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SPARK GAPS FOR INCORPORATION IN ENCLOSURES
CONTAINING GAS UNDER PRESSURE
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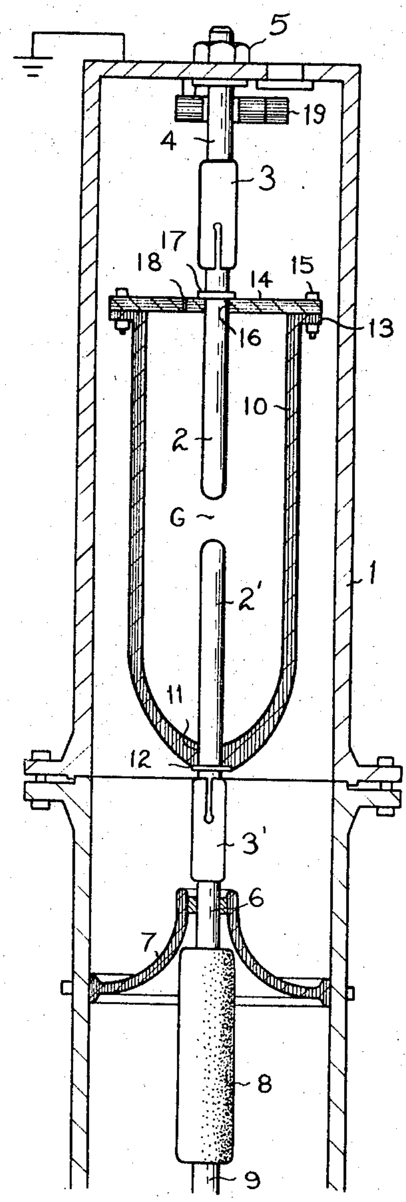

Inventors

Georg Koppl
Mathias Sanders

By Pierce, Scheffler & Parker
Attorneys

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SPARK GAPS FOR INCORPORATION IN ENCLOSURES CONTAINING GAS UNDER PRESSURE

Georg Koppl, Birr, and Mathias Sanders, Neuenhof, Switzerland, assignors to Aktiengesellschaft Brown, Boveri & Cie, Baden, Switzerland, a joint-stock company

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ABSTRACT OF THE DISCLOSURE

An encapsulated gas insulated electrical switch installation is provided with a spark gap located within the completely closed and gas filled housing which contains the switching equipment, the spark gap being designed to break down at a certain limiting voltage in order to ground and protect the equipment. To minimize the adverse effects caused by decomposition of the gas as a result of an arc-over of the spark gap, the electrodes which establish the spark gap are placed within a comparatively small auxiliary container located within the equipment housing, and this container is placed in communication with the interior of the housing through a small pressure equalizing port in the container wall. When arc-over occurs at the gap, decomposition of the gas is substantially limited to that part of the gas which is confined within the auxiliary container, thus leaving the larger, remaining portion of the gas within the housing practically uncontaminated.

The present invention relates to fully enclosed electrical switch installations and which include a spark gap designed to break down at a certain limiting voltage in order to protect the equipment.

The arc caused by breakdown, i.e., arcing over of the spark gap, causes the pressure to rise in the housing which fully encloses the switch equipment and the insulating gas used within the housing, to decompose. Both phenomena are undesirable, most particularly in the case where the insulating gas is of the type e.g., SF_6 in which the decomposition products attack insulation on the electrical equipment within the housing. Because of this undesirable consequence, it has been previously proposed to shorten the arc-over time of the spark gap by incorporating a specially constructed auxiliary device which permits the electrode ends which form the spark gap to come together at a predetermined time after the arc has been initiated. However, such an auxiliary device for closing the gap is quite expensive. Moreover, even though such a device is utilized, it is still necessary to clean the interior of the switch housing after an arc-over of the spark gap because of the fact that the decomposition products of the insulating gas have come into contact with the electrical equipment, and it is also necessary to renew or at least clean the insulation at the location of the spark gap.

The general object of the present invention is to provide an improved arrangement for the spark gap within the housing fully encapsulating the switch equipment and which avoids the disadvantages of the prior known constructions. This objective is attained by enclosing the electrodes, or at least the confronting end portions thereof which form the arc gap, in an auxiliary container made from electrically insulating material and located within the overall encapsulating housing for the switch equipment. This auxiliary container, which has a volume comparatively small in relation to that of the overall switch housing, is provided with a small port through the wall thereof placing the interior of the container in communication with the gas filled interior of the switch equipment housing so that under normal conditions the interior of the container within which the electrodes are located is filled with the insulating gas and at the same pressure. In the event that an arc-over of the spark gap occurs, the insulating gas within the auxiliary container will decompose, but since the pressure-equilization port is so small, practically all of the decomposition products will thus be confined to the interior of the container, thus leaving the larger volume of gas within the switch housing uncontaminated and not decomposed. A small amount of decomposed gas will escape from the container into the surrounding switch housing until the high pressure produced temporarily within the container as a result of the arc heat has equalized, but since the arcing time is rather short, this small quantity of decomposed gas is of no practical consequence.

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The foregoing as well as other objects and advantages of the invention will become more apparent from the following detailed description of one embodiment thereof and from the accompanying drawing wherein the sole view presented is a central vertical section through that part of the overall switch equipment housing in which the spark gap component is located.

With reference now to the drawing, that part of the overall switch equipment housing in which the protective arc gap component is located is indicated by numeral **1**, and can have a cylindrical configuration. The electrical equipment to be protected by the spark gap is located in another part of housing **1** and has not been included in order to simplify the drawing. The interior of housing **1** is filled with an insulating gas such as SF_6 at a super-atmospheric pressure. The required spark gap is established by stationary electrodes in the form of rods **2, 2'** which are axially aligned and have their ends in confronting spaced relation to establish a gap G. Electrode rod **2** is mounted at its opposite end in a plug type connector **3** which in turn is carried by a bolt **4** which extends through the end wall of housing **1**, which is grounded as indicated by the conventional symbol, and is secured to such wall by nut **5**. Electrode rod **2'** is mounted at its opposite end in a plug type connector **3'** which in turn is carried by a stud **6** which is secured to and passes through the central opening in a bell-like insulator **7** which is attached at its periphery to the inner wall surface of housing **1**. A resistor unit **8** is connected at one end to stud **6** and the opposite end of this stud is connected to a rigid rod type voltage-carrying conductor **9** which in turn is electrically connected to the equipment within the housing **1** desired to be protected by the arc gap.

In accordance with the invention, the electrode rods **2, 2'**, or at least the confronting ends thereof, are enclosed within an auxiliary container structure **10** made of electrically insulating material. The lower part of this container is cup-shaped and includes an aperture **11** through which the electrode rod **2'** passes. Aperture **11** is of substantially the same diameter as electrode rod **2'** to provide a snug, gas-tight fit, and the rest point for the electrode rod with respect to the container **10** is established by a collar **12** on rod **2'** which abuts against the outer surface of the container adjacent the pass-through aperture **11**. The upper part of container **10** is flanged at **13** and closed by an end plate **14** which is fastened to flange **13** by a plurality of circumferentially spaced bolts **15**. Electrode **2** passes through an aperture **16** in the closure plate **14** of substantially the same diameter as electrode rod **2** and the rest point for this electrode rod with respect to the closure plate **14** is established by a collar **17** on rod **2**.

The wall of container **10** includes a small port **18** placing the interior thereof in communication with the interior of housing **1**. In the present embodiment, this port is provided in the end plate **14** but could be located just as well at some other part of the wall of the container. Port **18** serves as a means for equalizing the gas pressure within the container **10** to that which prevails in the housing **1**. Thus, under normal conditions, the interior of container **10** is filled with the same gas which fills housing **1** and at the same pressure.

The construction is completed by an iron core component **19** of an indicator device, otherwise not detailed, mounted on the bolt **4**.

As previously explained, under normal operating conditions of the electrical equipment within housing **1**, the insulating gas within container **10** is at the same pressure as that which obtains in the interior of housing **1**. Should trouble now occur on the electrical equipment such that the voltage on electrode **2'** rises to a level so far above the ground potential which obtains on electrode **2** that the gap G breaks down, the heat of resulting arc between the electrode ends causes the gas within container **10** to decompose and its pressure to rise. This temporary increase in gas pressure within container **10** is relieved through port **18** and is accompanied by outflow of a small amount of the decomposed gas from the container into the surrounding housing **1**. However, since the arc lasts for only a comparatively short time, only a correspondingly small amount of decomposed gas will escape through this port. The decomposition products of the gas thus remain almost entirely within container **10**. The pressure peak within container **10** falls off rapidly after opening of the switch, as a consequence of heat transmission through the electrodes. Thus, the gas outside of container **10** but inside of the surrounding housing **1** remains practically uncontaminated. After opening of the switch, the spark gap electrodes can be easily replaced by dismantling the container.

I claim:

1. In an encapsulated electrical switch installation wherein the switch components are completely enclosed within a gas-filled housing and a spark gap structure is provided in circuit with the switch components to

protect the latter in the event of an overvoltage by breaking down to ground, the improvement wherein said spark gap structure is comprised of a pair of electrodes arranged in spaced relation to establish the gap therebetween, and said electrodes are enclosed within an auxiliary container located within said housing, said auxiliary container being provided with a pressure equalizing port in a wall thereof placing the interior of said container in communication with the interior of said housing, and which serves to confine therein substantially all of the gas decomposed as a result of an arc-over of said gap.

2. An encapsulated electrical switch installation as defined in claim **1** wherein said auxiliary container for said electrodes includes a removable cover to permit replacement of said electrodes.

3. An encapsulated electrical switch installation as defined in claim **1** and which further includes a resistance element connected in series with said electrodes and which is located within said housing but exteriorly of said auxiliary container.

4. An encapsulated electrical switch installation as defined in claim **1** and which further includes plug type connecting means for said electrodes located within said housing but exteriorly of said auxiliary container.

5. An encapsulated electrical switch installation as defined in claim **1** wherein said auxiliary container for said electrodes includes a removable cover to permit replacement of said electrodes and which further includes plug type connection means for said electrodes located within said housing but exteriorly of said auxiliary container.

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JOHN W. HUCKERT, *Primary Examiner.*

A. J. JAMES, *Assistant Examiner.*

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