United States Patent

Gard

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[45] **June 13, 1972**

[54] HIGH VOLTAGE CIRCUIT BREAKER OF LOW LIQUID TYPE

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[52] **U.S. Cl.** ..... **200/150 B**

[51] **Int. Cl.** **H01h 33/75**

[58] **Field of Search** ..... 200/150 B, 150 R

[56] **References Cited**

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1,169,459 11/1969 Great Britain ..... 200/150 B

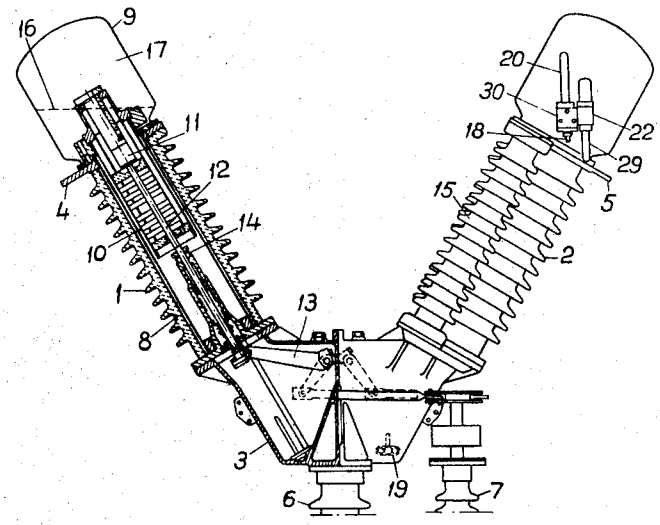
Primary Examiner—Robert S. Macon

Attorney—Jennings Bailey, Jr.

[57] **ABSTRACT**

In a high voltage circuit breaker of low liquid type the breaking chambers are pressurized to prevent the circuit breaker from restriking when breaking capacitive loads. All the seals required for these pressurized chambers are located below the liquid level in each chamber.

7 Claims, 3 Drawing Figures



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SHEET 1 OF 2

Fig. 1

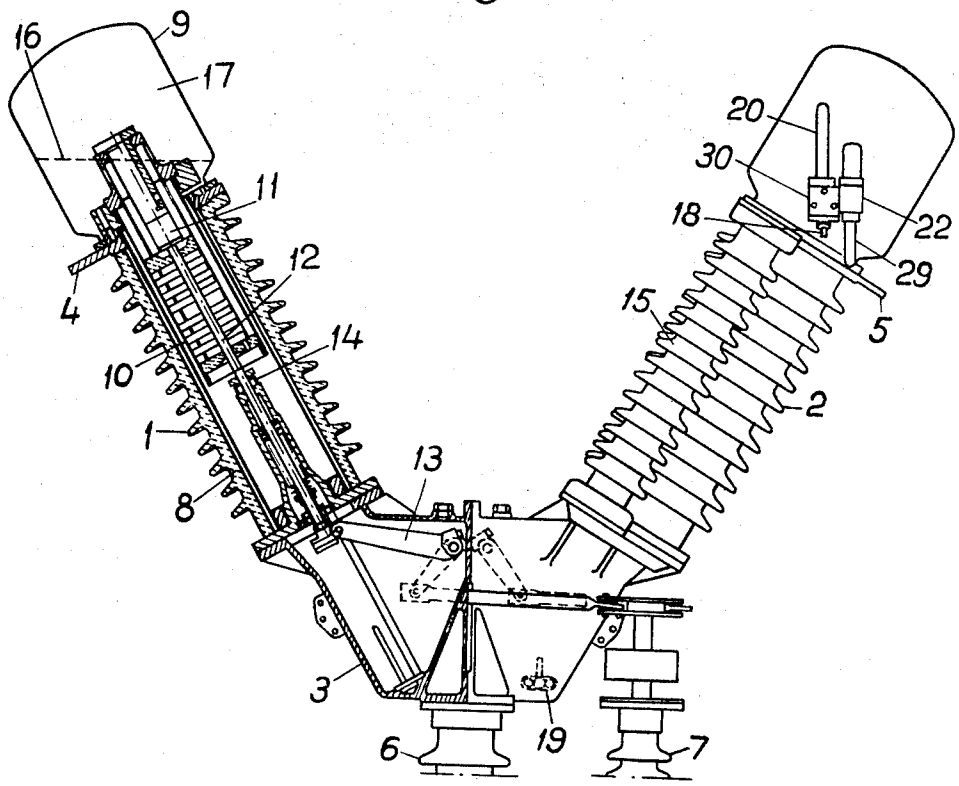

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Fig.2

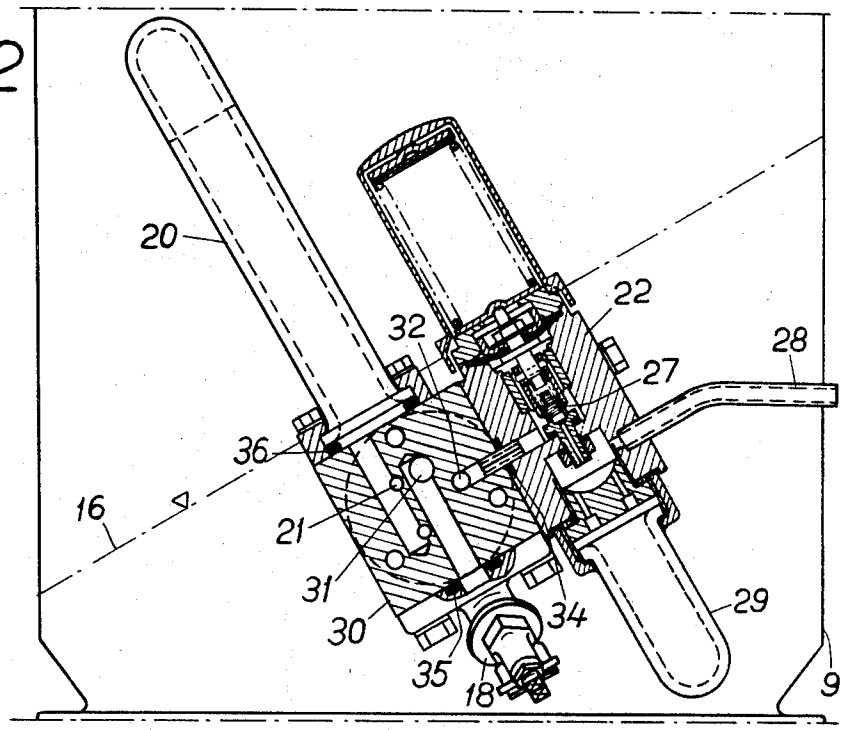
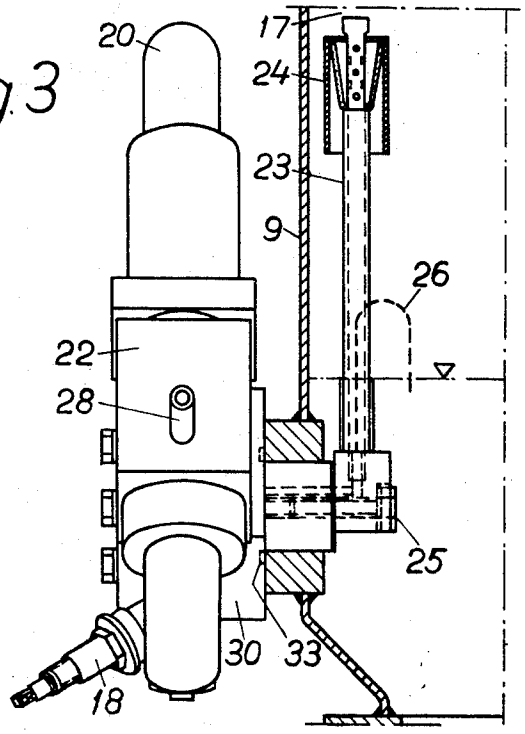


Fig.3



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HIGH VOLTAGE CIRCUIT BREAKER OF LOW LIQUID TYPE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a high voltage circuit breaker of low liquid type, particularly low oil circuit breakers of the sort having at least one contact pair arranged in a breaking chamber which is filled to a certain level, above which a space filled with pressurized gas is located, having a feeding valve for the supply of gas to the space and an exhaust valve which opens when the pressure in the chamber exceeds a certain value.

2. The Prior Art

Circuit breakers of this type are already known through Swedish published specification No. 310,726. Since the breaking chambers of these circuit breakers are placed under pressure with the help of pressurized gas, the breakers will not restrike when breaking capacitive loads, even at high operating voltages. In the construction described in the above-mentioned specification, a permanently connected compressor unit is used to place the circuit breaker under pressure although no air is used in the circuit breaker apart from leakage. The reason for this is that a high voltage circuit breaker must normally be able to be connected for years without supervision and with the previously known construction it was found virtually impossible to make the circuit breaker so tight that the desired overpressure could thus be maintained in the breaking chambers if they were not permanently connected to a source of pressurized gas. It has been found particularly difficult to achieve sufficient reliability in the seals for the feeding and exhaust valves arranged in connection with the volume of air above the liquid level in the top cover of the breaking chamber. Neither has it been possible to discover the first signs of leakage in these seals by simple means.

SUMMARY OF THE INVENTION

The object of the invention is to provide a solution to the problem mentioned above and thus effect a simpler and less expensive circuit breaker of the type in question. This is achieved by constructing the circuit breaker so as to have the valves connected to the gas space under overpressure through openings which are located below the liquid level in the chamber and provided with seals which are thus influenced by liquid pressure.

By locating all the seals below the liquid level, they will be protected by the liquid and a more reliable seal is obtained. Furthermore, it is then easy to check that all the seals are tight, both when the breaker is being put into operation and also during inspection while it is in operation. This means that a permanently connected compressor unit to place the circuit breaker under pressure is no longer required. This enables the cost of the circuit breaker to be considerably reduced.

During a breaking process, vaporization takes place and a chemical disintegration of liquid so that the pressure in the breaking chamber rises. At a certain pressure level the exhaust valve of the circuit breaker opens. So that as little liquid as possible is then removed from the breaking chamber, the space around the seals of the exhaust valve is supplied with liquid from the volume of liquid located in the breaking chamber through a throttle member or a capillary transport member while the inlet side of the valve communicates substantially freely with the area of the breaking chamber filled with pressurized gas. Thus, when the valve opens, substantially only gases are removed from the breaking chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further described in connection with an embodiment shown in the accompanying drawings. FIG. 1 shows partly in section the upper part of a low oil circuit breaker according to the invention. FIGS. 2 and 3 show partly in section two views perpendicular to each other of the valve members with a leakage indicator and gauges for pressure and liquid level arranged in connection with the breaking chambers.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The low oil circuit breaker shown in FIG. 1 consists of two series connected contact pairs, enclosed in individual breaking chambers 1 and 2 which are arranged in V-formation in relation to each other on a common mechanism housing 3. The connecting terminals of the breaker are designated 4 and 5. The mechanism housing 3 is supported by a support insulator 6. The circuit breaker is operated through a rotatable operating insulator 7 from an operating mechanism arranged at earth potential.

The breaking chambers 1 and 2, the chamber 1 being shown in cross-section, are identical. The breaking chamber 1 comprises a hollow porcelain insulator 8 with a metallic top cover 9. Inside the breaking chamber 1 is an extinguishing chamber 10 which operates according to the longitudinal blowing principle. The extinguishing chamber 10 contains the stationary contact 11 of the contact pair, this contact being in communication with the connecting terminal 4. The movable contact 12 of the contact pair consists of a solid contact plug which is connected through a link mechanism 13 to the operating insulator 7. The current transmission between the movable contact 12 and the mechanism housing 3 takes place through a sliding contact member 14. In order to ensure uniform voltage distribution between the different breaking gaps, each breaking gap is connected in parallel with a grading capacitor 15. The breaking chamber 1, together with one half of the mechanism housing 3, forms a hermetically closed unit which is filled with oil to a certain level 16. In order to increase the voltage strength in the oil and thus obtain a low oil circuit breaker which does not reignite during capacitive breaking, the space 17 above the oil volume in the breaking chamber is filled with compressed gas, for example of 5 atmospheres pressure. The pressurized gas is introduced before the breaker is put into operation, from a mobile pressurized gas source through a feeding valve 18 consisting of a manually operated closing valve; and, in principle, this pressurization only needs to be repeated if the breaking chamber has been dismantled for general overhaul, for example.

After the breaker has been assembled on the site, cold-resistant oil is poured in through a closing valve 19. The feeding valve 18 at this time is open. When the oil volume has increased to the level 16, which is indicated by oil starting to run out through the feeding valve 18, the valve 19 is closed. A movable pressurized gas source, for example a compressor or pressurized gas bottle, is then connected to the feeding valve 18 and the breaking chamber is pressurized to the desired overpressure. The valve 18 is then closed and the source of pressurized gas disconnected. Because of the overpressure in the breaking chamber, oil is pressed up in an oil gauge 20 which communicates through a drilled channel 21 with the volume of oil in the breaking chamber. The oil gauge 20 thus acts as a pressure and oil level indicator. If, for example, the overpressure in the breaking chamber disappears or the oil level drops to the critical level, which is on a level with the channel 21, the oil gauge 20 is emptied of oil. This is an indication that the circuit breaker must be taken out of operation for overhaul at the first possible opportunity.

During a breaking action, oil is vaporized in the oil pockets arranged along the arc channel so that the arc is subjected to a powerful axial flow of oil and gas. The cooling and deionization of the arc is thus extremely effective. In order to limit the pressure increase in the breaking chamber during breaking of high currents, an exhaust valve 22 is arranged in connection with the top cover 9 of the breaking chamber, said valve opening when the pressure exceeds a certain value and closing when the pressure again falls to operating pressure. The inlet side of the exhaust valve communicates, by way of a tube 23 and an oil separator 24, with the space 17 filled with pres-

surized gas, and also communicates with the volume of oil in the breaking chamber through a throttle member **25**. Instead of the throttle member **25**, a wick **26** or some other capillary member for transporting oil to the inlet side of the exhaust valve may be used with advantage. The movable valve member **27** of the exhaust valve and other seals therefore lie below the oil level during normal operation, but, in spite of this, only a very small quantity of oil is blown out through the blowout tube **28** when the valve opens during a breaking action. In order to indicate any leakage past the valve member **27** of the exhaust valve, an oil gauge **29** is arranged on the outlet side of the valve.

The exhaust valve **22**, the feeding valve **18** and the pressure and oil level indicator **20** are attached on a common base **30** which is provided with the required connection channels **21**, **31** and **32** secured by screws to the top cover **9**. The necessary seals **33,34,35** and **36** are arranged between the base **30** and top cover **9** and between the base **30** and the members **18,20** and **22** attached to it. All these seals are immersed in oil. This also applies to other seals required to seal the pressurized part of the breaker, for example the seals between the top cover **9** and the breaking chamber insulator **8** and the mechanism housing **3** and the shaft seal at the point where the link mechanism **13** passes through the wall of the mechanism housing. Since, thus, all seals of the space under pressure are immersed in oil and thus only to a limited extent affected by the relatively chemically active breaking gases, a considerably more reliable seal is obtained than in corresponding previously known constructions. By direct observation of the various sealing points, furthermore, it is possible at an early stage to discover if a leakage occurs and take the necessary steps at a suitable opportunity. This can be done in good time before there is a noticeable reduction in pressure or lowering of the oil level in the breaking chamber.

Instead of the longitudinal blowing chamber, of course, any other suitable type of extinguishing chamber may be used, for example a transverse blowing chamber.

I claim:

1. High voltage circuit breaker of low liquid type, having a breaking chamber (**1**) and at least one contact pair (**11,12**) arranged in the breaking chamber, liquid filling the breaking chamber to a certain level (**16**), and having a space filled with pressurized gas above the liquid, said circuit breaker being provided with a feeding valve (**18**) for the supply of pressurized gas to said space and with exhaust valve means (**22**) responsive to an increase of the pressure in the chamber (**1**) above a certain value to open communication to the outside, in which openings are provided connecting said valves (**18,22**) to said gas space (**17**), said openings (**31,32**) being located below the liquid level in the chamber, seals (**33,35**) around said openings, whereby said seals are exposed to liquid pressure.

2. High voltage circuit breaker according to claim **1**, in which the feeding valve (**18**) is a manually operated valve, and opened only when pressurized gas is being supplied before putting the equipment into operation and in connection with any overhaul of the circuit breaker.

3. High voltage circuit breaker according to claim **1**, having a channel (**23**) connecting the inlet side of the exhaust valve (**22**) with the gas space (**17**) and a passage of limited cross-section connecting said channel with the liquid in the breaking chamber (**1**).

4. High voltage circuit breaker according to claim **1**, in which the exhaust valve (**22**) is provided with a liquid leakage indicator (**29**) arranged on its outlet side.

5. High voltage circuit breaker according to claim **1**, in which an oil gauge pipe (**20**) acting as pressure gauge is arranged in communication with the breaking chamber (**1**).

6. High voltage circuit breaker according to claim **1**, in which the breaking chamber (**1**) is oblong and has its longitudinal axis directed upwardly, the movable contact (**12** of the contact pair being arranged to be moved downwardly when the breaker opens.

7. High voltage circuit breaker according to claim **6**, having at least two breaking chambers (**1,2**) per pole, in which the breaking chambers are arranged in V-formation.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,670,127 Dated June 13, 1972

Inventor(s) Inge Gard

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

After the Heading, insert:

Claims priority, Application Sweden,
April 27, 1970, 5758/70

Signed and sealed this 12th day of June 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334

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