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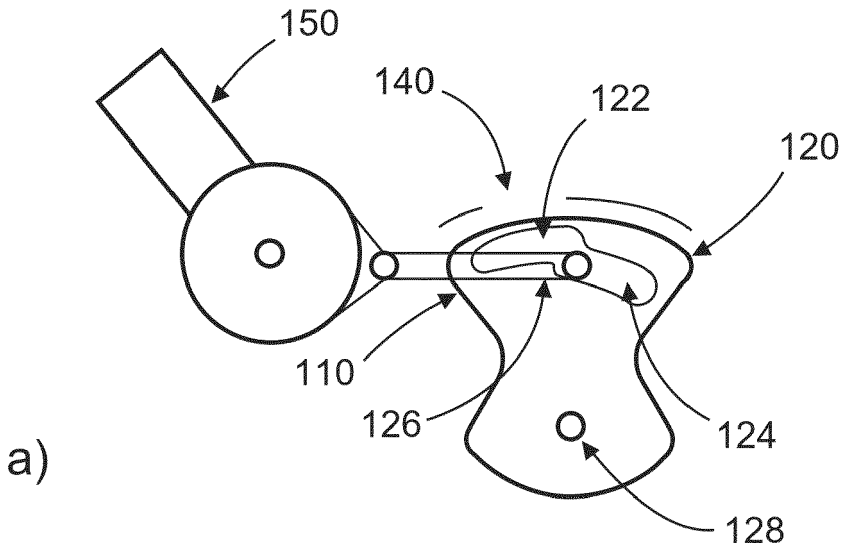
(54) INDICATOR SYSTEM FOR A CIRCUIT BREAKER DEVICE

(57) An indicator system for a circuit breaker device to indicate a trip status of the circuit breaker device is described, including:
a coupling bow, configured to mechanically couple a toggle of the circuit breaker with the indicator system and to lock an indicator element in a no-trip status position, if the circuit breaker is in a closed status and not tripped; and
a steering plate configured to unlock the indicator element from the coupling bow if the circuit breaker is triggered, for releasing the indicator element to achieve a trip status position.



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Description

Background of the invention

[0001] Circuit breakers, such as miniature circuit breakers (MCBs), including magnetic systems are used in electrical engineering systems to protect electrical circuits against overloads, e.g., caused by short circuits or the like, and are used to automatically interrupt an electrical current path, i.e., they trip, if such an overload occurs.

[0002] Typically, the circuit breakers are equipped with a tripping unit based on an electromagnetic component and a thermal release component, a trigger lever, which is configured to be latched, and a tripping element operational coupled to the latched trigger level, as well as an contact device providing a switchable electrical contact, an extinguishing chamber and connection terminals.

[0003] For some type of overload cases, the electromagnetic component is used to trip the circuit breaker. The electromagnetic component has a movable armature which, in the rest position, partially protrudes into a wire coil with electrical current flowing through, which has to be monitored. When the electrical current within the coil exceeds a predetermined trip current, the armature is displaced by the resulting magnetic field of the coil and trips a contact device of the circuit breaker via a plunger.

Detailed description of the invention

[0004] Such a circuit breaker typically provides a toggle to open and close the circuit breaker. After tripping of the circuit breaker the toggle is in an open position and an operator looking at the position of the toggle does not know, whether it got into the open position by turning the toggle or by triggering.

[0005] Aspects of the present invention are related to an indicator system for a circuit breaker device, a use of an indicator system, and a use of a circuit breaker device with subject matter as described in the independent claims. Advantageous modifications of the invention are stated in the dependent claims. All combinations of at least two of the features disclosed in the description, the claims, and the figures fall within the scope of the invention. In order to avoid repetition, features disclosed in accordance with the method shall also apply and be claimable in accordance with mentioned systems.

[0006] In this entire description of the invention, the sequence of procedural steps is presented in such a way that the process is easily comprehensible. However, the skilled person will recognize that many of the process steps can also be executed in a different order and lead to the same or a corresponding result. In this sense, the sequence of the process steps can be changed accordingly. Some features are provided with counting words to improve readability or to make the assignment more clear, but this does not imply the presence of certain features.

[0007] To achieve these and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, there is provided an indicator system for a circuit breaker device to indicate a trip status of the circuit breaker device, including:

an indicator element, configured to provide a tripped status position or a non-tripped status position;
a coupling bow, configured to mechanically couple a toggle of the circuit breaker with the indicator system and to lock the indicator element in a no-trip status position, if the circuit breaker is in a closed status and not tripped; and
a steering plate configured to unlock the indicator element from the coupling bow if the circuit breaker is triggered, for releasing the indicator element to achieve a trip status position.

[0008] Advantageously the indicator system can be configured to provide an information to an operator about the trip status of the circuit breaker based on a trip status position of the indicator element.
That means, that the indicator system can be configured to indicate the trip status of the circuit breaker independent of a position of the toggle of the circuit breaker, in particular if the circuit breaker is in a closed position and the circuit breaker was not tripped.
The information about the tripping status of the circuit breaker can reduce safety risks, because the root cause of the off-status of the circuit breaker is indicated by the system.

[0009] According to an aspect, the indicator element is configured to be latched in respect to a housing of the circuit breaker device to the non-tripped status position or the tripped status position for indicating the trip status. The latching of the indicator element in respect to the housing of the circuit breaker provides safe operation of the indicator element to keep its trip status position, in particular if there are mechanical interferences.

[0010] According to an aspect, the indicator element is configured to be locked to the non-tripped status position or the tripped status position based on a spring, which is mechanically coupled to the indicator element and configured to snap into two different respective detent positions provided by the housing of the circuit breaker device. The spring can provide means to maintain the detent status position of the indicator element and controls a preload of a trigger lever to initiate a change of the status position.

[0011] According to an aspect, the indicator element is configured to indicate the respective trip status of the circuit breaker device at a window of the circuit breaker, depending on a trip status position of the indicator element.
The trip status position of the indicator element can indicate a tripped status position or the non-tripped status position.
Therefore the position of the indicator element can be

indicated visually to the outside of the circuit breaker, as for instance a miniature circuit breaker (MCB), to an operator, e.g. by different appearance of the surface of the indicator element, e.g. different printing and/or different colours, shown to the outside of the circuit breaker, depending on the trip status position.

That means, the indicator system can be configured to indicate by the position of the indicator element, whether the circuit breaker was activated by a trigger lever, respectively a delatching lever, in case of tripping the circuit breaker and can be configured to be reset by changing the status of the circuit breaker from an off status to an on status, e.g. by a mechanical coupling to the toggle of the circuit breaker.

[0012] According to an aspect, the indicator element is configured to be reset into the non-trip status by the coupling bow, if the toggle of the circuit breaker is moved from an open status of the circuit breaker to the closed status of the circuit breaker device.

If the indicator element holds the trip status position, the indicator element can be configured to interact with the coupling bow to be moved to the non-tripped status position if the toggle of the circuit breaker is operated in the on-position.

[0013] According to an aspect, the indicator element is configured to keep the non-tripped status position if the toggle of the circuit breaker is operated.

The indicator element can be configured to be coupled to the toggle of the circuit breaker by the coupling bow, such that the toggle can be operated between the open and the closed position of the circuit breaker without changing the trip position of the indicator element, if the circuit breaker is not tripped.

The indicator element can be configured to keep the non-tripped status independent on the position of the toggle of the circuit breaker, based on a second slotted hole guiding a leg of the coupling bow as described below. This enables the indicator element to indicate the trip status of the circuit breaker independent of an operation of the toggle.

[0014] According to an aspect, the indicator system is configured to reset the indicator element to the non-trip status position, if the toggle of the circuit breaker is operated to the closed position after a tripping event of the circuit breaker device.

[0015] According to an aspect, the indicator element comprises two slotted holes, which are displaced against each other such that they are openly connected for enabling a leg of the coupling bow to be moved within both slotted holes; and the two slotted holes are displaced against each other and configured to form an edge at a connection point of the two slotted holes to define an anchor point for the leg of the coupling bow for locking the indicator element.

A first slotted hole can provide a functionality of the indicator element to change the position if the circuit breaker device is triggered even if the toggle is in its on position.

[0016] The second slotted hole can provide a functionality of the indicator element to keep its position if the toggle is operated, but the circuit breaker device is not tripped.

[0017] According to an aspect, the steering plate and the indicator element are configured to interact for locking the indicator element with the coupling bow in the non-tripped status position.

This interaction between the steering plate and the indicator element provides safe operation of the indicator element keeping its position without a trigger event of the circuit breaker device, in particular if there are mechanical disturbances.

For the interaction of the steering plate with the indicator element to lock the coupling bow in the non-trip status position the steering plate is configured with two slotted holes, which are displaced against each other such that they are openly connected for enabling a leg of the coupling bow to be moved within both slotted holes of the steering plate corresponding to the two slotted holes of the indicator element. To lock the coupling bow a leg of the coupling bow can be arranged within the two slotted holes of the steering plate and take indicator element. The steering plate is configured to be rotated in respect to the indicator element such that in the non-trip status position the leg of the coupling bow is locked at the anchor point of the indicator element based on the two slotted holes of the steering plate being rotated in respect to the two slotted holes of the indicator element. That means that the leg of the coupling bow is hindered to move within the first slotted hole of the indicator element, because one of the slotted holes of the steering plate fix the leg of the coupling bow at the anchor point position. A spring, which couple the indicator element and the steering plate elastically, can provide that the steering plate and the indicator element are rotated in respect to each other as described for locking the coupling bow in the non-trip status position.

[0018] According to an aspect, the steering plate is configured to unlock the indicator element from the coupling bow if a trigger lever of the circuit breaker device interacts with the steering plate during triggering of the circuit breaker device.

The interaction of the trigger lever with the steering plate can be e.g. by hitting the steering plate by the trigger lever.

The steering plate can be configured to release a leg of the coupling bow from the anchor point provided by the two displaced slotted holes allowing the indicator element to achieve the trip status position starting from the non-trip status position.

[0019] According to an aspect, the steering plate comprises means for coupling to the indicator element to move the indicator element from the non-trip status position to the trip status position, if the steering plate interacts with the trigger lever.

[0020] The steering plate can be configured to move the indicator element from the non-tripped status position to the trip status position, if the trigger lever interacts with

the steering plate, e.g. by hitting the steering plate, during a trigger event of the circuit breaker device, e.g. by means of a driving pin of the steering plate, for mechanically coupling to the indicator element.

[0021] According to an aspect, the steering plate is configured to release the leg of the coupling bow from the anchor point to unlock the indicator element from the coupling bow if the circuit breaker is triggered.

The steering plate can be configured to unlock the coupling bow from the indicator element if the circuit breaker is triggered by displacement of the coupling bow from the anchor point within the two slotted holes, after releasing the leg of the coupling bow from the locking position by change of its position.

[0022] A kit of parts, including the indicator element and the steering plate and the spring and the coupling bow is provided to be assembled for use within a circuit breaker device. This kit of parts can be preassembled to be inserted into the circuit breaker device, as e.g. a MCB, for assembling the circuit breaker device.

[0023] A circuit breaker device is provided, which includes an indicator system as described above.

Advantageously the circuit breaker device can indicate its trip status independent on the position of the toggle.

[0024] A use of an indicator system including an indicator element as described above is provided, to indicate a trip status of a circuit breaker device.

Such an indicator system provides a functionality to indicate a trip status of a circuit breaker device to an operator.

[0025] A use of a circuit breaker device as described above is provided, including an indicator system as described above, to indicate a trip status of a circuit breaker device.

Such circuit breaker device can provide a functionality to indicate a trip status of the circuit breaker device to an operator.

Brief description of the drawings

[0026] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiments of the invention and together with the description serve to explain the principle of the invention. The drawings display:

FIG. 1a-c depicts an indicator system with functional steps of a functional sequence;

FIG. 2a-d depicts an indicator system with functional steps of a functional sequence;

FIG. 3a-c depicts schematically the indication of the trip status;

FIG. 4a, b depicts a schematic drawing of the indicator system;

FIG. 5 depicts components of the indicator system;

FIG. 6a-g depicts an indicator system with functional steps of functional sequences from a first site of the indicator system; and

FIG. 7a-g depicts an indicator system with functional steps of functional sequences from a first site of the indicator system;

[0027] The sequence of figures 1a to 1c sketches schematically functional steps of an indicator system 200, as described above, if a toggle 150 of a circuit breaker device is operated. The toggle 150 in figure 1a is in an off-position of the circuit breaker device and the indicator element 120 is in a tripped status position such that a surface of the indicator element 120 with a defined appearance, e.g. different printing and/or different colours, is shown to the outside of the circuit breaker through the window 140 of the housing of the circuit breaker. The indicator element 120 is configured to take the different status positions by a rotation of the indicator element 120 centred to an axis 128. The indicator element 120 is coupled to the toggle 150 by means of a coupling bow 110. One leg of the coupling bow 110 is guided by the first slotted hole 122 and the second slotted hole 124, which are building an anchor point 126 for mechanical interaction for the leg of the coupling bow 110.

The toggle 150 in figure 1b is operated to an on-position of the circuit breaker as indicated by the arrow at the toggle 150 and resulting from this the indicator element 120 is moved to the non-trip status position, as indicated by the arrow at the indicator element, by means of a leg of the coupling bow 110, which is coupled to the indicator element 120 at the anchor point 126 to rotate the indicator element 120.

Figure 1c sketches that the toggle 150 can be moved freely within the second slotted hole 124 such that the indicator element 120 is kept in its latched position indicating a non-trip status of the circuit breaker device, because the leg of the coupling bow can slide within the second slotted hole 124 in this non-trip status position of the indicator element 120.

[0028] Figure 2 a to d sketch functional steps of changes of the latched non-trip status position of the indicator element 120 to the tripped status position, if the circuit breaker device is tripped. Figure 2a sketches a release of the leg of the coupling bow 110, which is arranged within the slotted holes 122, 124. If the trigger lever 210 is moving towards the steering plate 130 the steering plate 130 is configured to rotate about an axis 128 to displace the leg of the coupling bow 110 from the anchor position 126 to release the indicator element 122 to change to the tripped status position. By this, the leg of the coupling bow 110 can freely move within the first slotted hole 122. The steering plate 130 is configured to couple to the indicator element 120 to push the indicator element into the tripped status position, as indicated in figure 2c, if triggering of the circuit breaker device occurs.

[0029] If, because of tripping of the circuit breaker device, the toggle 150 is moving to the off-position, the indicator element 120 can be latched in its tripping status

position, because the indicator element 120 is configured such that the leg of the coupling bow 110 can move freely within the first slotted hole 122 and second slotted hole 124.

[0030] Figure 3a sketches an outside view of a circuit breaker device, wherein the toggle 150 is in an off-position and the window 140, within the housing of the circuit breaker device, indicates a tripping event by, e.g. a red, colour coding caused by a tripped status position of the indicator element 120.

[0031] Figure 3b sketches an outside view of the circuit breaker device, wherein the toggle 150 takes an on-position and the window 140, within the housing of the circuit breaker device, is reset to a non-tripping status by, e.g. green, colour coding caused by a non-tripped status position of the indicator element 120.

[0032] Figure 3c depicts a part of a technical drawing of the indicator system 200 integrated into a circuit breaker device. The toggle 150 is shown in the off position of the circuit breaker device and the indicator element 120 indicates the tripping of the circuit breaker device by its tripped status position. Because the steering plate 130 is placed beneath the indicator element 120 only coupling pins 510, 520, as shown in figure 4a, of the steering plate 130 are shown in figure 3c.

[0033] Figure 4a depicts a perspective technical drawing of the indicator system 200 within indicator element 120 including a first slotted hole 122 and the second slotted hole 124, which are openly displaced against each other to form an anchor point 126. One leg of the coupling bow 110 is placed within this two slotted holes 122, 124. The steering plate 130 is arranged to stack within the indicator element is close a explained below.

[0034] Figure 4b depicts the same indicator system 200 as in figure 4a drafted as a perspective technical drawing from an different point of view to show the backside of the indicator system 200. In addition, the spring 410 for latching the indicator element 120, which is coupled to the indicator element, is drawn.

[0035] Figure 5 depicts perspective technical drawings of components of the indicator system. The indicator element 120 is shown with the first slotted hole 122 and a second slotted hole 124 building an anchor point 126 as described before. The steering plate 130 is shown with a first coupling pin 510 and a second coupling pin 520 for forcing the indicator element 120 to the tripped status position. The coupling bow 110 includs two legs as shown, wherein the longer leg can be placed within the two slotted holes 122, 124. Also as shown, the spring 410 is configured to latch the indicator element 120 at the non-tripped status position or the tripped status position.

[0036] Figure 6a to c correspond as a technical drawing to figure 1a to c, respectively. Within figure 6b and d, a latch position 610 for the spring 410 within the housing of the circuit breaker is indicated.

[0037] Figure 6d to g correspond as a technical drawing to figure 2 a to d, respectively.

[0038] Figure 7 a to g correspond as a technical drawing from the different point of view from the opposite side to figure 6 a to g, respectively.

Claims

1. Indicator system (200) for a circuit breaker device to indicate a trip status of the circuit breaker device, comprising:

   an indicator element (120), configured to provide a tripped status position or a non-tripped status position;
   a coupling bow (110), configured to mechanically couple a toggle (150) of the circuit breaker with the indicator system (200) and to lock the indicator element (120) in a no-tripped status position, if the circuit breaker is in a closed status and not tripped; and
   a steering plate (130) configured to unlock the indicator element (120) from the coupling bow (110) if the circuit breaker is triggered, for releasing the indicator element (120) to achieve a trip status position.

2. The indicator system (200) according to the preceding claim, wherein the indicator element (120) is configured to be latched in respect to a housing of the circuit breaker device to the non-tripped status position or the tripped status position for indicating the trip status.

3. The indicator system (200) according to claim 2, wherein the indicator element (120) is configured to be locked to the non-tripped status position or the tripped status position based on a spring (410), which is mechanically coupled to the indicator element (120) and configured to snap into two different respective detent positions provided by the housing of the circuit breaker device.

4. The indicator system (200) according to any of the preceding claims,
   wherein the indicator element (120) is configured to indicate the respective trip status of the circuit breaker device at a window (140) of the circuit breaker, depending on a trip status position of the indicator element (120).

5. The indicator system (200) according to any of the preceding claims, wherein the indicator element (120) is configured to be reset into the non-tripped status by the coupling bow (110), if the toggle (150) of the circuit breaker is moved from an open status of the circuit breaker to the closed status of the circuit breaker device.

6. The indicator system (200) according to any of the preceding claims, wherein the indicator element (110) is configured to keep the non-tripped status position if the toggle (150) of the circuit breaker is operated.

7. The indicator system (200) according to any of the preceding claims, wherein the indicator system (200) is configured to reset the indicator element (120) to the non-tripped status position, if the toggle (150) of the circuit breaker is operated to the closed position after a tripping event of the circuit breaker device.

8. The indicator system (200) according to any of the preceding claims, wherein the indicator element (120) comprises two slotted holes (122, 124), which are displaced against each other such that they are openly connected for enabling a leg of the coupling bow (110) to be moved within both slotted holes (122, 124); and the two slotted holes (122, 124) are displaced against each other and configured to form an edge at a connection point of the two slotted holes to define an anchor point (126) for the leg of the coupling bow (110) for locking the indicator element (120).

9. The indicator system (200) according to the preceding claim, wherein the steering plate (130) and the indicator element (120) are configured to interact for locking the indicator element (120) with the coupling bow (110) in the non-tripped status position.

10. The indicator system (200) according to any of the preceding claims, wherein the steering plate (130) is configured to unlock the indicator element (120) from the coupling bow (110) if a trigger lever (210) of the circuit breaker device interacts with the steering plate (130) during triggering of the circuit breaker device.

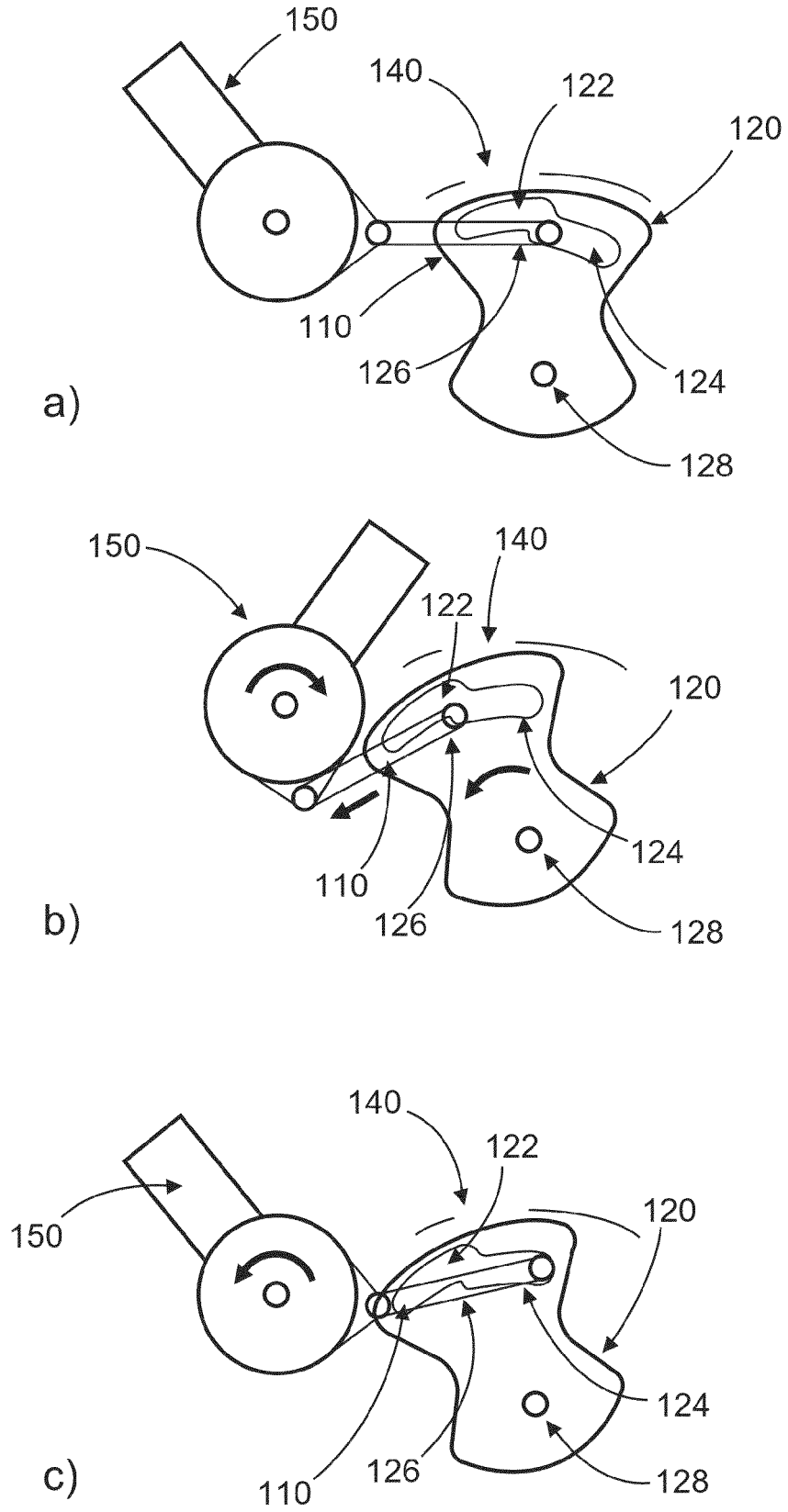
11. The indicator system (200) according to any of the preceding claims, wherein the steering plate (130) comprises means for coupling to the indicator element (120) to move the indicator element (120) from the non-tripped status position to the tripped status position, if the steering plate (130) interacts with the trigger lever (210).

12. The indicator system (200) according to any of claims 8 to 11, wherein the steering plate (130) is configured to release the leg of the coupling bow (110) from the anchor point (126) to unlock the indicator element (120) from the coupling bow (110) if the circuit breaker is triggered.

13. Circuit breaker device comprising an indicator system (200) according to any of the preceding claims.

14. Use of an indicator system (200) according to any of claims 1 to 12 comprising an indicator element (120), to indicate a trip status of a circuit breaker device.

15. Use of a circuit breaker device according to claim 13 comprising an indicator system (200) according to any of claims 1 to 12, to indicate a trip status of a circuit breaker device.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a)
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Fig. 1

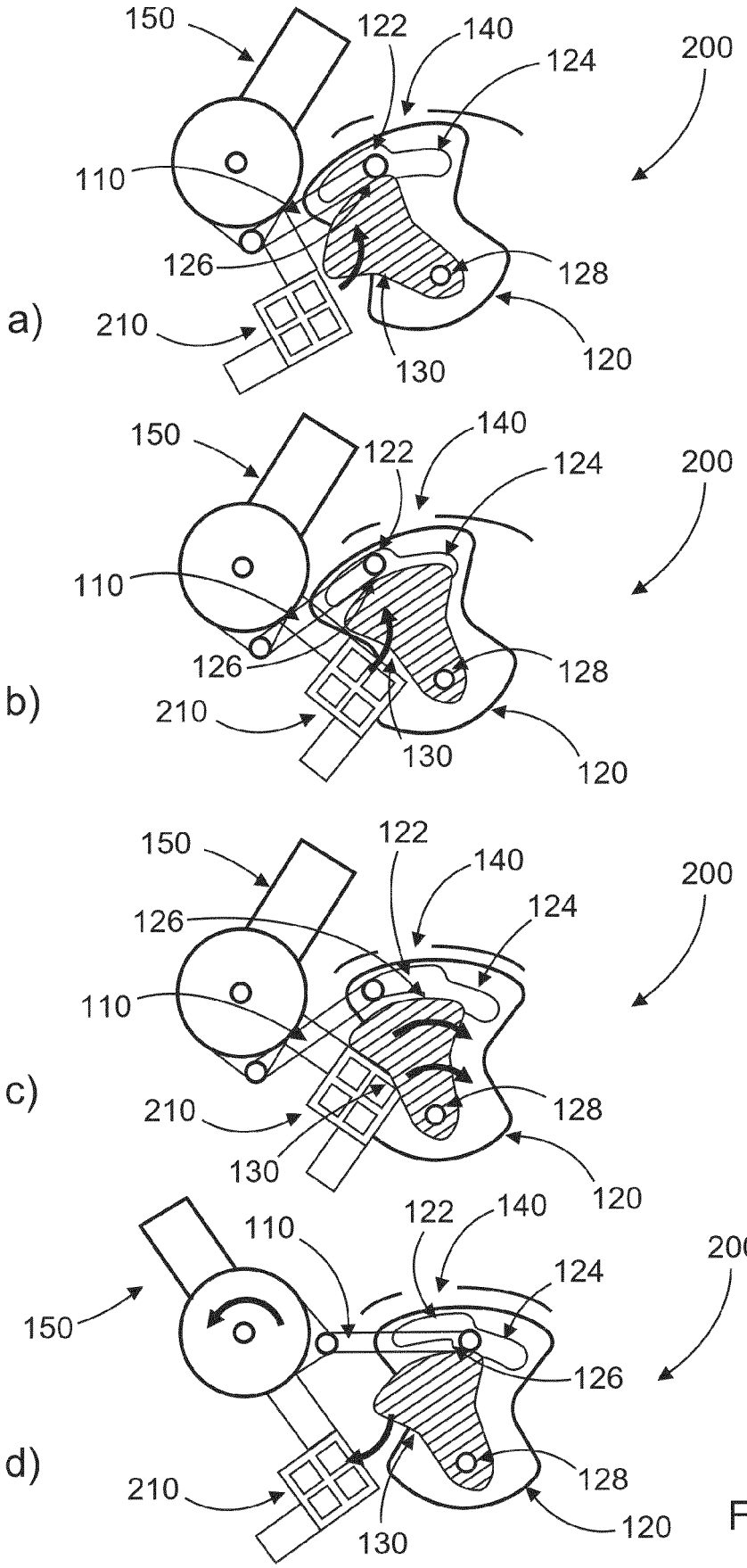
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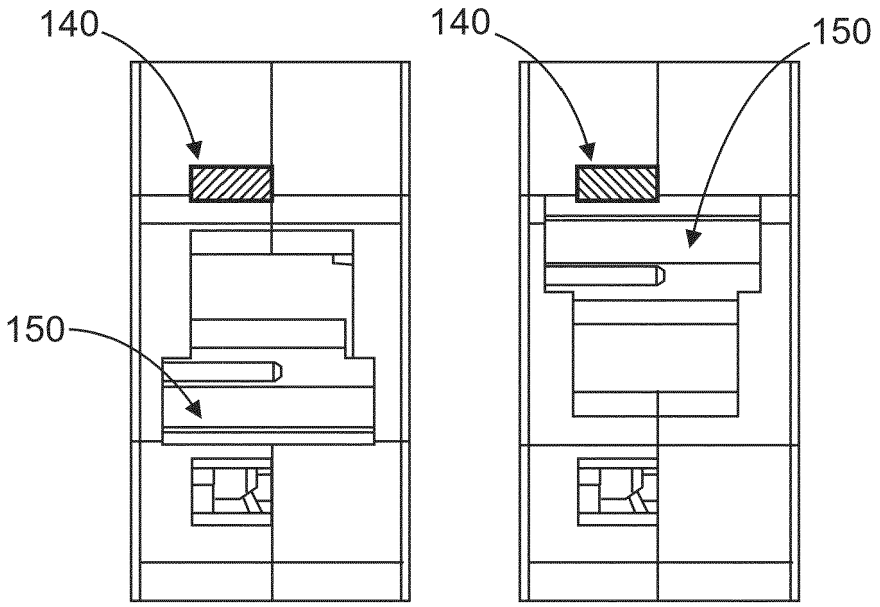
Fig. 2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b)

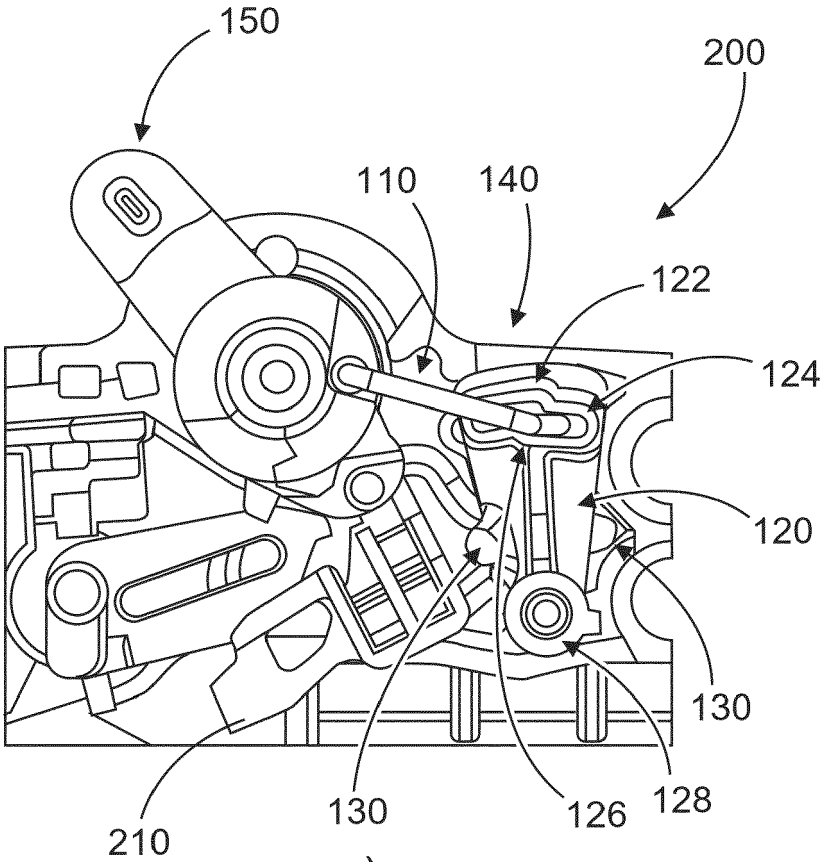
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Fig. 3

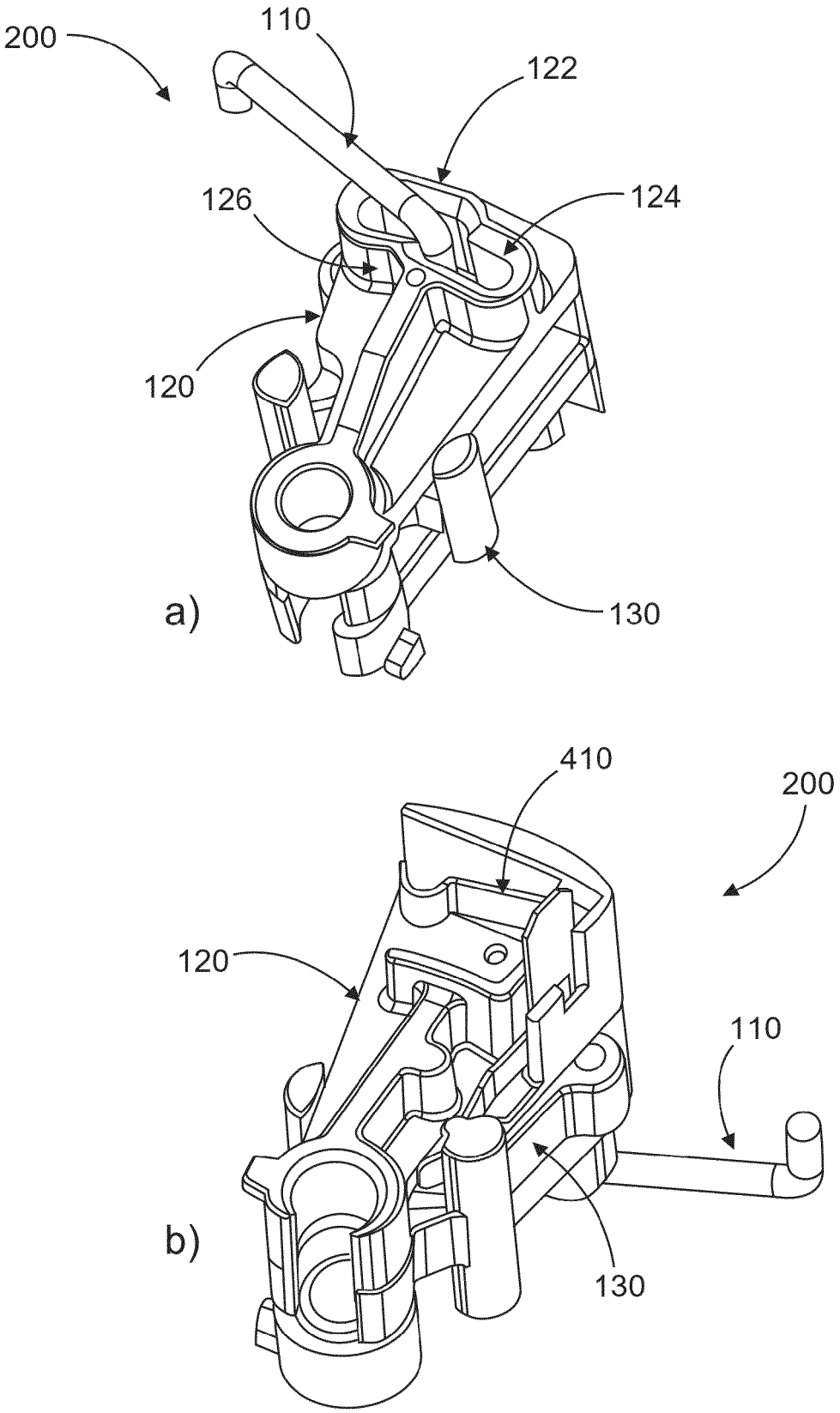

Fig. 4

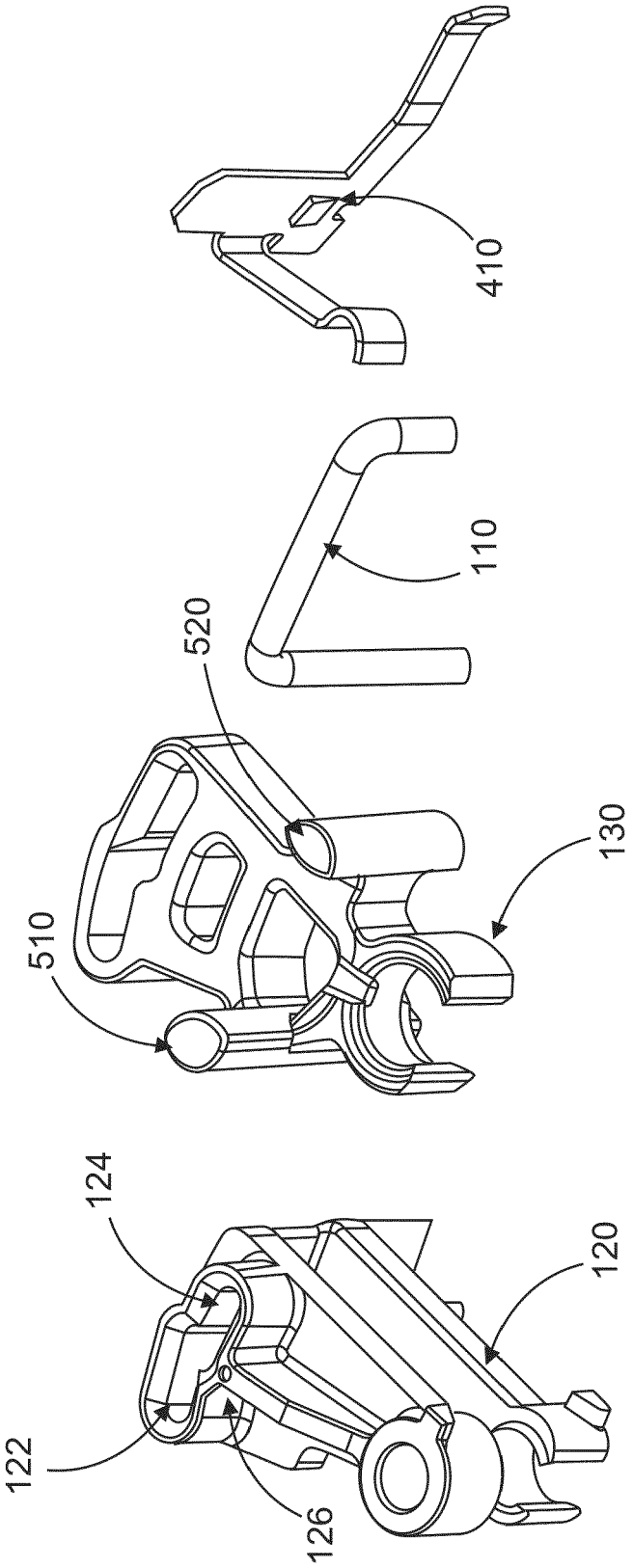

Fig. 5

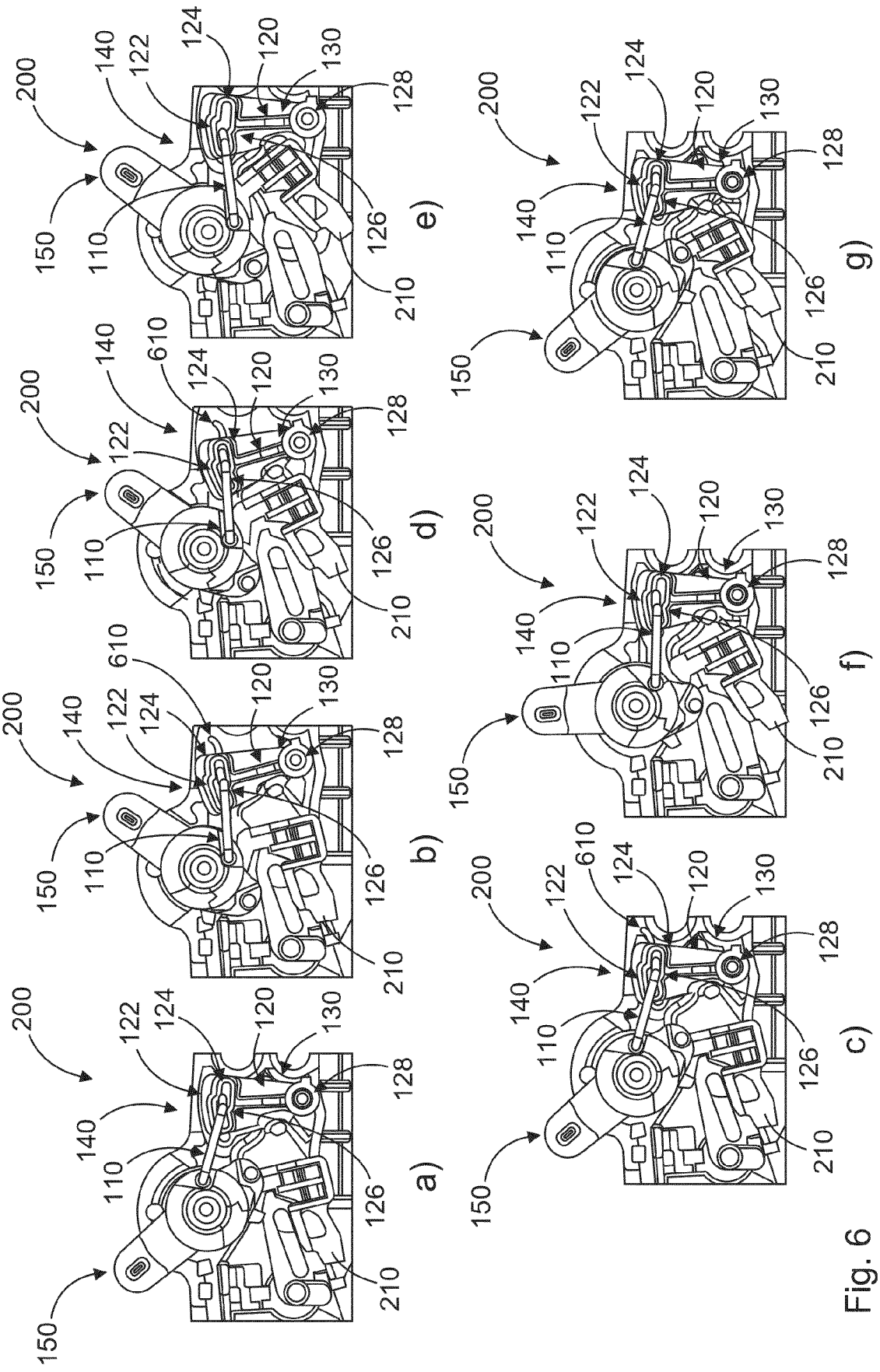

Fig. 6

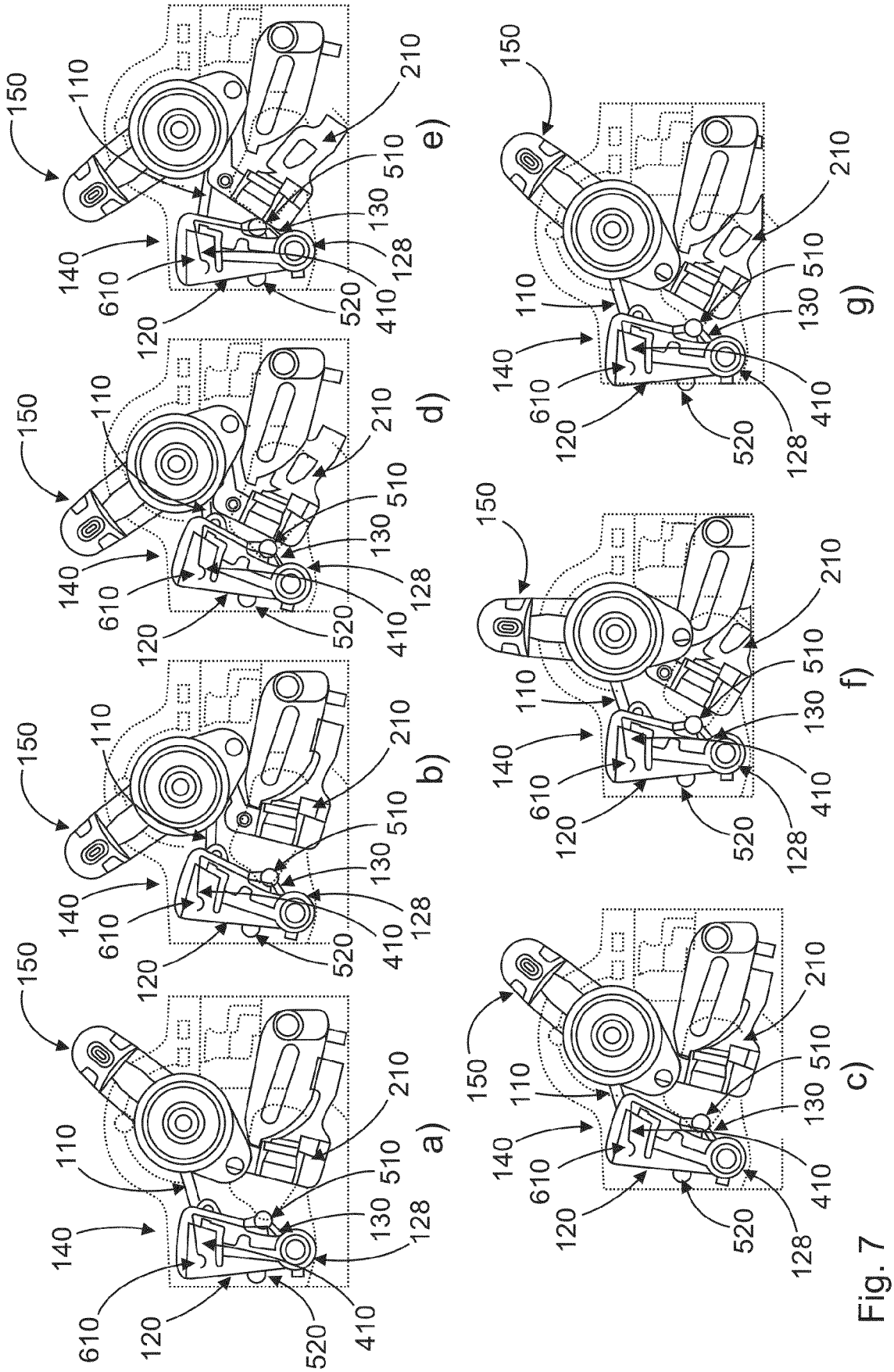

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 21 15 5765

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 Y A	US 9 343 256 B1 (EATON CORP [US]) 17 May 2016 (2016-05-17) * column 1, line 42 - line 50 * * column 7, line 45 - column 8, line 53 * * figures 7-12 * -----	1,2,4,6, 9-15 5,7 3,8	INV. H01H71/04
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A	US 6 104 266 A (TILGHMAN DOUGLAS B [US] ET AL) 15 August 2000 (2000-08-15) * column 2, line 51 - column 3, line 37 * * figures 2, 3 * -----	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 July 2021	Fribert, Jan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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