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ARC-EXTINGUISHING CIRCUIT BREAKER WITH ENCLOSED GAS SPACE

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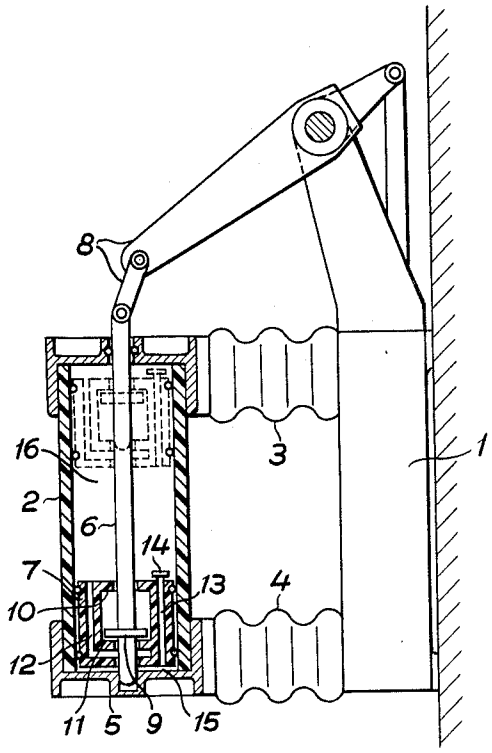

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ARC-EXTINGUISHING CIRCUIT BREAKER WITH ENCLOSED GAS SPACE

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Circuit breakers are known having a gas quantity consisting of for example sulphur hexafluoride (SF 6) permanently enclosed in an extinguishing chamber. In such circuit breakers the arc gases are not removed from the extinguishing chamber since to a great extent they are reconverted to the gas originally used. Reasonable breaking effects can be obtained by mechanically effecting an air blast on the breaking gap by means of momentary compression of part of the gas enclosed in the extinguishing chamber.

The present invention relates to a circuit breaker having a completely closed extinguishing chamber filled with gas and comprising a stationary and a movable contact. The invention is characterised in that the extinguishing chamber is formed as a pump housing in which a piston which divides the extinguishing chamber into an arc chamber containing the stationary contact and a pressure generating chamber is arranged to be moved forward biased by the movable contact. This is passed through the piston and provided with a carrier whose distance from a first stop in the piston in the closed position of the breaker is so chosen that the tip of the movable contact must be completely drawn into the piston before the carrier meets the first stop. An extinguishing gas channel is arranged through the piston, which channel is closed in the closed position of the circuit breaker by the movable contact, but is open when the carrier has reached the first stop in the piston.

By means of the invention an increased breaking capacity is obtained for breakers of the above mentioned type through intensified arc blowing. In addition to a compression of the gas in the pressure generating chamber, and under pressure is obtained in the arc chamber and the difference is pressure on both sides of the piston will be great and thus the extinguishing gas flow generated by this pressure difference will be powerful. The invention also provides a relative decrease in the work of the arc and the breaking gas development since the arc for a considerable part of its length will burn in a space having low pressure.

Another advantage with the construction is that during the opening movement when the carrier has reached the stop in the piston, the movable contact and the extinguished air channel are in rest position relative to each other and thus the arc is exposed to an intensive blast at one base point during almost the entire breaking process.

In order to direct a flow of extinguishing gas towards the base of the arc from all sides the tip of the movable contact is arranged to form an annular slot with the opening in the piston for the movable contact, which slot is in communication with the extinguishing air channel. It is further suitable to provide the piston with a second stop which is met by the carrier when the circuit breaker is closed, whereby the distance between the stops is chosen so that when the circuit breaker is closed the volume of the arc chamber will be as small as possible. In this way it is ensured that as low a pressure as possible is generated in the arc chamber at a breaking action.

To prevent a gas pocket being compressed in the arc, chamber, which gas pocket, when the circuit breaker is

closed, prevents or delays the closing, it is suitable to arrange a by-pass channel through the piston and provide this channel with nonreturn valve allowing gas to flow from the arc chamber to the pressure generating chamber.

The accompanying drawing shows one embodiment of the invention. In the FIGURE 1 designates the breaker support to which the extinguishing chamber **2** is attached by means of insulators **3** and **4**. A stationary contact **5** is arranged at the bottom of the extinguishing chamber. The movable contact **6** passes through the piston **7** which slides in an air-tight manner in the extinguishing chamber **2** formed as a pump housing. The movable contact is operated by means of a lever system of insulating rods **8**. The movable contact is provided with a carrier **9**. Two stops are also arranged in the piston, namely a first stop **10** and a second stop **11**. Further, an extinguishing gas channel **12** and a by-pass channel **13** provided with a nonreturn valve **14**. The arc chamber is formed by the space **15** and the pressure generating chamber by the space **16**. The extinguishing chamber **2** is filled with sulphur hexafluoride.

An important feature of the present invention is that the volume of the arc chamber or space **15** in the closed position of the breaker is very small compared to the volume of the pressure generating chamber or space **16**.

To explain this more clearly, it should be noted that, in order to ensure an extinguishing of the arc, the gas should flow through the gas channel **12** in the piston at the speed of sound. This speed is obtained when the pressure on one side of the piston is twice as great as the pressure on the other side of the piston, that is the side limiting the space into which the gas flows. In the breaker of this invention, the pressure in the space **15** decreases to half its initial value when this space **15** is doubled, if the assumption is made that during this first part of the breaking movement very little gas flows through the channel **12**. As the piston will have to move only a small distance in order to cause a doubling of space **15**, the pressure in space **16** will, during this first part of the breaking operation, remain unchanged substantially. Thus a condition necessary for a flow of extinguishing gas through the channel **12** at the speed of sound will be achieved at the beginning of the breaking movement of the movable contact.

At an opening movement the movable contact **6** is moved upwards until the carrier meets the stop **10**. Only then does the piston **7** begin to move and a flow of extinguishing gas passes through the channel **12** which is now freed by the movable contact pin **6**. Thus a powerful flow of extinguishing gas hits the arc between the contacts **5** and **6** and particularly the tip of the movable contact is cooled considerably by the flow of extinguishing gas. In the upper part of the extinguishing chamber **2** a piston is inserted in dotted lines to show the circuit breaker in its open position.

The circuit breaker is closed by the movable contact **6** moving downwards, whereby the carrier **9** meets the second stop **11** and the movable contact closes the extinguishing air channel **12**. The piston now moves downwards with the movable contact **6**. The gas in the arc chamber **15** is thus compressed and in order to prevent the compression becoming too great channels **13**, as mentioned earlier, have been arranged. Thus gas now flows from the arc chamber to the pressure generating chamber through the channel **13** past the nonreturn valve **14**, and a pressure equalization occurs between the arc chamber and the pressure generating chamber **16**. The stops **10** and **11** have been placed at such a distance from each other that at closed breaking gap the piston **7** almost touches the bottom of the extinguishing chamber so that

in the closed position of the circuit breaker the arc chamber **15** has a very small volume. The normal pressure in the extinguishing chamber **2** may be atmospheric pressure, but it may also have other values, for example, a couple of atmospheres over-pressure. In this case flexible gas sealings are suitably arranged for the passage of the movable contact through the upper wall of the extinguishing chamber.

I claim:

1. A circuit breaker comprising a completely closed extinguishing chamber filled with gas and having a closed cylindrical portion, a piston slidable in the cylindrical portion and dividing the chamber into an arc chamber having an end wall and a pressure generating chamber, the cross-section of the piston at the end nearest said end wall being equal to the internal cross-section of the closed cylindrical portion, a stationary contact within the arc chamber, a movable contact passing through said piston, said piston being slidably mounted on the movable contact, means for moving the movable contact from and towards the stationary contact, said movable contact and piston having cooperating means thereon for limiting the sliding movement of the piston with respect to the movable contact between first and second limit positions, said movable contact having a tip, the tip of the movable contact being completely drawn into the piston when said piston reaches one of said limit positions during opening movement, said piston having an extinguishing gas channel therethrough, said movable contact closing said gas channel in the closed position of the circuit breaker, said cooperating means including means allowing said movable contact, as it first moves away from the stationary

contact, to slide in said piston to an extent sufficient to uncover said gas channel, said cooperating means further including means to move said piston with the movable contact during further movement of the movable contact away from the stationary contact, said piston, when said contacts are closed and said piston is in the second limit position, lying closely adjacent the end wall of the arc chamber.

2. In a circuit breaker according to claim **1**, said piston having an annular slot exposed by the tip of the movable contact when said piston readies said first limit position forming a part of the extinguishing gas channel.

3. In a circuit breaker according to claim **1**, said piston having a by-pass channel therethrough provided with a non-return valve allowing gas to flow from the arc chamber to the pressure generating chamber only.

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