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(54) **Vacuum interrupter**

(57) The invention relates to a vacuum interrupter (1) for use as both a load break switch and a circuit breaker switch in medium voltage applications, which vacuum interrupter (1) comprises:

- a housing (2);
- a first (3) and second contact (5) arranged in the housing

(2) and each having a conductor (4,6) running to the outside of the housing (2);

- means (9) for moving the first (3) and second contact (5) towards and away from each other; wherein
- the first contact is the cathode in the load break switch applications and the second contact is the cathode in circuit breaker switch applications.

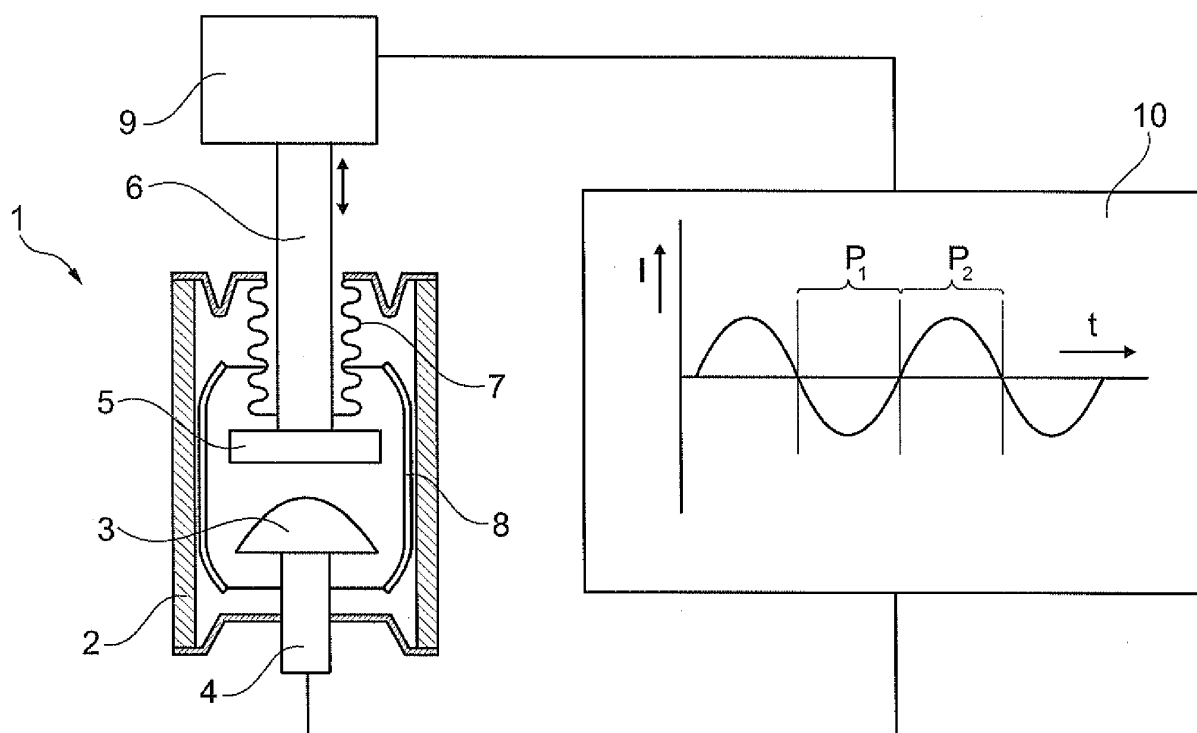


Fig.

Description

[0001] The invention relates to a vacuum interrupter for use as both a load break switch and a circuit breaker switch in medium voltage applications, which vacuum interrupter comprises:

- a housing;
- a first and second contact arranged in the housing and each having a conductor running to the outside of the housing;
- means for moving the first and second contact towards and away from each other. Vacuum interrupters are in the prior art used in medium voltage switch gear as circuit breakers and as load break switches.

[0002] The vacuum interrupter is used as circuit breaker to break the circuit when overload or short circuit occurs in the electricity grid. The vacuum interrupter is automatically operated when an overload or short circuit is detected. When the contacts of the vacuum interrupter are moved away from each other to break the circuit, which is overloaded, an arc will be generated between the contacts. Parameters such as current amplitude, recovery voltage, growing distance between contacts at opening and externally applied magnetic field determine when the arc will extinguish. During the period that the arc exists, the contacts will have to take up the damaging effects of the arc. Accordingly, the contacts of the vacuum interrupters to be used as circuit breakers, are specifically designed for this kind of use, to prevent substantial wear of the contacts.

[0003] The vacuum interrupter is used as a load break switch to interrupt or connect an electricity grid with either another part of the grid or a power supply. The electricity grid is provided with electrical components which provide an electrical load on the circuit. A specific task of a load break switch is switching on a short circuit. Just before the contacts of the load break switch physically engaged, a flash over will occur and an arc will be established, which causes wear on the contacts. Accordingly, the contacts of vacuum interrupters are typically designed for the specific use as a load break switch.

[0004] So, according to the prior art, vacuum interrupters are typically designed as either a circuit breaker switch or as a load breakload break switch, but not as both.

[0005] It has been observed by the applicant, that the wear of the contacts in the vacuum interrupter will always be most prominent on the contact functioning as the cathode during the switching action of the vacuum interrupter.

[0006] It is an object of the invention to provide a vacuum interrupter according to the preamble, which can be used for both applications.

[0007] This object is achieved according to the invention, with a vacuum interrupter, which is **characterized in that** the first contact is the cathode in load breakload break switch applications and the second contact is the

cathode in circuit breaker switch applications.

[0008] With the vacuum interrupter according to the invention, the first contact is used as the cathode, when the vacuum interrupter is used as a load breakload break switch, while the second contact of the vacuum interrupter is used as cathode for circuit breaker applications.

[0009] As a result, a dedicated contact is present in the vacuum interrupter according to the invention for either one of the two applications of the vacuum interrupter. This dedicated contact can be optimized for the specific application.

[0010] A preferred embodiment of the vacuum interrupter according to the invention further comprises control means for detecting the phase of the current through the contacts and to operate the means for moving the first and second contacts dependent on the detected phase and on the application of the vacuum interrupter.

[0011] By detecting the phase of the current, it is possible to determine when either one of the first and second contacts functions as a cathode. In combination with the intended use of the vacuum interrupter it is possible to determine the optimal moment of controlling the means for moving the contacts. In this way it can be assured, that the first contact functions as a cathode when the contacts are brought together in a load break switch application. Similarly, the contacts can be moved away from each other when the second contact functions as a cathode, if the vacuum interrupter is used as a circuit breaker application.

[0012] Preferably, the first contact is optimized for load break switch applications and the second contact is optimized for circuit breaker switch application.

[0013] The optimization of the contacts is straight forward for a person skilled in the art. The optimization will take into account at least the design of the contact and the material of the contact.

[0014] In another embodiment of a vacuum interrupter according to the invention one of the contacts is statically arranged and the other contact is movable arranged.

[0015] Preferably, with the vacuum interrupter according to the invention the movable contact is connected to the moving means through a drive rod.

[0016] These and other features of the invention will be elucidated in conjunction with the accompanying drawing.

[0017] The figure shows a schematic view of an embodiment of the vacuum interrupter according to the invention.

[0018] In the figure a vacuum interrupter 1 is shown. This vacuum interrupter 1 has a cylindrical housing 2. A first contact 3 is statically arranged in the housing 2 and connected to a conductor 4, which extends to outside of the housing 2.

[0019] A second contact 5 is attached to a drive rod 6 and accordingly movable arranged in the housing. To ensure an airtight sealing of the housing 2, a metal bellow 7 is arranged between the drive rod 6 and the housing 2.

[0020] Furthermore, a shield 8 is positioned around the

two contacts 3, 5 to shield and guide the electrical field.

[0021] The drive rod is axially movable by moving means 9, which could for example comprise an electro-magnet. These moving means 9 cause the contacts 3 and 5 to move towards each other or to move away from each other.

[0022] Control means 10 are furthermore provided to measure the phase of the current I through the conductor 4 and to operate the moving means 9.

[0023] As schematically depicted in the drawing, the first contact 3 is designed for use as a cathode in load break switch applications, while the second contact 5 is designed for use as a cathode in circuit breaker switch applications.

[0024] The control means 10 measure the phase of the current I on the conductor. During the period p_1 , the first contact 3 functions as a cathode, while during the period p_2 the second contact 5 functions as a cathode.

[0025] If the vacuum interrupter 1 is used as a load break switch, then the control means 10 will ensure that the contacts 3, 5 are brought in contact with each other during the period p_1 , as this is the most crucial moment during load break switch applications. If the vacuum interrupter 1 is used as a circuit breaker switch, then the control means 10 will ensure that the contacts 3, 5 move away from each other during the period p_2 , as during this period the damage to the cathode would be the largest. However, the contact 5 is specifically designed to withstand this damage during circuit breaker switch applications.

in the first contact is optimized for load break switch applications and the second contact is optimized for circuit breaker switch application.

- 5 4. Vacuum interrupter according to any of the preceding claims, wherein one of the contacts is statically arranged and the other contact is movably arranged.
- 10 5. Vacuum interrupter according to claim 4, wherein the movable contact is connected to the moving means through a drive rod.

Claims

1. Vacuum interrupter for use as both a load break switch and a circuit breaker switch in medium voltage applications, which vacuum interrupter comprises:
 - a housing;
 - a first and second contact arranged in the housing and each having a conductor running to the outside of the housing;
 - means for moving the first and second contact towards and away from each other; **characterized in that**
 - the first contact is the cathode in load break switch applications and the second contact is the cathode in circuit breaker switch applications.
2. Vacuum interrupter according to claim 1, further comprising control means for detecting the phase of the current through the contacts and to operate the means for moving the first and second contacts dependent on the detected phase and on the application of the vacuum interrupter.
3. Vacuum interrupter according to claim 1 or 2, where-

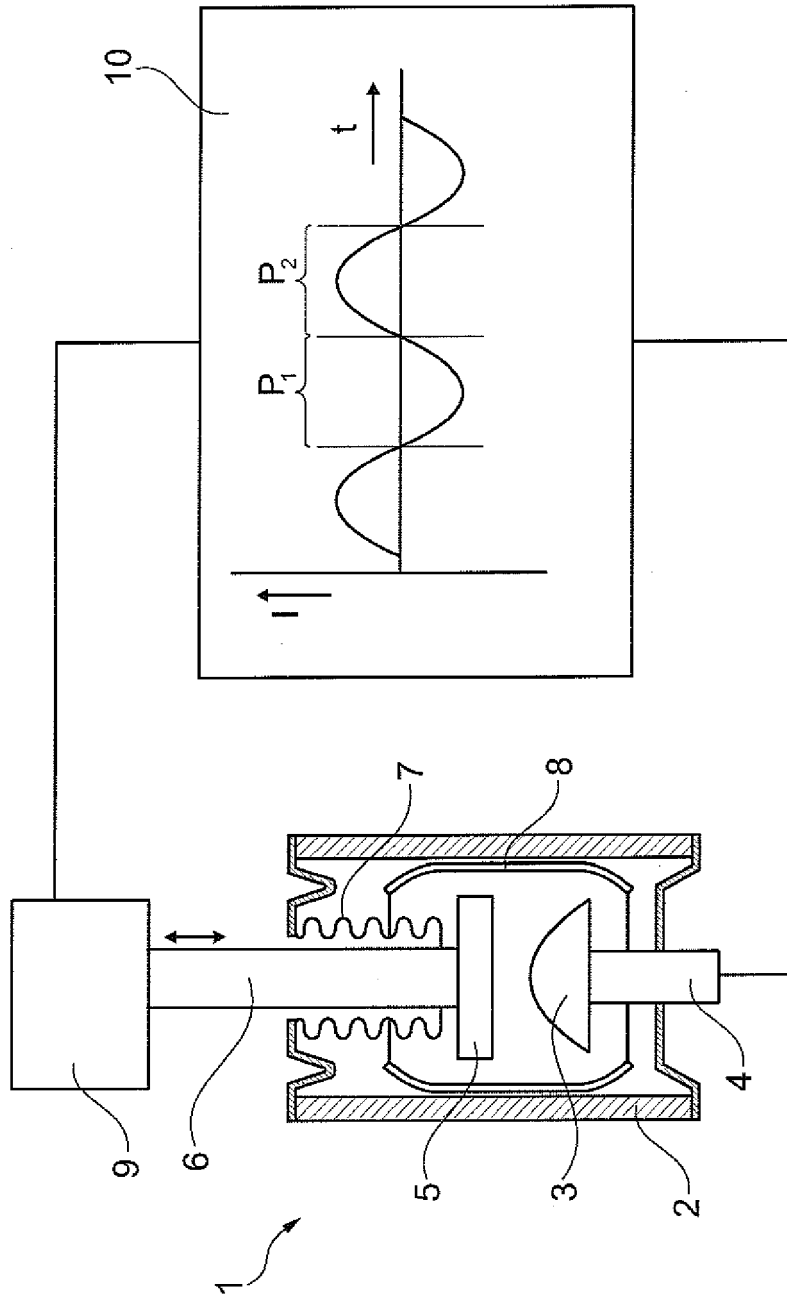


Fig.



EUROPEAN SEARCH REPORT

Application Number
EP 11 19 4474

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 8 241656 A (MEIDENSHA ELECTRIC MFG CO LTD) 17 September 1996 (1996-09-17) * paragraph [0024] - paragraph [0031]; figures 1,4 *	1-5	INV. H01H33/12 H01H33/664 H01H33/666
A	CA 836 116 A (ENGLISH ELECTRIC CO LTD) 3 March 1970 (1970-03-03) * page 1, line 1 - page 3, line 13; figure 1 *	1-5	
A	DE 198 03 775 C1 (GEBAUER ECHEHARD DR ING [DE]) 15 July 1999 (1999-07-15) * figures 1,2 *	1,2,4,5	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 May 2012	Examiner Ernst, Uwe
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 19 4474

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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07-05-2012

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 8241656	A	17-09-1996	NONE	

CA 836116	A	03-03-1970	NONE	

DE 19803775	C1	15-07-1999	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82