

(19)



(11)

EP 4 033 514 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.07.2022 Bulletin 2022/30

(51) International Patent Classification (IPC):
H01H 71/24 ^(2006.01) **H01H 3/00** ^(2006.01)
H01H 71/52 ^(2006.01)

(21) Application number: **22151091.0**

(52) Cooperative Patent Classification (CPC):
H01H 71/2463; H01H 3/001; H01H 71/2409;
H01H 71/526

(22) Date of filing: **12.01.2022**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **SPRITZENDORFER, Bernd**
2731 Urschendorf (AT)
• **ERTL, Michael**
1210 Vienna (AT)

(74) Representative: **Eaton IP Group**
EMEA
c/o Eaton Intellectual Power Limited
Eaton House
30 Pembroke Road
Dublin 4 (IE)

(30) Priority: **20.01.2021 GB 202100722**

(71) Applicant: **Eaton Intelligent Power Limited**
Dublin 4 (IE)

(54) MOVING CONTACT OSCILLATING DAMPER

(57) For a trigger device (1) for a circuit breaker (2) comprising a push rod (3) which is movably guided in a push rod housing (4) and a coil (5) which is substantially wrapped around said push rod housing (4), it is suggested, that the push rod (3) comprises at least two different stop surfaces (6, 8), whereby at least one first stop sur-

face (6) is adapted to contact a latch (7) in order to trigger said latch (7) of the circuit breaker (2) and at least one second stop surface (8) is adapted to contact a moving contact (9) of the circuit breaker (2) to prevent a backward movement of the moving contact (9) in direction of a fixed contact (10).

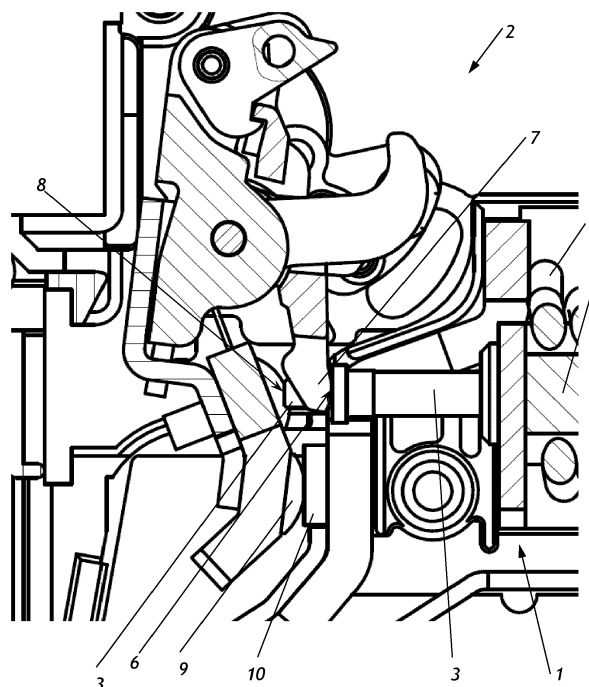


FIG. 1

EP 4 033 514 A1

Description

[0001] The present disclosure relates to a trigger device according to the generic part of claim 1.

[0002] Hitherto, it is common practice to use a trigger device comprising a simple push rod to push away a latch triggering a moving contact from a fixed contact in a circuit breaker in the event of a short circuit. Hereby it is important to disconnect the moving contact from the fixed contact in a short amount of time.

[0003] The aforementioned circuit breaker has the disadvantage, that after the trigger device got triggered and therefore said contacts are disconnected from each other, the moving contact may bounce back generating an electric arc and therefore eroding and physically damaging said contacts. As a result, the lifespan of the contacts is shortened and therefore the lifespan of the circuit breaker is shortened.

[0004] It is an object of the present invention to overcome the drawbacks of the state of the art by providing a trigger device with which a safe operation of the circuit breaker is enabled and the lifespan of the moving contact and the fixed contact is prolonged.

[0005] According to the invention, the aforementioned object is solved by the features of claim 1.

[0006] As a result, the trigger device fulfils the object and has the advantages that a safe operation of the circuit breaker is enabled and the lifespan of the moving contact and the fixed contact is prolonged. Through the features, that the push rod comprises at least two different stop surfaces, whereby at least one first stop surface is adapted to contact a latch in order to trigger said latch of the circuit breaker and at least one second stop surface is adapted to contact a moving contact of the circuit breaker, a backward movement of the moving contact in direction of the fixed contact is prevented and said contacts can be disconnected safely from each other without damage inflicted by a bouncing moving contact.

[0007] It is a further object of the present invention to overcome the drawbacks of the state of the art by providing a circuit breaker comprising a trigger device with which a safe operation of the circuit breaker is enabled and the lifespan of the moving contact and the fixed contact is prolonged.

[0008] According to the invention, said object is solved by the features of claim 5.

[0009] The advantages of the trigger device comply with the advantages of the circuit breaker.

[0010] The dependent claims describe further preferred embodiments of the invention.

[0011] The invention is described with reference to the drawings. The drawings show only exemplary embodiments of the invention.

Fig. 1 illustrates a preferred embodiment of a section of a circuit breaker with a triggered trigger device wherein the push rod touches the latch in a schematic side view.

Fig. 2 illustrates the preferred embodiment of a section of a circuit breaker with a triggered trigger device wherein a latching point is released in a schematic side view.

Fig. 3 illustrates the preferred embodiment of a section of a circuit breaker with a triggered trigger device wherein the push rod is in an end position in a schematic side view.

Fig. 4 illustrates the preferred embodiment of a section of a circuit breaker with a triggered trigger device wherein the pushing contact collides with a stop in the frame of the circuit breaker in a schematic side view.

Fig. 5 illustrates the preferred embodiment of a section of a circuit breaker with a triggered trigger device wherein the moving contact bounced back from the stop and collides with the push rod in a schematic side view.

Fig. 6 illustrates a preferred embodiment of the push rod in a schematic side view.

Fig. 7 illustrates the preferred embodiment of the push rod in an axonometric view.

Fig. 1 to 7 illustrate at least a part of a preferred embodiment of a trigger device 1 for a circuit breaker 2 comprising a push rod 3 which is movably guided in a push rod housing 4 and a coil 5 which is substantially wrapped around said push rod

housing 4, wherein the push rod 3 comprises at least two different stop surfaces 6, 8, whereby at least one first stop surface 6 is adapted to contact a latch 7 in order to trigger said latch 7 of the circuit breaker 2 and at least one second stop surface 8 is adapted to contact a moving contact 9 of the circuit breaker 2 to prevent a backward movement of the moving contact 9 in direction of a fixed contact 10.

[0012] Further, a circuit breaker 2 comprising a trigger device 1 is provided, the circuit breaker further comprising a moving contact 9 which contacts a fixed contact 10 in a closed position, a spring loaded latch 7 to disconnect said moving contact 9 from the fixed contact 10, whereby the first stop surface 6 is adapted to trigger said latch 7 to mechanically disconnect the moving contact 9 from the fixed contact 10 and the second stop surface 8 is adapted to contact said moving contact 9 to prevent a backward movement of the moving contact 9 in direction of said fixed contact 10.

[0013] As a result, the trigger device 1 fulfils the object and has the advantages that a safe operation of the circuit breaker 2 is enabled and the lifespan of the moving contact 9 and the fixed contact 10 is prolonged. Through the features, that the push rod 3 comprises at least two dif-

ferent stop surfaces 6,8, whereby at least one first stop surface 6 is adapted to contact a latch 7 in order to trigger said latch 7 of the circuit breaker 2 and at least one second stop surface 8 is adapted to contact a moving contact 9 of the circuit breaker 2, a backward movement of the moving contact 9 in direction of the fixed contact 10 is prevented and said contacts 9,10 can be disconnected safely from each other without damage inflicted by a bouncing moving contact 9.

[0014] In general, a circuit breaker 2 is an automatically operated electrical device which is designed to protect an electrical circuit from damage caused by excess current from an overload or short circuit.

[0015] In the following description, the term circuit breaker 2 may comprehensively refer to a miniature circuit breaker (MCB) or to a residual current circuit breaker with overcurrent protection (RCBO) or to an arc fault detection device (AFDD).

[0016] It may be preferred, that the trip current for the circuit breaker 2 is approximately 10 times higher than the rated current. For example, if the rated current is 16 A, it can be preferred, that the trip current is approximately 160 A.

[0017] Said trigger device 1 comprises a movably guided push rod 3 which is particularly located in a push rod housing 4. Said push rod housing 4 could comprise a bearing element. Preferably, a ferromagnetic anchor is attached to a rear end of the nonmagnetic push rod 3. Said push rod 3 might be spring loaded. A coil 5 is substantially wrapped around said push rod housing 4. In case of an overcurrent or short circuit, a magnetic field is formed via said coil 5 moving said ferromagnetic anchor and thus pushing said push rod 3 out of the push rod housing 4 to a defined extent. The push rod 3 comprises at least two different stop surfaces 6, 8, whereby at least one first stop surface 6 is adapted to contact a latch 7 in order to trigger said latch 7 of the circuit breaker 2 and at least one second stop surface 8 is adapted to contact a moving contact 9 of the circuit breaker 2 to prevent a backward movement of the moving contact 9 in direction of a fixed contact 10.

[0018] Said circuit breaker 2 comprises said trigger device 1 and further a spring loaded moving contact 9 which contacts a fixed contact 10 in a closed position, and a latch 7 to mechanically disconnect said moving contact 9 from the fixed contact 10.

[0019] According to a preferred embodiment, the push rod 3 has a movement direction predefined by the push rod housing 4 and that the at least one first stop surface 6 and the at least one second stop surface 8 are arranged staggered to each other in said movement direction. Preferably, said push rod 3 is linearly guided in the push rod housing 4.

[0020] Hereby, the push rod 3 can be manufactured in an easy and compact way.

[0021] According to another preferred embodiment, the second stop surface 8 is located at a protrusion, which, in particular, protrudes the centre of the first stop

surface 6, which is exemplarily shown in figs. 6 and 7. With this preferred embodiment, the second stop surface 8 can easily be staggered from the first stop surface 6. In order to enable an especially easy way to manufacture the push rod 3, it can be preferred, that the first stop surface 6 is particularly annular and surrounding the protrusion. This feature is also exemplarily shown in figs. 6 and 7.

[0022] It can also be preferred, that the latch 7 has a gap for the penetration of the second stop surface 8. Here, the second stop surface 8 penetrates said gap and contacts the moving contact 9 to prevent the moving contact 9 from bouncing in the direction of the fixed contact 10.

[0023] Particularly, in an event of a short circuit, the push rod 3 is pushed out of the push rod housing 4 due to electromagnetic forces. The push rod 3 hits with its first stop surface 6 a latch 7, whereby said latch is loosened from its latching point and pushes away the moving contact 9 from the fixed contact 10 and thereby disconnecting said contacts 9, 10, which is exemplarily illustrated in Fig. 1 to 3. Said moving contact 9 is pushed against a stop within the frame of the circuit breaker 2 and may swing back towards the fixed contact 10, which is exemplarily illustrated in Fig. 4.

[0024] Fig. 5 exemplarily illustrates the contacting of the moving contact 9 with the second stop surface 10 of the push rod 3. The push rod 3 is held in its triggered position because the electromagnetic mechanism is still in operation because the emerging arc keeps the current still flowing through the coil. The moving contact 9 swings towards the fixed contact 10 and contacts the second stop surface 10 of the push rod 3 keeping the contacts 9, 10 at a maximum distance from each other.

[0025] While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the appended claims. The exemplary embodiments should be considered as descriptive only and not for purposes of limitation. Therefore, the scope of the present invention is not defined by the detailed description but by the appended claims.

[0026] Hereinafter are principles for understanding and interpreting the actual disclosure.

[0027] Features are usually introduced with an indefinite article "one, a, an". Unless otherwise stated in the context, therefore, "one, a, an" is not to be understood as a numeral.

[0028] The conjunction "or" has to be interpreted as inclusive and not as exclusive, unless the context dictates otherwise. "A or B" also includes "A and B", where "A" and "B" represent random features.

[0029] By means of an ordering number word, for example "first", "second" or "third", in particular a feature X or an object Y is distinguished in several embodiments,

unless otherwise defined by the disclosure of the invention. In particular, a feature X or object Y with an ordering number word in a claim does not mean that an embodiment of the invention covered by this claim must have a further feature X or another object Y.

5

Claims

1. Trigger device (1) for a circuit breaker (2) comprising a push rod (3) which is movably guided in a push rod housing (4) and a coil (5) which is substantially wrapped around said push rod housing (4), **characterised in, that** the push rod (3) comprises at least two different stop surfaces (6, 8), whereby at least one first stop surface (6) is adapted to contact a latch (7) in order to trigger said latch (7) of the circuit breaker (2) and at least one second stop surface (8) is adapted to contact a moving contact (9) of the circuit breaker (2) to prevent a backward movement of the moving contact (9) in direction of a fixed contact (10). 10 15 20
2. Trigger device (1) according to claim 1, **characterised in, that** the push rod (3) has a movement direction predefined by the push rod housing (4) and that the at least one first stop surface (6) and the at least one second stop surface (8) are arranged staggered to each other in said movement direction. 25
3. Trigger device (1) according to claim 1 or 2, **characterised in, that** the second stop surface (8) is located at a protrusion, which, in particular, protrudes the centre of the first stop surface (6). 30
4. Trigger device (1) according to claim 3, **characterised in, that** the first stop surface (6) is particularly annular and surrounding the protrusion. 35
5. Circuit breaker (2) comprising a trigger device (1) according to any of the claims 1 to 3, a moving contact (9) which contacts a fixed contact (10) in a closed position, a spring loaded latch (7) to disconnect said moving contact (9) from the fixed contact (10), **characterised in, that** the first stop surface (6) is adapted to trigger said latch (7) to mechanically disconnect the moving contact (9) from the fixed contact (10) and the second stop surface (8) is adapted to contact said moving contact (9) to prevent a backward movement of the moving contact (9) in direction of said fixed contact (10). 40 45 50

55

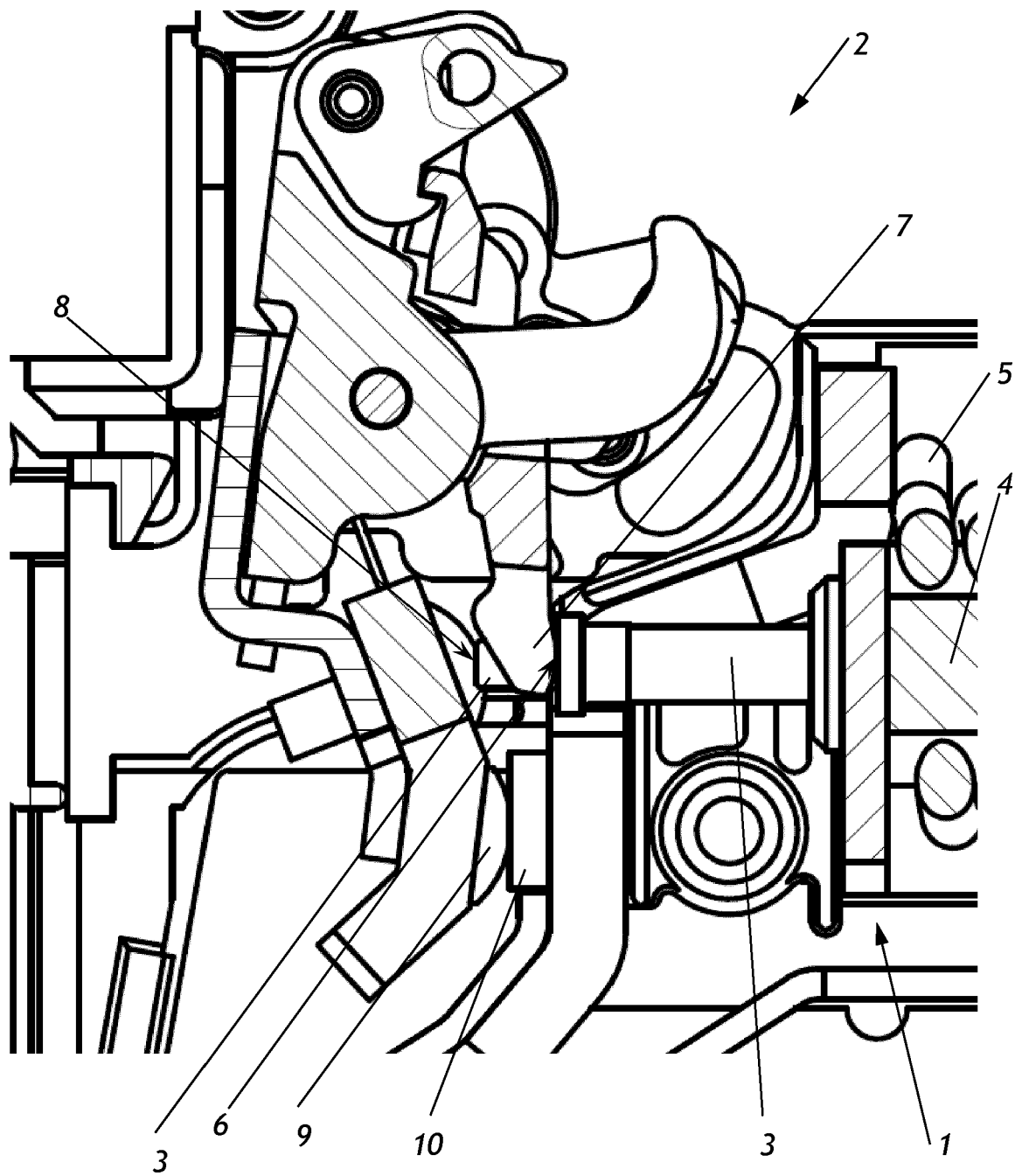


FIG. 1

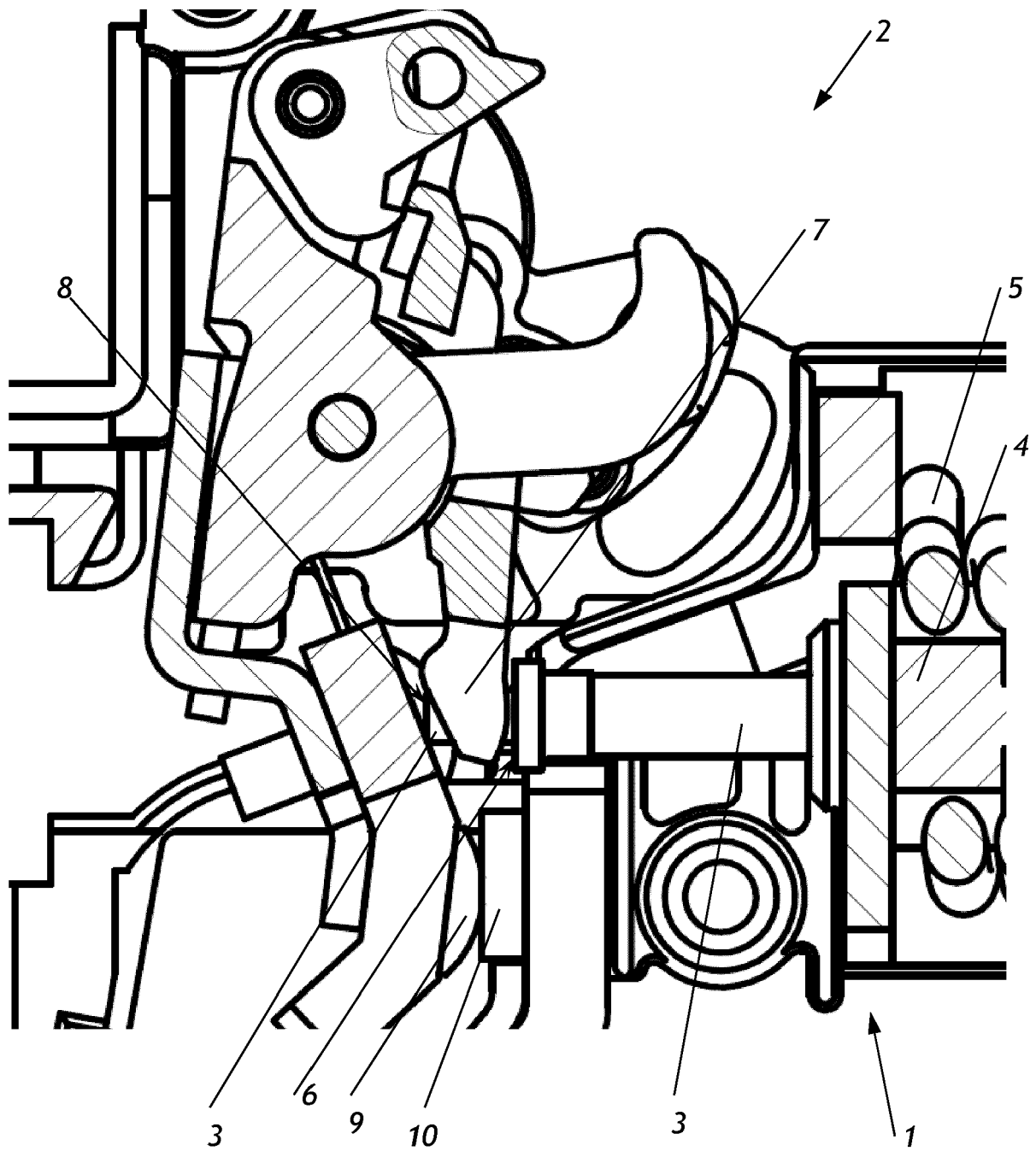


FIG. 2

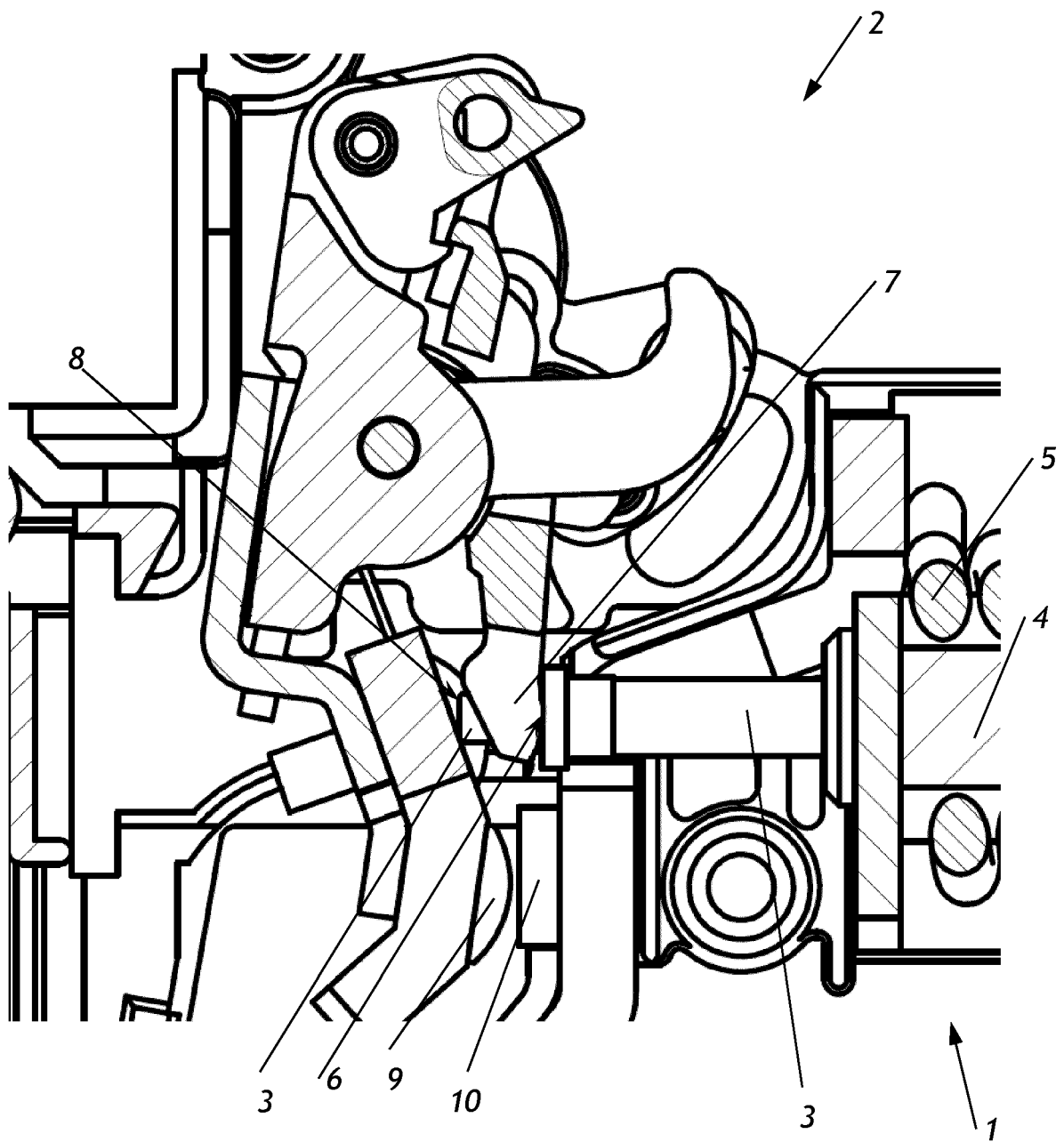


FIG. 3

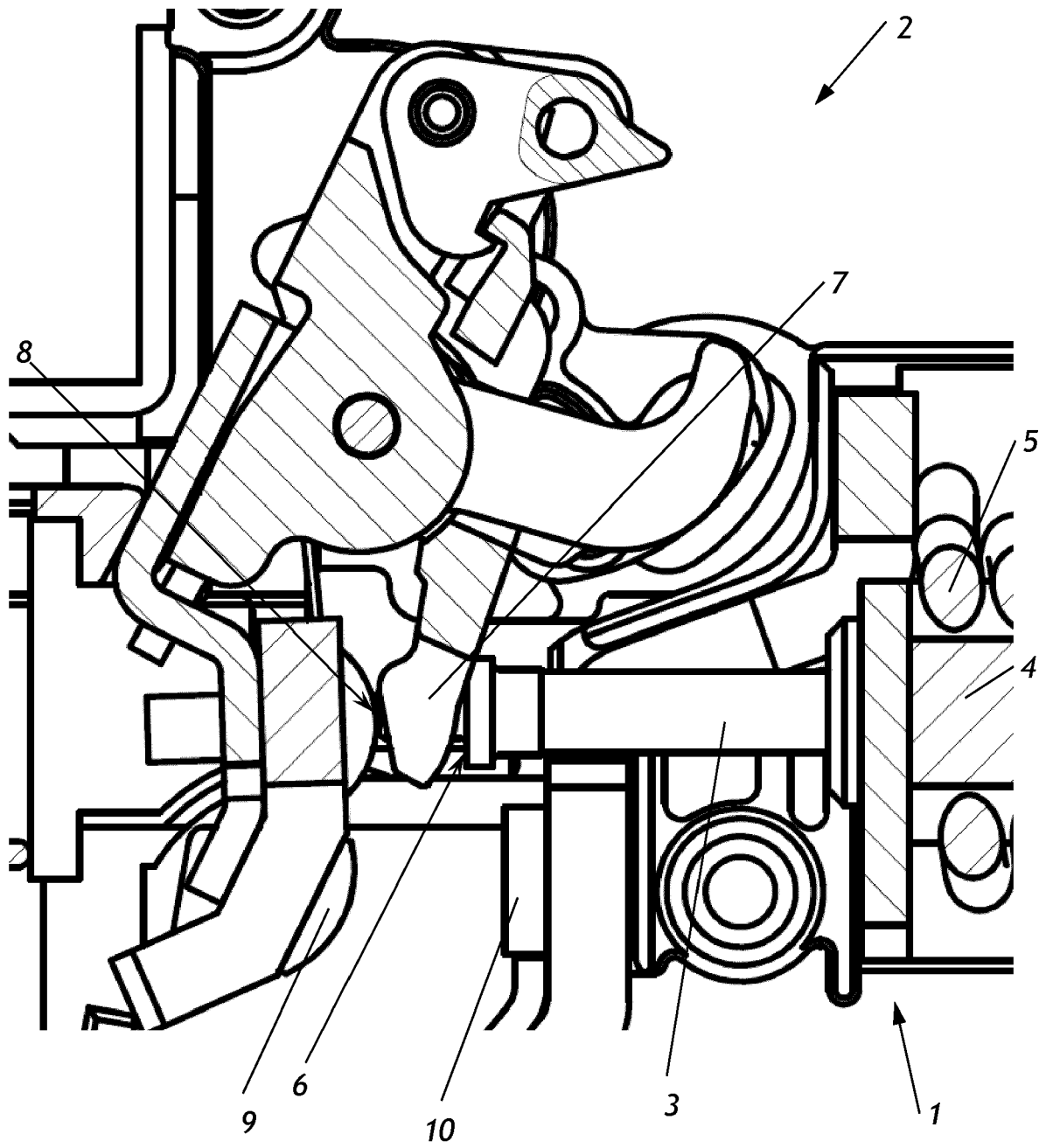


FIG. 4

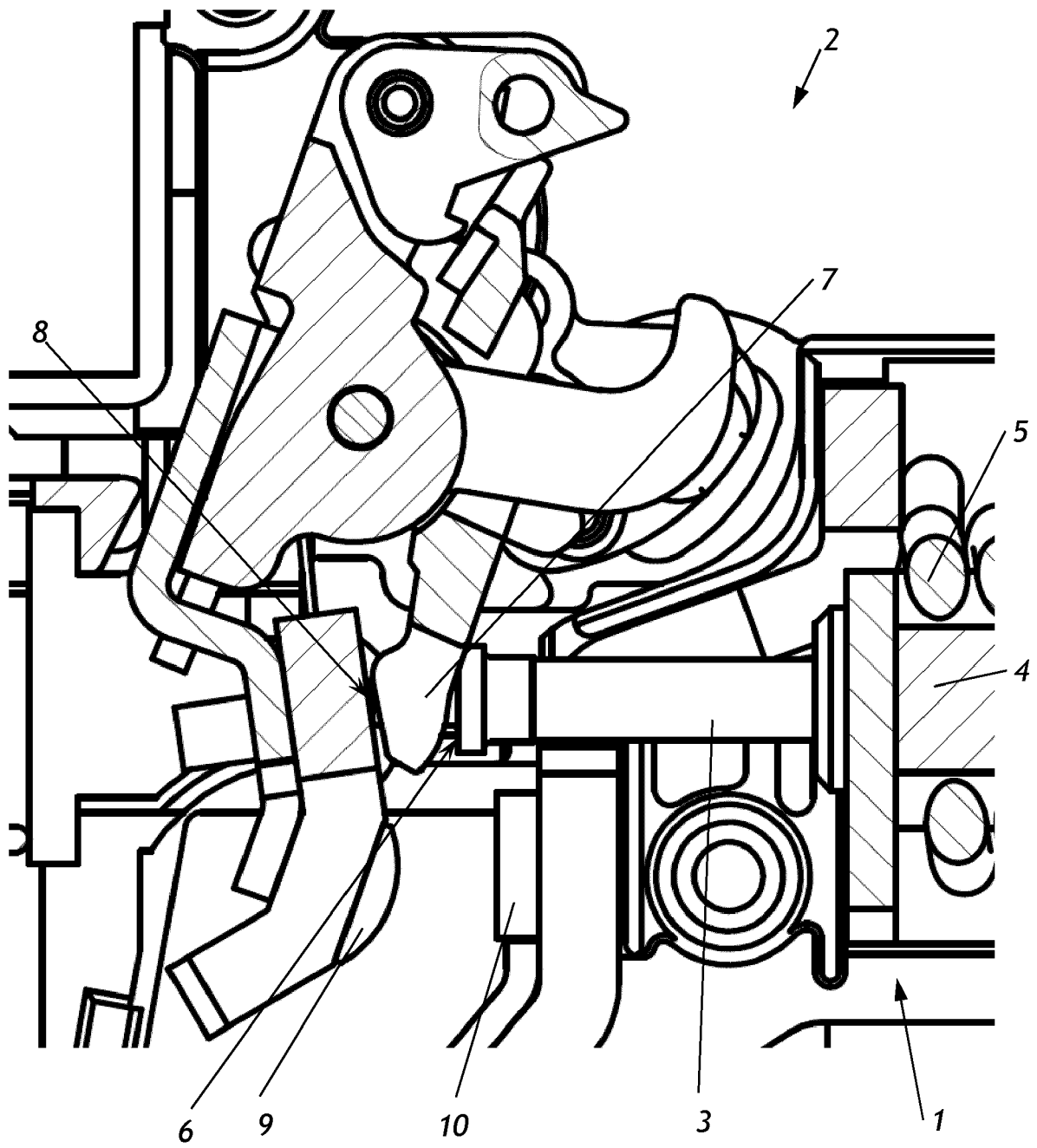
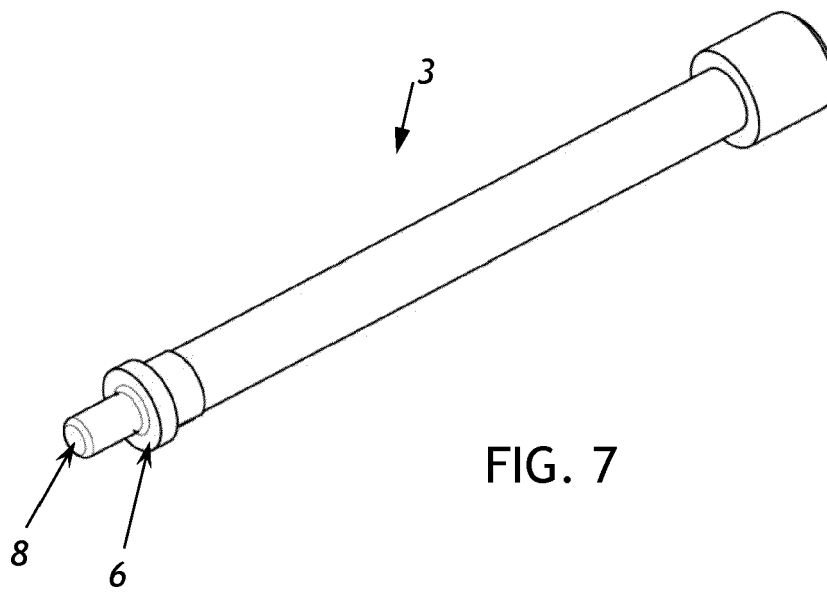
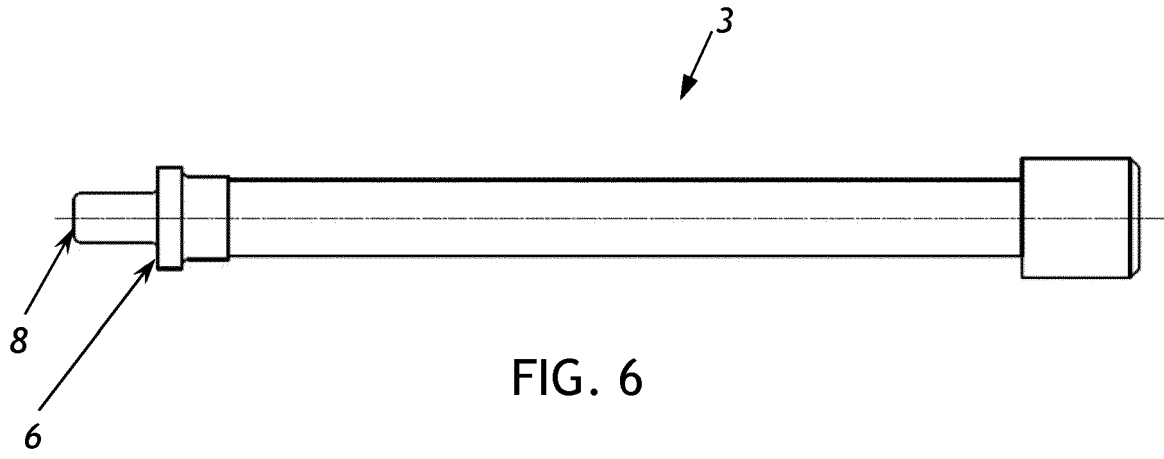


FIG. 5





EUROPEAN SEARCH REPORT

Application Number

EP 22 15 1091

5

10

15

20

25

30

35

40

45

50

55

1

EPO FORM 1503 03.82 (P04C01)

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	WO 2009/121696 A1 (SIEMENS AG [DE]; HEINZLMER MANFRED [DE] ET AL.) 8 October 2009 (2009-10-08)	1-3, 5	INV. H01H71/24 H01H3/00
Y	* page 4, line 10- - page 5, line 38; figures 1-3 * * page 1, lines 5-19 *	3, 4	ADD. H01H71/52
X	DE 10 2006 055936 A1 (SIEMENS AG [DE]) 12 June 2008 (2008-06-12)	1-3, 5	
Y	* paragraphs [0001], [0031] - [0033]; figures 2, 3 *	3, 4	
Y	DE 10 2004 056279 A1 (ABB PATENT GMBH [DE]) 24 May 2006 (2006-05-24) * paragraphs [0046] - [0058]; figures 1, 2, 9, 10 *	3, 4	
Y	GB 2 040 573 A (WOLFF H W) 28 August 1980 (1980-08-28) * page 1, lines 93-115; figures 1-3 *	3, 4	
Y	EP 2 680 293 A1 (SIEMENS AG [DE]) 1 January 2014 (2014-01-01) * abstract; figures 2A, 2B *	3, 4	TECHNICAL FIELDS SEARCHED (IPC) H01H
A	DE 10 2006 037225 A1 (SIEMENS AG [DE]) 14 February 2008 (2008-02-14) * paragraphs [0010] - [0030]; figures 1-3 *	1-5	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 2 June 2022	Examiner Arenz, Rainer
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	

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

EP 22 15 1091

5

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-06-2022

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009121696 A1	08-10-2009	AT 493747 T	15-01-2011
		BR PI0903503 A2	30-06-2015
		CN 101681746 A	24-03-2010
		EP 2132760 A1	16-12-2009
		ES 2356036 T3	04-04-2011
		WO 2009121696 A1	08-10-2009

DE 102006055936 A1	12-06-2008	NONE	

DE 102004056279 A1	24-05-2006	NONE	

GB 2040573 A	28-08-1980	NONE	

EP 2680293 A1	01-01-2014	CN 103515160 A	15-01-2014
		DE 102012210745 A1	02-01-2014
		EP 2680293 A1	01-01-2014

DE 102006037225 A1	14-02-2008	BR PI0715410 A2	02-07-2013
		CN 101501806 A	05-08-2009
		DE 102006037225 A1	14-02-2008
		EP 2050115 A1	22-04-2009
		WO 2008017612 A1	14-02-2008
