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(54) Title: MECHANISM FOR OPENING AND CLOSING A CIRCUIT BREAKER

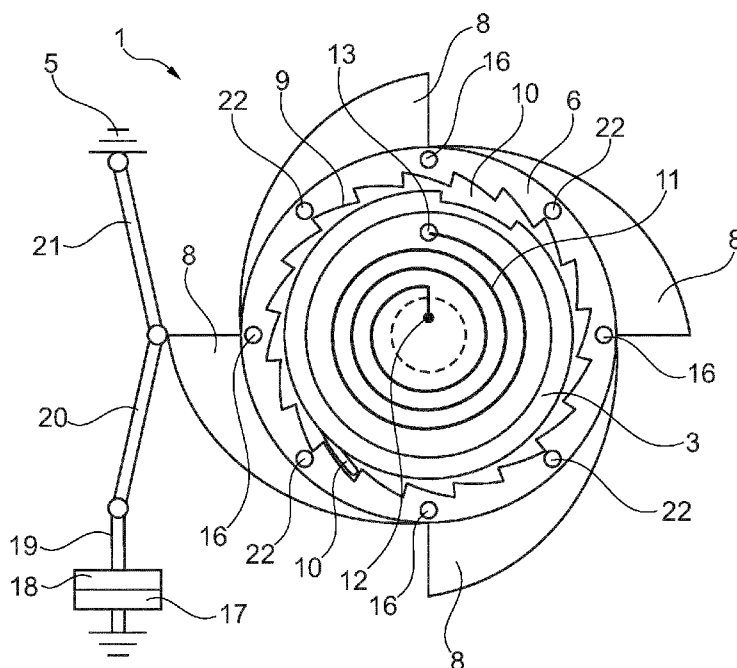


Fig. 2

(S7) Abstract: The invention relates to a mechanism for opening and closing a circuit breaker having an operating rod for moving the contacts of the circuit breaker between an open position and a closed position, which mechanism comprises: - a frame - a freewheel mechanism with a driveshaft and a driven shaft, wherein the freewheel mechanism is arranged rotatably in the frame; - spring means coupling the driveshaft of the freewheel mechanism with the frame; - locking means for locking the driven shaft of the freewheel mechanism; - a cam wheel arranged on the driven shaft, wherein the cam wheel comprises at least two cam lobes for actuating the operating rod of a circuit breaker.

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Mechanism for opening and closing a circuit breaker

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The invention relates to a mechanism for opening and closing a circuit breaker having an operating rod for moving the contacts of the circuit breaker between an open position and a closed position.

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For certain applications it is required that a circuit breaker, after detecting a fault, opens the contacts and then quickly closes the contacts. When the fault remains, the contacts can then be opened again for a longer duration. The first opening and closing of the contacts should be

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performed in less than a second, typically less than 0,3 seconds. If the fault remains, the contacts can then be opened again for a longer duration, for example a minute. This is called in the art a open-close-open (OCO) cycle.

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Due to space restrictions in the switch gear, wherein the circuit breakers are applied, it is not possible to provide an electric motor, sufficient strong and quick to open the contacts within a split second. So, a mechanism is required in which for example spring energy is used to provide the quick opening and closing of the contacts.

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BE 902318 describes a mechanism for operating a control of a switch or for directly operating a switch. The mechanism is provided with a toothed spring housing, in which a spiral spring is provided. The teeth on the outside of the housing are provided to tension the spiral spring with a

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solenoid, which pushes the housing tooth by tooth.

A latch is provided, which can release the spiral spring, such that a shaft is driven and contacts of a switch

are moved. The toothed spring housing can rotate freely along the tensioning solenoid, which provides a freewheel mechanism.

In order to operate the contacts, an excenter is arranged on the drive shaft, which excenter drives an arm, which engages the operating lever of the switch, such that the lever can be pushed up and down by the mechanism.

However, this mechanism does not allow for quick open-close-open functionality, because the spring only unwinds over part of a full revolution, after which the freewheel mechanism allows for further movement of the arm. As the arm is operated by an excenter, this mechanism is only suitable to perform one open-close operation, after which the spring needs to be wound by the solenoid, which takes a substantial amount of time.

It is an object of the invention to reduce the above mentioned disadvantages.

This object is achieved with a mechanism comprising:

- a frame
- a freewheel mechanism with a driveshaft and a driven shaft, wherein the freewheel mechanism is arranged rotatably in the frame;
- spring means coupling the driveshaft of the freewheel mechanism with the frame;
- locking means for locking the driven shaft of the freewheel mechanism;
- a cam wheel arranged on the driven shaft, wherein the cam wheel comprises at least two cam lobes for actuating the operating rod of a circuit breaker.

With the mechanism according to the invention it is possible to control an open-close-open cycle by simply controlling the locking means of the driven shaft. The at least two lobes on the cam wheel allow for the operating rod

of the circuit breaker to be moved between an open and a closed position twice. So, with the mechanism according to the invention it is possible to provide the desired OCO functionality by first tensioning the spring means and then
5 controlling the locking means accordingly.

If more than two lobes are provided, the spring means can provide energy for multiple OCO-cycles.

In an embodiment of the mechanism according to the invention the springs means comprise a torsional spring
10 arranged with one end to the frame and with the other end to the driveshaft of the freewheel mechanism.

The torsion spring can easily be arranged coaxial with the driven shaft and the driveshaft of the freewheel mechanism, allowing for a compact construction.

15 In a preferred embodiment of the mechanism according to the invention the freewheel mechanism is a ratcheting freewheel mechanism. Although other freewheel mechanisms could be used for the invention, a ratcheting freewheel mechanism ensures that there cannot be any slip between the driveshaft
20 and the driven shaft of the freewheel mechanism.

In a further preferred embodiment of the mechanism according to the invention the trailing edge of each lobe extends substantially radially relative to the cam wheel.

By having the trailing edge of each lobe extending
25 substantially radially relative to the cam wheel a very quick movement of the operating rod of the circuit breaker from a closed to an open position is possible, which is particularly of importance when a fault occurs.

The invention also relates to a combination of a
30 mechanism according to the invention and a circuit breaker comprising two contacts movable relative to each other between a closed position and an open position, and an operating rod

arranged to at least one of the contacts for moving the at least one contact, wherein the cam wheel of the mechanism is in contact with the operating rod to move the operating rod to open and close the contacts by rotation of the cam wheel.

5 In a preferred embodiment of the combination according to the invention the operating rod comprises at least two linked rods each rod having a single degree of freedom, wherein one free end of the linked rods is hingedly connected to the frame, wherein the other free end of the
10 linked rods is hingedly connected to at least one of the contacts, and wherein the cam wheel of the mechanism engages one of the linked rods in a direction substantially perpendicular to the longitudinal direction of said rod.

 These and other features of the invention will be
15 elucidated in conjunction with the accompanying drawings.

 Figure 1 shows a cross-sectional view of an embodiment of the invention.

 Figure 2 shows a side view of the embodiment of figure 1.

20 Figure 1 shows a mechanism 1 according to the invention. This mechanism 1 has a freewheel mechanism with a driveshaft 2 on which an inner ring 3 is arranged. The driveshaft 2 is arranged rotatably via a bearing 4 into a frame 5.

25 The freewheel mechanism further has an outer ring 6, which is rotatably arranged in the frame 5 via a bearing 7 on the driveshaft 2. The outer ring 6 is provided on the outside with four cam lobes 8 (see also figure 2). The inner surface 9 of the outer ring 6 is provided with a serrated profile in
30 which resilient lips 10, which are arranged to the outer surface of the inner ring 3, hook to provide a ratcheting freewheel mechanism.

A torsional spring 11 is furthermore arranged with one end 12 to the inner ring 3 and therewith to the driveshaft 2, and with the other end 13 to the frame 5.

In order to lock the outer ring 6 with the cam lobes 8 in a desired rotational position, an actuator 14 is provided, which actuator 14 can move a locking pin 15 into a hole 16 in the circumference of the outer ring 6 with the circuit breaker in closed position. Also holes 22 are provided to lock the outer ring 6 with the circuit breaker in the open position.

With the mechanism 1 it is possible to operate a circuit breaker having a fixed contact 17 and a movable contact 18 between a closed position (as shown in figure 2) and an open position. The movable contact 18 is connected to an operating rod 19, which in turn is connected to two linked rods 20, 21, wherein each rod 20, 21 has a single degree of freedom.

When the actuator 14 is operated to retract the locking pin 15 from the hole 16, the torsional spring 11 will unwind by pushing the inner ring 3. The inner ring 3 will push via the resilient lips 10, interlocking with the serrated profile of the inner surface 9, the outer ring 6. As a result the outer ring 6 will start to rotate and the cam lobes 8 will move the two rods 20, 21 and accordingly and repeatedly open and close the contacts 17, 18 of the circuit breaker.

This open-close-open action will continue as long as the torsional spring 11 unwinds or until the actuator 14 is operated to extend the locking pin 15 into one of the holes 16 locking the rotational position of the outer ring 6.

When the outer ring 6 is in a locked position, the torsional spring 11 can be retensioned by rotating the driveshaft 2. Due to the freewheel mechanism and in particular

due to the resilient lips 10 being able to slide along the serrated profile 9 in one direction, it is possible to retension the torsional spring 11 without moving the outer ring 6 and therefore without moving the cam lobes 8.

Claims

1. Mechanism for opening and closing a circuit
breaker having an operating rod for moving the contacts of the
5 circuit breaker between an open position and a closed
position, which mechanism comprises:

- a frame

- a freewheel mechanism with a driveshaft and a
driven shaft, wherein the freewheel mechanism is arranged
10 rotatably in the frame;

- spring means coupling the driveshaft of the
freewheel mechanism with the frame;

- locking means for locking the driven shaft of the
freewheel mechanism;

15 - a cam wheel arranged on the driven shaft, wherein
the cam wheel comprises at least two cam lobes for actuating
the operating rod of a circuit breaker.

2. Mechanism according to claim 1, wherein the
springs means comprise a torsional spring arranged with one
20 end to the frame and with the other end to the driveshaft of
the freewheel mechanism.

3. Mechanism according to claim 1 or 2, wherein the
freewheel mechanism is a ratcheting freewheel mechanism.

4. Mechanism according to any of the preceding
25 claims, wherein the trailing edge of each lobe extends
substantially radially relative to the cam wheel.

5. Combination of a mechanism according to any of
the preceding claims and a circuit breaker comprising two
contacts movable relative to each other between a closed
30 position and an open position, and an operating rod arranged
to at least one of the contacts for moving the at least one
contact, wherein the cam wheel of the mechanism is in contact

with the operating rod to move the operating rod to open and close the contacts by rotation of the cam wheel.

6. Combination according to claim 5, wherein the operating rod comprises at least two linked rods each rod
5 having a single degree of freedom, wherein one free end of the linked rods is hingedly connected to the frame, wherein the other free end of the linked rods is hingedly connected to at least one of the contacts, and wherein the cam wheel of the mechanism engages one of the linked rods in a direction
10 substantially perpendicular to the longitudinal direction of said rod.

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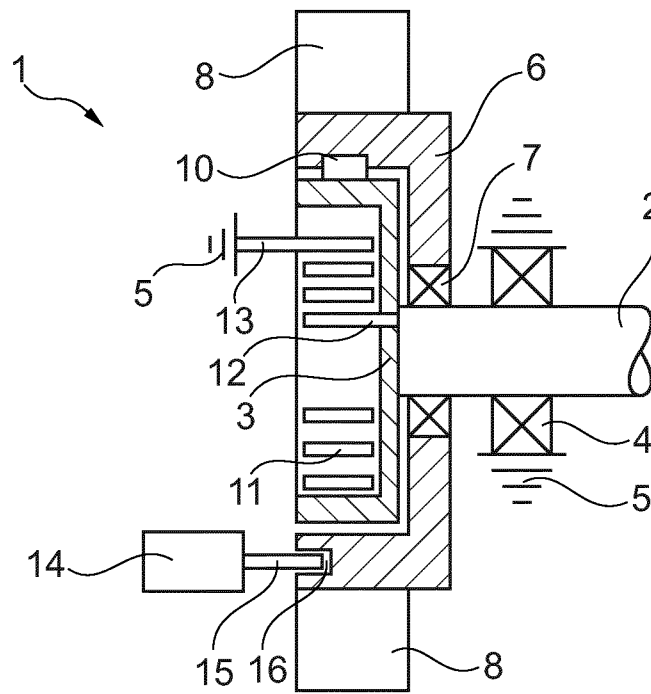


Fig. 1

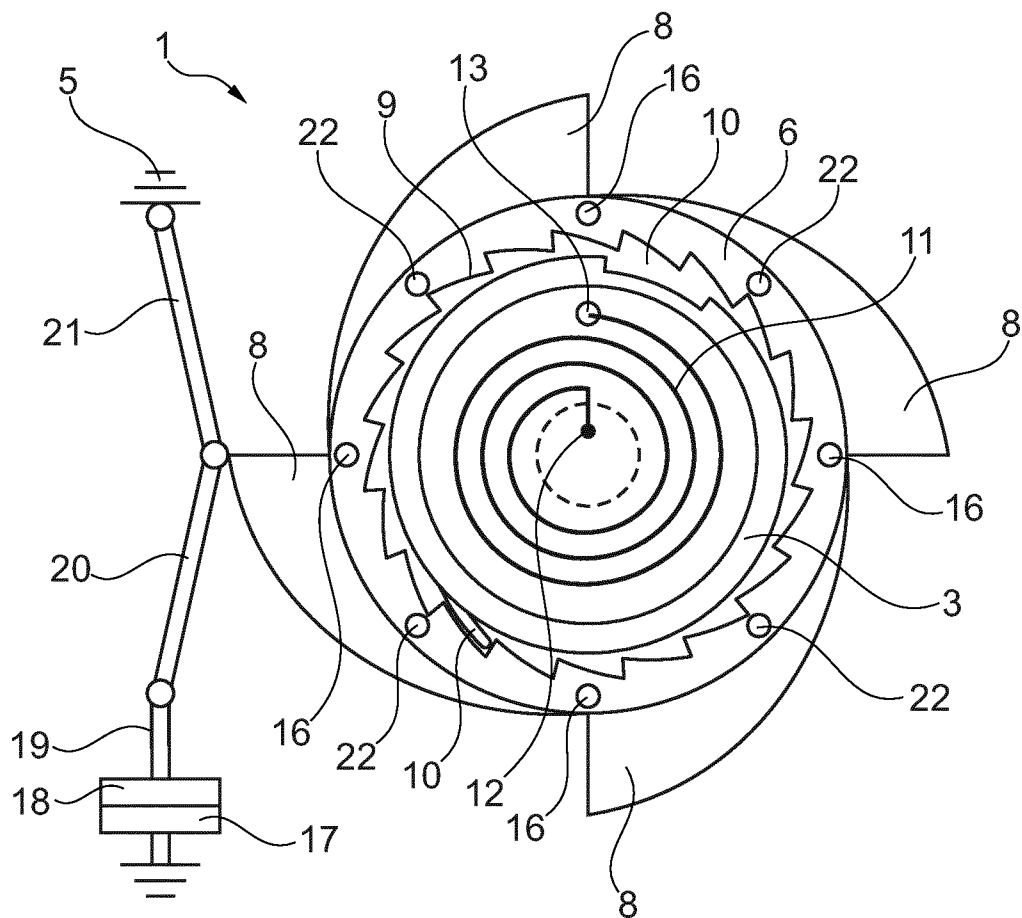


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER		
INV.	H01H3/30 H01H3/34	H01H3/42 H01H3/46 H01H71/72 H01H75/04
ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) H01H		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2015/311005 A1 (YANG CHAO [CN] ET AL) 29 October 2015 (2015-10-29) the whole document -----	1-6
Y	US 2 326 061 A (OW JOSEPH W) 3 August 1943 (1943-08-03) page 2, line 32 - page 4, line 46; figures -----	1-6
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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Date of the actual completion of the international search 13 December 2017		Date of mailing of the international search report 22/12/2017
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Ramírez Fueyo, M

INTERNATIONAL SEARCH REPORT

Information on patent family members

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