Nov. 24, 1970 K. D. MADSEN 3,542,985

CIRCUIT BREAKER FOR HIGH VOLTAGE DIRECT CURRENT

Filed Jan. 25, 1968

Fig. 1

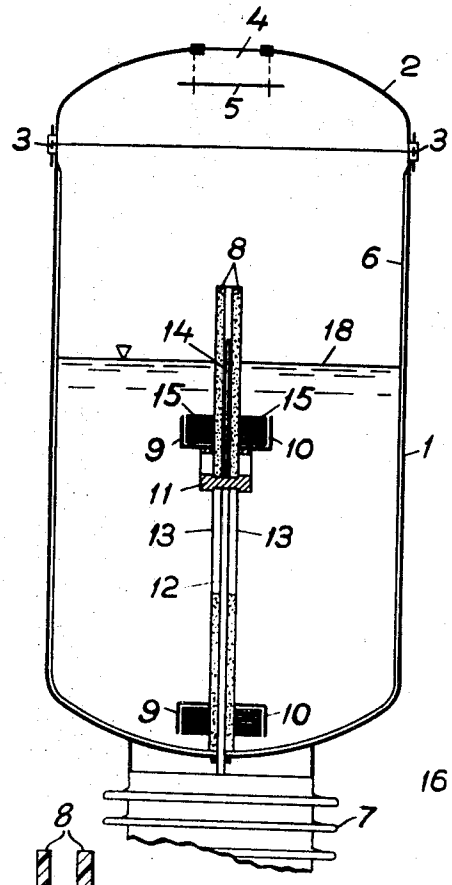
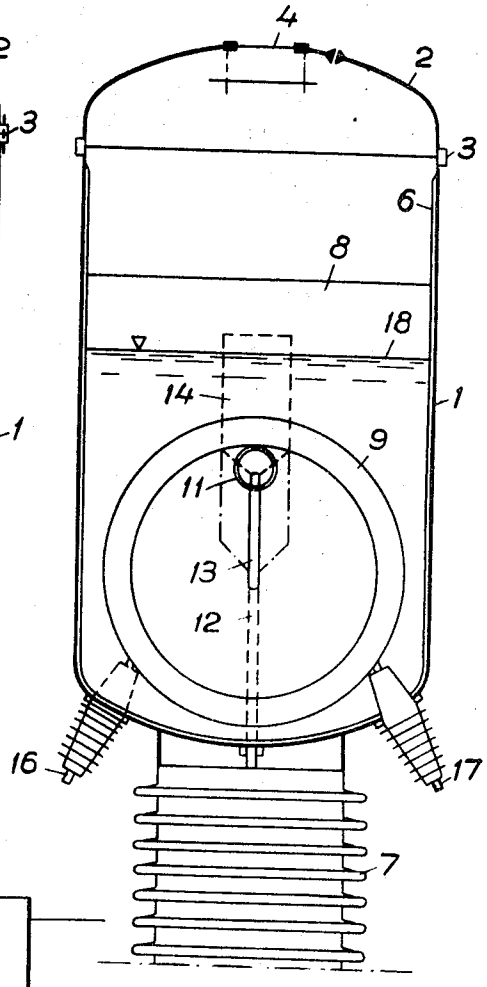


Fig. 2



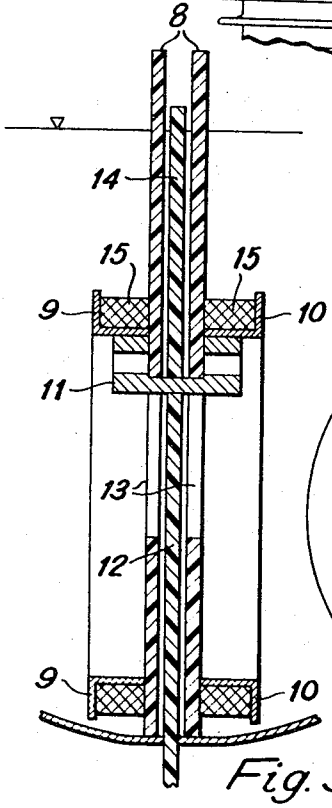


Fig. 3

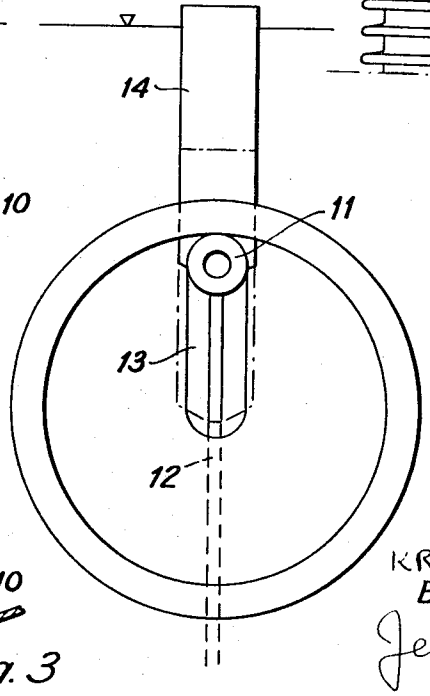


Fig. 4

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CIRCUIT BREAKER FOR HIGH VOLTAGE DIRECT CURRENT

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Int. Cl. H01h 33/18, 9/44, 33/68
U.S. Cl. 200—147 3 Claims

ABSTRACT OF THE DISCLOSURE

A circuit breaker is formed of two spaced apart annular outer electrodes, combined with which is a means for generating an axial magnetic flux. Means is provided inside the outer electrode which moves towards and away from centers of the outer electrodes for bridging the spacing for closing and opening the electrical connection between the outer electrodes. This means may be an annular inner electrode operated by a bar passing between the outer electrodes. Two parts of insulating material separate the outer electrodes leaving a slot between them for the bar, and an electrically insulating shield is arranged between the parts and attached to the bar to cover the opening between the parts when the inner electrode is moved to circuit-breaking position.

BACKGROUND OF THE INVENTION

Field of the invention

The invention relates to a circuit breaker for high voltage direct current.

The prior art

It is known to operate circuit breakers by using prestressed springs or hydraulic and pneumatic means. In such operating systems, however, it is extremely difficult to meet the desired increased demands for rapid operation of circuit breakers. As regards circuit breakers for high voltage current there is also the special fact that the arc must have a considerable length before breaking is obtained. With known operating systems of the mentioned types it is hard to achieve in sufficiently short a time the necessary distance between the contact surfaces which is necessary for breaking. By using explosives or some explosive gas for operating the breaker, very short operating times for circuit breakers can be obtained. When using such a method of operation, however, it is difficult to obtain several breakings in short intervals in high voltage circuit breakers which is necessary for instance during rapid reclosing. Furthermore, circuit breakers operated in such a way often have the disadvantage that the products of combustion will soil the operating cylinder and the surrounding breaking parts. This can result in disturbances, for instance on account of reduced insulating ability, particularly if the operating cylinder is placed near the breaking means at the high voltage potential. Because the operators often are being unaccustomed to explosives, this type of circuit breaker also involves considerable risk of accidents. Operation is also usually rather noisy.

SUMMARY OF THE INVENTION

The present invention relates to a circuit breaker, preferably for high voltage current consisting of a number of series-connected and substantially identical breaking devices. Such a breaking device consists of an outer, circular electrode provided with means for generating an axial magnetic flux and an inner electrode arranged inside the outer electrode. The invention is characterised in

that the inner electrode is arranged in a diametrical plane with respect to the outer electrode and that at least one of the elecrtodes is provided with means for obtaining closing and opening of the electrical connection between the electrodes in said diametrical plane.

BRIEF DESCRIPTION OF THE DRAWINGS

On the accompanying drawing FIGS. 1 and 2 show two sections perpendicular to each other through a circuit breaker with two series-connected breaking devices. FIG. 3 is an enlarged cross-section of a part of FIG. 1 and FIG. 4 is an enlargement of a part of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The circuit breaker shown in FIGS. 1 and 2 has a casing **1**, suitably of strong metal sheet which can withstand the high pressure arising at opening. The casing has a cover **2** at the top attached to the casing by bolts **3** or the like. The cover is provided at the top with a blast plate **4** which yields if the pressure inside the casing increases so much that there is risk of the casing bursting. In order to prevent extinguishing medium splashing out if the blast plate should burst, a shield **5** is arranged below the blast plate. Below the cover the casting is provided internally with an insulating covering **6**. The circuit breaker is placed on an insulator **7** which contains the operating apparatus necessary for operating the circuit breaker.

The circuit breaker comprises two breaking devices arranged close to each other and separated by two plates **8** of insulating material. The right hand breaking device shown in FIG. 1 has an outer electrode **10**. The series connection is obtained by two of the breaking devices having a common inner electrode **11**. The inner electrode is operated by a rod **12** arranged between the plates **8** and extending into the insulator **7** to the operating apparatus. When operating the inner electrode it moves in openings **13** in the plates **8**. In order to prevent the arcs in the two breaking devices from coming into contact with each other during the breaking process, a shield **14** of insulating material is attached to the inner electrode. The shield, together with the plates **8**, makes a sufficiently long distance to prevent creeping current flash-over between the two breaking devices. In FIG. 2 the shield is shown with broken lines in the closed position of the circuit breaker, the inner electrode connecting the two outer electrodes. The dot and dash lines show the shield in the open position of the circuit breaker when the inner electrode is in the middle of the outer electrodes.

The coil **15** for generating the axial magnetic flux is arranged immediately outside the outer electrode. The magnet coils for the two breaking devices are series-connected so that the magnet flux has the same direction in both breaking elements. Each of the outer electrodes is connected to that network which is to be opened over the terminals **16** and **17** which are arranged in the casing **1**, as can be seen from FIG. 2. Due to this and to the fact that both the breaking devices are connected to each other by means of the common inner electrode the current in one breaking device will flow towards the inner electrode from one of the terminals over one of the outer electrodes, while in the second breaking device the current will flow from the inner electrode over the second outer electrode to the second terminal. This means that the two arcs from the inner electrode **11** to the two outer electrodes **9** and **10** will rotate in opposite directions under influence of the magnetic flux from the coils **15**. This substantially eliminates the torque which influences the circuit breaker due to electrodynamic forces.

To extinguish the arc the casing **1** is filled with a suitable medium, such as oil or clean water, and its free surface is designated **18**. The extinguishing substance must com-

pletely cover the breaking devices, but there must be enough space for the gases which are generated during breaking. Particularly if oil is used, it is important to pay attention to this fact as considerable quantites of gas are generated when the oil around the arc is heated.

I claim:

1. Circuit breaker comprising two outer circular electrodes arranged side by side and insulated and spaced from each other, each electrode being provided with means for generating an axial magnetic flux and means arranged inside the outer electrodes and movable towards and away from the centers of the outer electrodes for bridging said space for closing and opening the electrical connection between the outer electrodes, said two outer electrodes are separated by two plates of insulating material arranged at distance from each other separating said outer electrodes, said plates forming a slot between them, and a rod is arranged, movably mounted in said slot connected to the movable means for the operation thereof.

2. Circuit breaker according to claim 1 in which that part of the plates which is situated inside the outer electrodes has a radial opening for the movement of the movable means.

3. Circuit breaker according to claim 2, in which an electrically insulating shield is arranged between the plates and attached to the rod, thereby covering the opening in the plates when the movable means is in the center of the outer circular electrodes.

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