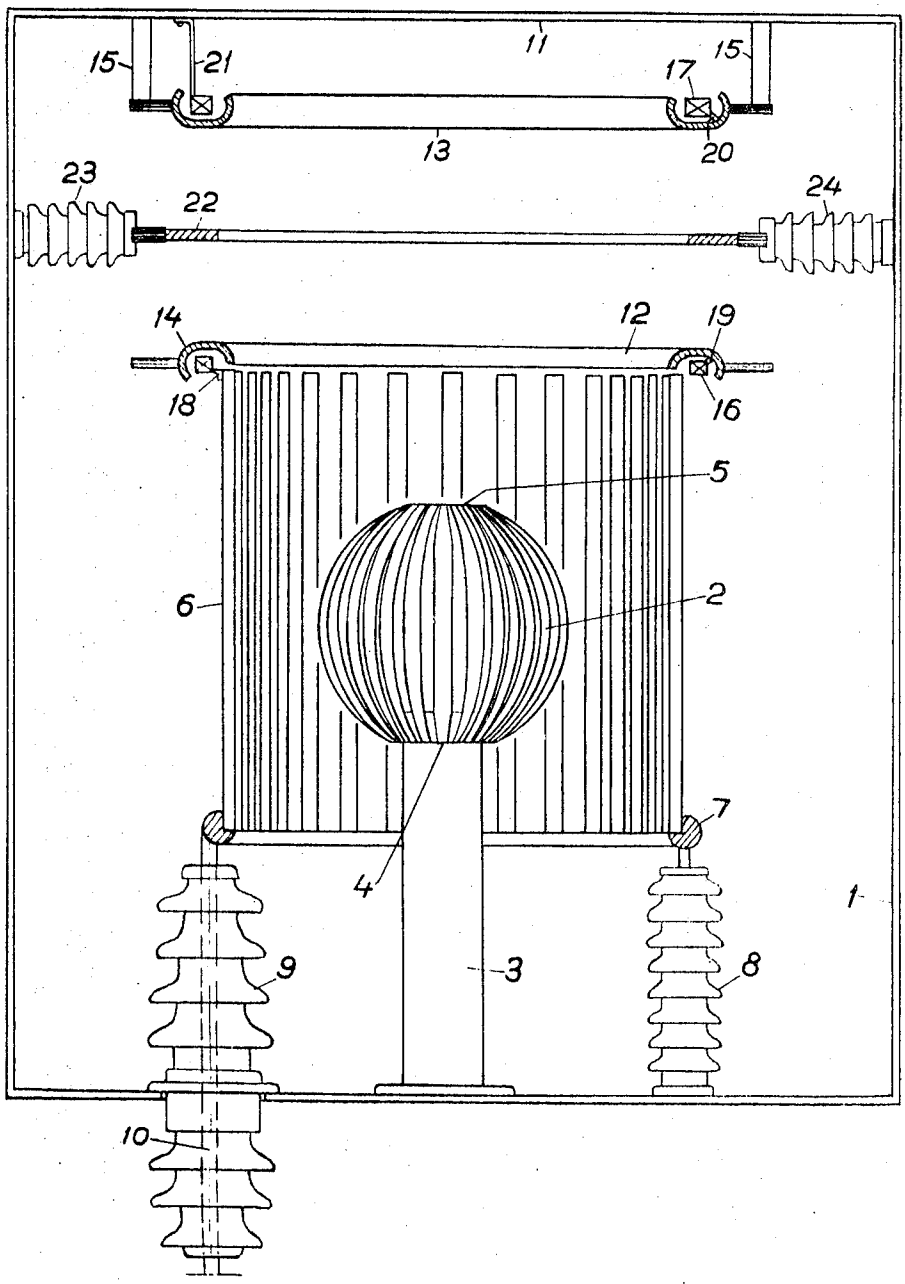

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SPARK GAP HAVING TWO ELECTRODES FORMED OF SPACED BARS ENCLOSED IN A CASING

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a spark gap with the air sparking path and the two electrodes arranged in a common casing.

SUMMARY OF THE INVENTION

The present invention relates to a spark gap with the sparking path in air and the two electrodes between which the spark arises arranged in a common casing, characterized in that the two electrodes are built up of a number of bars which are electrically connected to each other at one end, but otherwise insulated from each other and that one of the electrodes, the inner electrode, is arranged inside the other electrode, the outer electrode.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompany drawing shows a spark gap according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The spark gap is enclosed in a casing 1 of conducting material. One of the electrodes, which hereinafter will be called the inner electrode, is designated 2 and is supported by a pillar 3 of conducting material, which is mounted on the casing 1 so that the inner electrode is in direct electrical connection with the casing. The electrode is built up of a number of bars each shaped as part of a circular arc. The finished electrode thus has the shape of a ball. The two diametrically opposite areas where the bars meet are designated 4 and 5, one of which faces the pillar 3 and the other of which faces upwards. The inner electrode 2 is arranged inside the second outer electrode 6. The outer electrode is cylindrical and is built up of a number of straight bars which at the lower end are attached in a ring 7 of conducting material so that the electrode has the shape of a cylindrical cage. At the upper end the bars are free. In this way all the bars are joined to each other at the lower end but are free at the upper end. The outer electrode is arranged in the casing and is supported by a number of insulators 8, only one of which is shown. One of the insulators is designed as a through-bushing 9 through the casing 1 for the connection 10 to the outer electrode 6.

The pillar 3 is arranged to be displaceable in the horizontal direction on the inside of the casing. It is thus possible to displace the ball perpendicular to the central axis of the cage so that the ball can be placed centrally or eccentrically inside the cage. The ball is suitably placed somewhat eccentrically and so that its least distance to the cage is at that bar in the cage which is situated nearest the connection 10, as shown in the drawing. The construction also makes it possible to vary and adjust the ignition voltage of the spark gap.

Between the upper end of the outer electrode 6 and the upper part 11 of the casing 1, two annular electrodes 12 and 13 are inserted. The electrodes have an open, bowl-shaped cross section which is shown at 14 in the drawing. The lower electrode 12 is attached near the upper edge of the bars, but insulated from them. The electrode is suitably attached to some of the bars by an insulating spacer. The upper annular electrode 13 is suspended at the upper part of the casing by supports 15. Inside each of the electrodes is a winding 16, 17, respectively, comprising a few turns. The winding 16 situated inside the lower electrode 12 is attached by one end to the upper edge of a bar, as shown at 18 in the drawing. The other end of the winding is connected to the electrode 12 at a point 19 to the right in the drawing. In the same way the coil 17 in the upper electrode 13 is connected to the electrode at a point 20 whereas its other end is connected to the casing by means of a conductor 21.

Between the two annular electrodes 12 and 13, and preferably at equal distances from these, an annular intermediate electrode 22 is inserted. The intermediate electrode is attached to the casing 1 by means of insulators 23 and 24. If a spark arises between the inner electrode 2 and the outer electrode 6 so that an arc arises between the two electrodes, the arc will be thrown upwards by the current forces and ignition takes place between the two annular electrodes 12 and 13. After through-ignition the current path will go from the cage 6 through the winding 16 to the electrode 12 and from there as an arc to the electrode 13 by way of the intermediate electrode 22 and then through the winding 17 and conductor 21 to the casing 1.

The current through the coils 16 and 17 effects a toroid magnetic field around the two electrodes 12 and 13. The magnetic field, together with the current in the arc, causes the arc to start rotating and thus pass the intermediate electrode 22 which will then act as a guide for the arc, but which also effects a more rapid deionisation of the discharge path and thus accelerates extinction of the arc and counteracts reignition. Due to the rotation of the arc heating of the electrode surfaces is reduced and the returning strength is improved.

The spark gap according to the invention thus assures that the arc primarily generated between the ball 2 and the cage 6 will move rapidly to a location between the two annular electrodes 12 and 13 where it will be brought to rotate. The rotation causes the base points of the arc on the electrodes to be continuously moved so that heating of the electrode surfaces will be minimum. The rotation also effects effective cooling of the arc and deionisation of the discharge path. All this leads to a rapid extinction of the arc.

The fact that the electrodes are built up of bars also has the great advantage that, if the arc should again arise between the ball and cage after having been thrown up to rest between the two annular electrodes, the hairpin effect caused by the bars will again press the arc upwards against the annular electrodes. If the electrode surfaces are flat this phenomenon is not obtained.

We claim:

1. Spark gap with the air sparking path and first and second electrodes between which the spark arises arranged in a common casing (1), in which each of the two electrodes comprises bars which are electrically connected to each other at one end but insulated from each other otherwise, and that the first of the electrodes (2) is arranged within the second electrode (6).

2. Spark gap according to claim 1, in which the inner electrode (2) is substantially spherical and is built up of a number of bars each shaped as a part of a circular arc.

3. Spark gap according to claim 2, in which the inner electrode (2) is electrically connected by a pillar (3) to the casing (1), the pillar also acting as support for the inner electrode and being displaceable perpendicular to the central axis of the outer electrode.

4. Spark gap according to claim 1, in which the outer electrode (6) is shaped as a cylindrical cage and is built up of a number of straight bars joined to each other at one end by a ring (7) of conducting material and free at the other end.

5. Spark gap according to claim 4, in which the outer electrode (6) is supported by insulators (8,9) arranged between the casing (1) and the ring (7).

6. Spark gap according to claim 1, in which a first annular electrode (12) is arranged concentrically with the outer electrode (6) and in the vicinity of the free ends of the bars and a second annular electrode (13) is arranged coaxially with the first annular electrode (12) and attached at a distance therefrom to the casing (1).

7. Spark gap according to claim 6, in which an annular intermediate electrode (22) is arranged between the first and the second annular electrodes (12,13) and insulated at its point of attachment to the casing.

8. Spark gap according to claim 6, in which the annular electrodes (12,13) have bowl-shaped cross section and a winding is arranged inside each of the electrodes, one end of

each winding being connected to the electrode inside which it is arranged.

9. Spark gap according to claim 8, in which in the lower annular electrode (12) the other end of the winding is joined to a bar in the outer electrode (6), and in the upper annular electrode (13) the other end of the winding (17) is connected to the casing.