



(11) **EP 4 459 649 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.11.2024 Bulletin 2024/45

(51) International Patent Classification (IPC):
H01H 9/22 (2006.01) **H01H 33/48** (2006.01)
H01H 31/00 (2006.01)

(21) Application number: **24171107.6**

(52) Cooperative Patent Classification (CPC):
H01H 33/48; H01H 9/22; H01H 31/003

(22) Date of filing: **18.04.2024**

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

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(30) Priority: **04.05.2023 IN 202341031831**

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(54) **A SWITCHGEAR AND A SAFETEY ASSEMBLY FOR AN INTERLOCKING MECHANISM OF THE SWITCHGEAR**

(57) A switchgear 300 including an interlocking mechanism 200, coupled to at least one electrical component is disclosed. The interlocking mechanism 200 includes a shutter 128 positioned adjacent to a socket 130. A safety assembly 100 including a housing 102 is couplable to the switchgear 300. A cam 104 is coupled to a handle 106. The handle 106 is rotatably coupled to the housing 102. The handle 106 is selectively operable to rotate the cam 104 within the housing 102. An actuator 108 is positioned adjacent to the cam 104 in the housing 102. The actuator 108 is slidable along the first axis (A-A) of the housing 102 between the first position (A) and a second position (B). The first end 108a of the actuator 108 is coupled to the cam 104. A second end 108b of the actuator 108 is coupled to the shutter 128 of the interlocking mechanism 200.

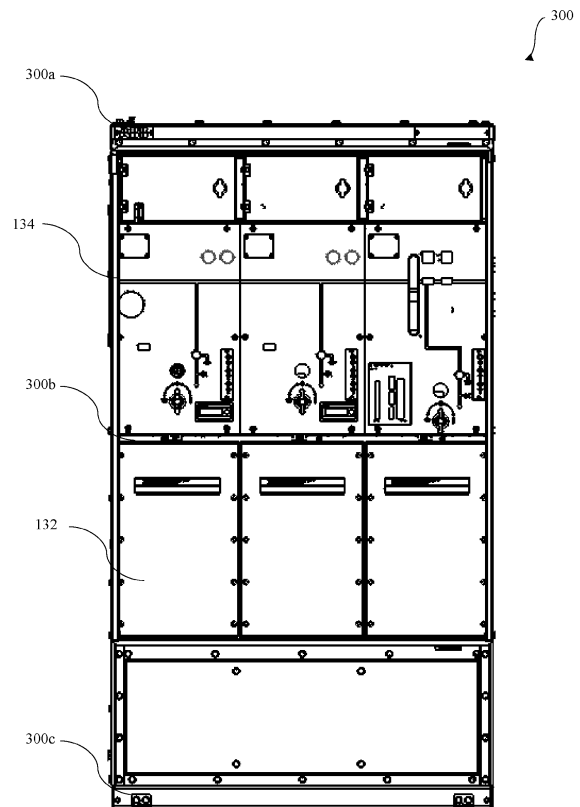


Figure 1

Description**TECHNICAL FIELD**

[0001] Present disclosure relates in general to a switchgear in an electrical power system. More particularly, the present disclosure relates to a safety assembly for an interlocking mechanism configured in the switchgear. Further, embodiments of the disclosure disclose, the configuration of the safety assembly which is operable to switch the interlocking mechanism between an operable condition and a non-operable condition.

BACKGROUND OF THE DISCLOSURE

[0002] Electrical switchgears are used in electrical power distribution systems to distribute electrical power and selectively isolate electrical loads. Conventionally, switchgears are produced in many forms. Typically, a switchgear includes a combination of electrical components such as a main distribution bus or a busbar, disconnecter assemblies, fuses, load break switches and circuit breakers. Switchgears are located where electrical distribution, isolation and/or protection is required. These locations may include, for example, generators, factories, motors, transformers, and substations.

[0003] Generally, in electrical switchgears, disconnection of the electrical components is carried out by an interlock assembly. The interlock assembly is an arrangement that can be operated to switch the electrical components between an ON position, an OFF position and a GROUND position. Further, the electrical components are operated or switched to the GROUND position while conducting any maintenance work or repair work on the switchgear. The switchgear is rendered to be safe for conducting any maintenance work when the electrical components are in the GROUND position. Generally, access to the interlock assembly is restricted or is prevented when the switchgear is under maintenance. The restricted access to the interlock assembly ensures that the electrical components in the switchgear are not erroneously operated to the ON position during maintenance. Further, there are scenarios where the electrical components are to be tested during maintenance in order to ascertain the working conditions of the electrical components. The restricted access to the interlock assembly during the maintenance of the switchgear prevents the operation of the electrical components during maintenance. Consequently, testing or ascertaining the working condition of electrical components in the switchgear during maintenance of the switchgear becomes difficult.

[0004] The present disclosure is directed to overcome one or more limitations stated above. The information disclosed in this background of the disclosure section is only for enhancement of understanding of the general background of the invention and should not be taken as an acknowledgement or any form of suggestion that this information forms the prior art already known to a person

skilled in the art.

SUMMARY OF THE DISCLOSURE

[0005] One or more shortcomings of the conventional device, system and method are overcome, and additional advantages are provided through the device, the system and method as claimed in the present disclosure. Additional features and advantages are realized through the techniques of the present disclosure. Other embodiments and aspects of the disclosure are described in detail herein and are considered a part of the claimed disclosure.

[0006] In a non-limiting embodiment of the disclosure, a switchgear is disclosed. The switchgear includes at least one electrical component switchable between an ON position, an OFF position, and an EARTH position. An interlocking mechanism is coupled to the at least one electrical component in the switchgear, where the interlocking mechanism includes a shutter positioned adjacent to a socket. The shutter is operable to allow or restrict access to the socket. A safety assembly, couplable to the switchgear and engageable with the interlocking mechanism is provided. The safety assembly includes a housing couplable to a middle section of the switchgear, where the middle section is defined between a top section and a bottom section of the switchgear. A cam is coupled to a handle, where the handle is rotatably coupled to the housing and the handle protrudes outwardly from a front end of the housing. The handle is selectively operable to rotate the cam within the housing. An actuator is positioned adjacent to the cam in the housing. The actuator is slidable along a first axis of the housing between a first position and a second position, where a first end of the actuator is coupled to the cam and a second end of the actuator is coupled to the shutter of the interlocking mechanism.

[0007] In an embodiment of the disclosure, a first extension and a second extension are defined to the first end of the actuator, where the first extension and the second extension extend in a direction perpendicular to the first axis of the housing and are parallel to each other. Further, the first extension and the second extension are configured to engage with the cam.

[0008] In an embodiment of the disclosure, the first extension is defined by a first surface and the second extension is defined by a second surface which is opposite to the first surface.

[0009] In an embodiment of the disclosure, the cam is configured to contact at least one of the first surface and the second surface of the actuator.

[0010] In an embodiment of the disclosure, the second end of the actuator is defined by a cutout, and the second end is configured to receive the shutter of the interlocking mechanism.

[0011] In an embodiment of the disclosure, a fixed member is positioned at a top end of the housing where, the fixed member restricts the sliding movement of the

actuator towards the top end of the housing.

[0012] In an embodiment of the disclosure, at least one guide member is positioned between the fixed member and a bottom end of the housing.

[0013] In an embodiment of the disclosure, the at least one guide member extends through at least one opening defined to each of the first extension and the second extension of the actuator along an axis parallel to the first axis.

[0014] In an embodiment of the disclosure, at least one flexible member is configured to at least one guide member and positioned between the bottom end of the housing and the actuator.

[0015] In an embodiment of the disclosure, a rear end of the housing is defined with a profile that is engageable to the section of the switchgear.

[0016] In an embodiment of the disclosure, the socket is configured to lie proximal to the middle section of the switchgear.

[0017] In a non-limiting embodiment of the disclosure, a safety assembly for an interlocking mechanism in a switchgear is disclosed. The safety assembly includes a housing couplable to a middle section of the switchgear. The middle section is defined between a top section and a bottom section of the switchgear. A cam is coupled to a handle, where the handle is rotatably coupled to the housing and the handle protrudes outwardly from a front end of the housing. The handle is selectively operable to rotate the cam within the housing. Further, an actuator is positioned adjacent to the cam in the housing where, the actuator is slidable along a first axis of the housing between a first position and a second position. Further, a first end of the actuator is coupled to the cam and a second end of the actuator is coupled to the interlocking mechanism.

[0018] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE ACCOMPANYING FIGURES

[0019] The novel features and characteristics of the disclosure are set forth in the appended claims. The disclosure itself, however, as well as a mode of use, further objectives, and advantages thereof, will best be understood by reference to the following detailed description of embodiments when read in conjunction with the accompanying drawings. One or more embodiments are now described, by way of example only, with reference to the accompanying drawings wherein like reference numerals represent like elements and in which:

Figure 1 illustrates a front view of a switchgear, in accordance with an embodiment of the disclosure.

Figure 2 illustrates a front view of the interlocking mechanism in the switchgear in a non-operable condition, in accordance with an embodiment of the disclosure.

Figure 3 illustrates a perspective view of the switchgear with a safety assembly in the first position, in accordance with an embodiment of the disclosure.

Figure 4 illustrates a perspective view of the safety assembly in the first position, in accordance with an embodiment of the disclosure.

Figure 5 illustrates a perspective view of the safety assembly from Figure 4 without a housing, in accordance with an embodiment of the disclosure.

Figure 6 illustrates a perspective view of a cam and a connecting member in the safety assembly, in accordance with an embodiment of the disclosure.

Figure 7 illustrates a side view of the safety assembly connected to a shutter, in accordance with an embodiment of the disclosure.

Figure 8 illustrates a front view of the interlocking assembly in the switchgear with the safety assembly in the first position, in accordance with an embodiment of the disclosure.

Figure 9 illustrates a perspective view of the safety assembly in a second position, in accordance with an embodiment of the disclosure.

Figure 10 illustrates a perspective view of the safety assembly from Figure 9 without the housing, in accordance with an embodiment of the disclosure.

Figure 11 illustrates a side view of the safety assembly connected to the shutter, in accordance with an embodiment of the disclosure.

Figure 12 illustrates a front view of the interlocking assembly in the switchgear with the safety assembly in the second position, in accordance with an embodiment of the disclosure.

[0020] The figures depict embodiments of the disclosure for purposes of illustration only. One skilled in the art will readily recognize from the following description that alternative embodiments of the thermal conductivity detector device illustrated herein may be employed without departing from the principles of the disclosure described herein.

DETAILED DESCRIPTION

[0021] The foregoing has broadly outlined the features

and technical advantages of the present disclosure in order that the description of the disclosure that follows may be better understood. Additional features and advantages of the disclosure will be described hereinafter which form the subject of the disclosure. It should be appreciated by those skilled in the art that the conception and specific embodiments disclosed may be readily utilized as a basis for modifying or designing other systems for carrying out the same purposes of the present disclosure. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the scope of the disclosure. The novel features which are believed to be characteristic of the disclosure, as to its organization, together with further objects and advantages will be better understood from the following description when considered in connection with the accompanying figures. It is to be expressly understood, however, that each of the figures is provided for the purpose of illustration and description only and is not intended as a definition of the limits of the present disclosure.

[0022] While the disclosure is susceptible to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and will be described below. It should be understood, however, that it is not intended to limit the disclosure to the particular forms disclosed, but on the contrary, the disclosure is to cover all modifications, equivalents, and alternatives falling within the scope of the disclosure.

[0023] The terms "comprises", "comprising", or any other variations thereof used in the disclosure, are intended to cover a non-exclusive inclusion, such that device and system comprises a list of components does not include only those components but may include other components not expressly listed or inherent to such device or system. In other words, one or more elements in device and system proceeded by "comprises" does not, without more constraints, preclude the existence of other elements or additional elements in the system or device.

[0024] The following paragraphs describe the present disclosure with reference to Figures 1 to 12. In the figures, the same element or elements which have similar functions are indicated by the same reference signs. For the purpose of promoting and understanding of the principles of the disclosure, reference will now be made to specific embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the disclosure is thereby intended, such alterations and further modifications in the illustrated methods, and such further applications of the principles of the disclosure as illustrated therein being contemplated as would normally occur to one skilled in the art to which the disclosure pertains.

[0025] The following detailed description is merely exemplary in nature and is not intended to limit application and uses. Further, there is no intention to be bound by any theory presented in the preceding background or

summary or the following detailed description. It is to be understood that the disclosure may assume various alternative orientations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices or components illustrated in the attached drawings and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hereinafter, preferred embodiments of the present disclosure will be described referring to the accompanying drawings. While some specific terms directed to a specific direction will be used, the purpose of usage of these terms or words is merely to facilitate understanding of the present invention referring to the drawings.

[0026] Accordingly, it should be noted that meaning of these terms or words should not improperly limit the technical scope of the present disclosure. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. Unless specified or limited otherwise, the terms "mounted," "connected," "supported," and "coupled" and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings. Further, "connected" and "coupled" are not restricted to physical or mechanical connections or couplings. It is to be understood that this disclosure is not limited to the specific devices, methods, applications, conditions, or parameters described and/or shown herein, and that the terminology used herein is for the purpose of describing particular embodiments by way of example and is not intended to be limiting of the claimed invention. In the present document, the word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any embodiment or implementation of the present subject matter described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments.

[0027] Referring to **Figures 1 to Figure 3**, there is disclosed an exemplary embodiment of a switchgear 300. The switchgear 300 may be defined by a body 134. The body 134 of the switchgear 300 may be defined by a top section 300a, a middle section 300b and a bottom section 300c. The body 134 may include at least one electrical component [herein after referred to as the electrical component] which is switchable between an ON position, an OFF position, and a GROUND position. The switchgear 300 may also include one or more protection devices, one or more metering devices and the like. The body 134 may be made of metallic materials such as but not limiting to steel, steel alloys and metal composites. In some embodiments, the body 134 may be made of composite materials such as but not limiting to polymer composites. In an embodiment, the body 134 of the switchgear 300 may include at least one door 132. In this embodiment, the at least one door 132 may be positioned in a region between the middle section 300b and the bottom section 300c of the body 134. The positioning of the at least one door 132 must not be considered as a limitation. The at least

one door 132 may be operable to provide and restrict access to electrical components housed within the body 134 of the switchgear 300. The body 134 of the switchgear 300 may also accommodate at least one interlocking mechanism 200 [hereinafter referred to as the interlocking mechanism]. The interlocking mechanism 200 is coupled to the electrical components. The interlocking mechanism 200 may be operable to switch the electrical components between the ON position, the OFF position, and the GROUND position. In an embodiment, the electrical components may be devices including but not limited to circuit breakers, busbars etc.

[0028] The interlocking mechanism 200 may include a socket 130, which may be configured to receive a tool (not shown in FIGs) for operation of the interlocking mechanism 200. Further, the interlocking mechanism 200 may be selectively operated, based on the required operating condition of the electrical component. The tool may be inserted into the socket 130 and the tool may be rotated in a clockwise direction or in an anti-clockwise direction for operating the interlocking mechanism 200 between the ON position, the OFF position, and the GROUND position. The switchgear 300 may further include a shutter 128 and the same may be positioned adjacent to the socket 130. As seen from the Figure 2, and in this embodiment, the shutter 128 may be positioned proximal to the middle section 300b of the switchgear 300. The shutter 128 may be selectively couplable to the at least one door 132 [hereinafter referred to as the door] of the switchgear 300. In this embodiment, the shutter 128 may block the socket 130 when the door is in an open condition. The open condition of the door 132 may be herein defined as the condition of the door which provides access to the electrical components in the switchgear 300. Since, the shutter 128 blocks the socket 130, the access to the socket 130 is restricted. Consequently, the tool cannot be inserted into the socket 130. Therefore, the interlocking mechanism 200 cannot be operated to switch the electrical component between the ON position, the OFF position, and the GROUND position. Further, the shutter 128 may be configured to couple with the door 132 or the shutter 128 may be configured to be displaced when the door 132 contacts the shutter 128. In this embodiment, the shutter 128 may be configured such that the door 132 in the closed condition may cause the shutter 128 to be traversed downwardly. The closed condition of the door 132 may herein be a condition where the access to the electrical components in the switchgear 300 is restricted by the door 132. As the door 132 is closed, the door 132 may engage with the shutter 128 and may cause the shutter 128 to be moved downwardly [seen from the Figure 12] such that there is no restriction for accessing the socket 130. Consequently, the tool can be inserted into the socket 130 and the interlocking mechanism 200 can be operated to switch the electrical component between the ON position, the OFF position, and the GROUND position. Thus, the safety of an operator is ensured since access to the socket 130 is

allowed by the shutter 128 only when the door 132 is in the closed condition.

[0029] The switchgear 300 may include a safety assembly 100 as seen from the Figure 3. Further, access to the electrical components is required for conducting tests during maintenance in order to ascertain the working conditions of the electrical components. Consequently, the interlocking mechanism 200 is to be operated between the ON position, the OFF position, and the GROUND position for testing the electrical components. Simultaneously, the door 132 is also required to be in the open condition for providing access to the electrical components such that the electrical components can be suitably tested. As seen from the Figure 3, the safety assembly 100 may be coupled to the middle section 300b of the switchgear 300. Further, the safety assembly 100 may be operated to traverse the shutter 128 downwardly and for providing access to the interlocking mechanism 200 when the door is in the open condition. The configuration and the working of the safety assembly 100 is explained below with greater detail.

[0030] Reference is made from **Figure 4 to Figure 7**. The safety assembly 100 includes a housing 102. The housing 102 in this embodiment may be of a square cuboidal shape. The shape of the housing 102 must not be considered as a limitation and the housing 102 of different shapes may also be adapted including but not limited to rectangular and trapezoidal shapes. In an embodiment, the housing 102 may be defined with a front end 102a and a rear end 102b. In an embodiment, a first axis (A-A) may extend through the center of the housing 102. The first axis (A-A) may extend along a vertical direction and may extend along the length of the housing 102. In an embodiment, the front end 102a of the housing 102 may be defined as a single structure or a single plate. The front end 102a of the housing may be defined by a central hole 136 that extends in a direction perpendicular to the first axis (A-A). Further, the housing 102 may also be defined by side walls 152. The side walls 152 may be connected to the front end 102a of the housing 102. The end of the side walls 152 which are opposite to the ends connected to the front end 102a are defined as the rear end 102b of the housing 102. The rear end 102b may be defined with a profile or a cutout which complements the shape of the middle section of the switchgear 300. In an implementation, the side walls 152 and the complete housing 102 may be made of partially flexible material which may deform and may be coupled to the middle section 300b of the switchgear 300. In an implementation, the housing 102 and particularly the rear end 102b of the housing may be configured with mechanisms or subassemblies which enable the removable coupling of the housing 102 to the middle section 300b of the switchgear 300. In an embodiment, the housing 102 may further be defined with a top end 116 and a bottom end 114. The top end 116 and the bottom end 114 may extend along the side walls 152 and the front end 102a of the housing 102.

[0031] The safety assembly 100 may include a fixed member 122 positioned at or proximal to the top end 116 of the housing 102. The fixed member 122 may be immovable and placed in the housing 102. The fixed member 122 may be configured to enclose a section of the housing 102 along the top end 116 of the housing 102. The safety assembly 100 may include an actuator 108. The actuator 108 may be defined by a first end 108a and a second end 108b. The actuator 108 may be defined by a first extension 110 and a second extension 112. In an embodiment, particularly, the first end 108a of the actuator 108 may be defined with the first extension 110 and the second extension 112. The first extension 110 may extend from an upper end at the first end 108a of the actuator 108. The first extension 110 may extend in a direction perpendicular to the first axis (A-A) of the housing 102. The first extension 110 may extend in a direction that is towards the front end 102a of the housing 102. Further, the second extension 112 may extend from a lower end at the first end 108a of the actuator 108. The second extension 112 may also extend in a direction perpendicular to the first axis (A-A) of the housing 102. The second extension 112 may also extend in a direction that is towards the front end 102a of the housing 102. In an embodiment, the first extension 110 and the second extension 112 may be configured to be parallel to each other. In an embodiment, the first extension 110 and the second extension 112 may be configured with pre-determined thickness such that the first extension 110 and the second extension 112 are separated by a pre-determined distance. Further, the first extension 110 may be defined by a first surface 110a which lies away from the top end 116 of the housing 102. The second extension 112 may also be defined by a second surface 112a which lies away from the bottom end 114 of the housing 102. The first surface 110a of the first extension 110 and the second surface 112a of the second extension 112 are configured to lie opposite to each other. In an embodiment, each of the first extension 110 and the second extension 112 may be defined with at least one opening 124 [hereinafter referred to as the opening]. The opening 124 may be defined along the same axis on the first extension 110 and the second extension 112. The opening 124 on the first extension 110 and the second extension 112 may be configured to extend along the axis that is parallel to the first axis (A-A). In an embodiment, the second end 108b of the actuator 108 may be defined with a cutout 118. The cutout 118 may be defined with a profile that complements a bottom end of the shutter 128. The cutout 118 may be configured to accommodate the shutter 128 [seen from Figure 7] of the interlocking mechanism 200.

[0032] Further, the actuator 108 may be positioned within the housing 102. The actuator 108 may be configured or positioned within the housing 102 such that the actuator 108 lies proximal or contacts the side walls 152 and the front end 102a of the housing 102. The actuator 108 may be slidably accommodated within the housing 102 and the actuator 108 may be configured to slide along

the first axis (A-A) of the housing 102. The actuator 108 may be slidable to a first position (A) [seen from Figure 4] and a second position (B) [seen from Figure 9]. The actuator 108 may be positioned in the housing 102, such that the first extension 110 may come in contact with the fixed member 122 when the safety assembly 100 is in the first position (A) [seen from figure 4] and the second extension 112 lies away from the bottom end 114 of the housing 102. The actuator 108 may also be positioned in the housing 102, such that the second extension 112 may contact the bottom end 114 when the safety assembly is in the second position (B) [seen from figure 9] and the first extension 110 lies away from the fixed member 122. The movement of the actuator 108 may be restricted by the fixed member 122 at the top end 116 of the housing 102 and the bottom end 114 of the housing 102. Since the fixed member 122 is immovably coupled to the region proximal to the top end 116 of the housing 102, the movement of the actuator 108 is physically restricted by the fixed member 122.

[0033] The safety assembly 100 may include at least one guide member 120 [hereinafter referred to as the guide member]. The guide member 120 in this embodiment may be a cylindrical structure with a diameter that is lesser than the opening 124 on the first extension 110 and the second extension 112. The guide member 120 may be positioned within the housing 102. Particularly, the guide member 120 may be positioned to extend in a direction parallel to first axis (A-A) of the housing 102. The guide member 120 may be positioned to extend through each of the opening 124 of the first extension 110 and the second extension 112. One end of the guide member 120 may be fixed to the bottom end 114 of the housing 102 and the opposite end of the guide member 120 may be connected to the fixed member 122. In an embodiment, the safety assembly 100 may include at least one flexible member 126 [hereinafter referred to as the flexible member]. The flexible member 126 may be configured around the guide member 120. Particularly, the flexible member 126 may be configured such that one end of the flexible member 126 is positioned on the bottom end 114 of the housing 102 and the opposite end of the flexible member 126 is configured to abut the actuator 108. In an embodiment, one end of the flexible member 126 is positioned on the bottom end 114 of the housing 102 and the opposite end of the flexible member 126 is configured to abut one of the second extension 112 or the first extension 110 of the actuator 108. The flexible member 126 may be configured to provide tension and compression force to the operation of the actuator 108. Particularly, the flexible member 126 may be configured to push the actuator 108 from the second position (B) to the first position (A).

[0034] The safety assembly 100 may include a cam 104. In an embodiment, the cam 104 may be a triangular shaped structure with chamfered edges. The safety assembly 100 may also include a connecting member 150 and a handle 106. One end of the connecting member

150 may be coupled to the cam 104 and the opposite end of the connecting member 150 may be coupled to the handle 106. The connecting member 150 may be rotatably positioned in the central hole 136 of the housing 102. In an embodiment, the connecting member 150 may be rotatably coupled to the housing 102 through a coupling ring or a washer. Further, one end of the connecting rod 150 may be configured to fixedly receive the handle 106. The handle 106 may protrude outwardly from the front end 102a of the housing 102. The handle 106 may be selectively operable to rotate the connecting member 150 in the clockwise or anti-clockwise direction. The cam 104 may be coupled to the end of the connecting rod 150 that is opposite to the end of the handle 106. Rotation of the handle 106 in the clockwise direction and the anti-clockwise direction may cause the cam 104 to rotate in the clockwise direction or the anti-clockwise direction, respectively through the intermediate connecting rod 150. Further, the actuator 108 may be positioned adjacent to the cam 104. In an embodiment, particularly, the cam 104 may be positioned to lie between the first extension 110 and the second extension 112 of the actuator 108. The cam 104 may engage with the first extension 110 and the second extension 112 when the cam 104 is rotated by the rotation of the handle 106. The cam 104 may be configured to contact at least one of the first surface 110a and the second surface 112a of the actuator 108. As the handle 106 is rotated in the clockwise direction, the cam 104 exerts force onto the second surface 112a of the second extension 112 and the cam pushes the actuator 108 downwardly towards the bottom end 114 of the housing 102. As the handle 106 is rotated in the anti-clockwise direction, the cam 104 exerts force onto the first surface 110a of the first extension 110 and the cam pushes the actuator 108 upwardly towards the fixed member 122 in the housing 102. In an embodiment, the cam 104 may be operated by an electric motor. In an embodiment, a plurality of buttons may be configured on the switchgear 300 where, actuation of one of the buttons operates the electric motor and the cam rotates in the clockwise direction. Similarly, the actuation of another button operates the electric motor, and the cam 104 rotates in the anti-clockwise direction. In an embodiment, the handle 106 may be manually operated by a user for rotating the cam 104.

[0035] The working of the safety assembly 100 is described below. Reference is made from Figures 3 to 8. The doors 132 of switchgear 300 may initially be in the open condition for conducting maintenance on the electrical components inside the switchgear 300. The shutter 128 may block access to the socket 130 when the doors 132 are in the open condition and consequently the interlocking mechanism 200 may not be operated. The operator may initially couple the safety assembly 100 to the middle section 300b of the switchgear 300. The rear end 102b of the housing 102 may engage with the middle section 300b of the switchgear 300 and the housing 102 of the safety assembly 100 may be fixedly coupled to the

switchgear 300. The housing 102 is coupled to the middle section 300b of the switchgear 300 that lies proximal to the interlocking mechanism 200. Further, the safety assembly 100 is coupled to the switchgear 300 such that the second end 108b of the actuator 108 engages with the shutter 128 of the interlocking mechanism 200. The cutout 118 at the second end 108b of the actuator 108 engages with the shutter 128 of the interlocking mechanism 200. As seen from Figures 4 and 5, the actuator 108 may be in the first position (A). The first position (A) may herein be the position where the actuator 108 lies proximal or adjacent to the fixed member 122 of the safety assembly 100. Further, the cam 104 is oriented to lie in a substantially horizontal position. Particularly, the tip or the free end of the cam 104 is configured to extend in a direction perpendicular to the first axis (A-A) or in the horizontal direction. The cam 104 is oriented such that the first surface 110a of the first extension and the second surface 112a of the second extension 112 contact the cam 104. The cam 104 may be sandwiched between the first extension 110 and the second extension 112 when the actuator 108 is in the first position (A). Further, the flexible member 126 may be in an expanded state where the flexible member 126 exerts force or tension for the upward movement of the actuator 108. The flexible member 126 may push the actuator 108 to the first position (A) where actuator 108 abuts the fixed member 122 and helps in retaining the actuator 108 at the first position (A). Since the actuator 108 lies in the first position (A), the shutter 128 also lies in the position where it blocks the socket 130 of the interlocking mechanism 200 [seen from Figures 7 and 8].

[0036] Subsequent to conducting maintenance on the electrical components in the switchgear 300, the operator may check the operability of the switchgear 300 in order to ascertain the working conditions of the electrical components. For checking the operability of the electrical components, the interlocking mechanism 200 is operated such that the electrical components are switched to the operating condition. For operating the interlocking mechanism 200, the safety assembly 100 is operated such that the shutter 128 is traversed downwardly towards the middle section 300b of the switchgear 300 and access to the socket 130 is cleared. Reference is further made to the Figures 9 to 12. The operator may rotate the handle 106 in the clockwise or the anti-clockwise direction. In this embodiment, the handle 106 is rotated in the clockwise direction. As the handle 106 rotates in the clockwise direction, the connecting member 150 which is fixedly coupled to the handle 106 also rotates in the clockwise direction. Further, the cam 104 that is coupled to the connecting member 150 also begins to rotate in the clockwise direction. Consequently, the cam 104 pushes or exerts force onto the second surface 112a of the second extension 112. As the cam 104 rotates, the actuator 108 is displaced from the first position (A) to the second position (B) and actuator 108 is traversed downwardly along the first axis (A-A). The guide members 120

direct the movement of the actuator 108 through the openings 124 defined in the first extension 110 and the second extension 112 of the actuator 108. The actuator 108 in the second position (B) lies away from the fixed member 122. The first surface 110a of the first extension 110 lies away from the fixed member 122 and the second surface 112a of the second extension 112 lies in proximity to the bottom end 114 of the housing 102. The flexible members 126 that abut the actuator 108 are also traversed to a compressed state when the actuator 108 is in the second position (B). As seen from the Figures 11 and 12, the second end 108b of the actuator 108 also traverses downwardly to the second position (B) as the actuator 108 traverses towards the second position (B). The second end 108b of the actuator 108 is coupled to the shutter 128 and traversing the actuator 108 to the second position (B) causes the shutter 128 to be traversed downwardly towards the middle section 300b of the switchgear 300. Consequently, the socket 130 is unblocked or access to the socket 130 is gained. The operator may insert the tool into the socket 130 to operate the interlocking mechanism 200 to the required operational condition. Thus, the electrical components are also operated to the required operational condition. The operator may further conduct the required tests to ascertain the working condition of the electrical components in the switchgear 300. The operator may subsequently operate the safety assembly 100 back to the first position (A) as described above. Further, the safety assembly 100 may be removed after conducting the maintenance work on the switchgear 300. In an embodiment, access to the interlocking mechanism 200 may be gained by operating the safety assembly 100 for further operating the electrical components in the switchgear 300. In an embodiment, conducting tests to ascertain the working conditions of the electrical components during maintenance is achieved by operating the safety assembly 100 to allow access to the socket 130 and to allow the operation of the interlocking mechanism 200.

Equivalents:

[0037] With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity.

[0038] It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims e.g., bodies of the appended claims are generally intended as "open" terms e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.. It will be further understood by those within the art that if a specific number

of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" e.g., "a" and/or "an" should typically be interpreted to mean "at least one" or "one or more"; the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean *at least* the recited number e.g., the bare recitation of "two recitations," without other modifiers, typically means *at least* two recitations, or *two or more* recitations. Furthermore, in those instances where a convention analogous to "at least one of A, B, and C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention e.g., "a system having at least one of A, B, and C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.. In those instances, where a convention analogous to "at least one of A, B, or C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention e.g., "a system having at least one of A, B, or C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.. It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase "A or B" will be understood to include the possibilities of "A" or "B" or "A and B." While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope being indicated by the following claims.

Referral numerals:

[0039]

Description	Referral numerals
Safety assembly	100
Housing	102
Front end	102a
Rear end	102b
Cam	104
Handle	106
Actuator	108
First end	108a
Second end	108b
First extension	110
First surface	110a
Second extension	112
Second surface	112a
Bottom end	114

Top end	116
Cut out	118
Guide member	120
Fixed member	122
Opening	124
Flexible member	126
Shutter	128
Socket	130
Door	132
Body	134
Central hole	136
Connecting member	150
Side wall	152
Interlocking mechanism	200
Switchgear	300
Top section	300a
Middle section	300b
Bottom section	300c

Claims

1. A safety assembly (100) for an interlocking mechanism (200) in a switchgear 300, the safety assembly (100) comprising:

a housing (102) couplable to a middle section (300b) of the switchgear (300), wherein the middle section (300b) is defined between a top section (300a) and a bottom section (300c) of the switchgear (300);

a cam (104) coupled to a handle (106), wherein the handle (106) is rotatably coupled to the housing (102) and the handle (106) protrudes outwardly from a front end (102a) of the housing (102), and wherein the handle (106) is selectively operable to rotate the cam (104) within the housing (102); and

an actuator (108) is positioned adjacent to the cam (104) in the housing (102) wherein, the actuator (108) is slidable along a first axis (A-A) of the housing (102) between a first position (A) and a second position (B), wherein a first end (108a) of the actuator (108) is coupled to the cam (104) and a second end (108b) of the actuator (108) is coupled to the interlocking mechanism (200).

2. The safety assembly (100) as claimed in claim 1, further comprising a first extension (110) and a second extension (112) defined to the first end (108a) of the actuator (108), wherein the first extension (110) and the second extension (112) extend in a direction perpendicular to the first axis (A-A) of the housing (102) and are parallel to each other, and wherein, the first extension (110) and the second extension (112) engage with the cam (104).

3. The safety assembly (100) as claimed in claim 2, wherein the first extension (110) is defined by a first surface (110a) and the second extension (112) is defined by a second surface (112a) which is opposite to the first surface (110a).

4. The safety assembly (100) as claimed in claim 2 or 3, wherein the cam (104) is configured to contact at least one of the first surface (110a) and the second surface (112a) of the actuator (108).

5. The safety assembly (100) as claimed in any of the previous claims, wherein the second end (108b) of the actuator (108) is defined by a cutout (118), and wherein the second end (108b) is configured to receive the shutter (128) of the interlocking mechanism (200).

6. The safety assembly (100) as claimed in any of the previous claims, further comprising a fixed member (122) positioned at a top end (116) of the housing (102) wherein, the fixed member (122) restricts the sliding movement of the actuator (108) towards the top end (116) of the housing (102).

7. The safety assembly (100) as claimed in any of the

previous claims, further comprising at least one guide member (120) positioned between the fixed member (122) and a bottom end (114) of the housing (102).

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8. The safety assembly (100) as claimed in any of the previous claims, wherein the at least one guide member (120) extends through at least one opening (124) defined to each of the first extension (110) and the second extension (112) of the actuator (108) along an axis parallel to the first axis (A-A). 10
9. The safety assembly (100) as claimed in any of the previous claims, further comprising at least one flexible member (126) configured to at least one guide member (120) and positioned between the bottom end (114) of the housing (102) and the actuator (108). 15
10. The safety assembly (100) as claimed in any of the previous claims, further comprising a rear end (102b) of the housing (102) defined with a profile that is engageable to the section of the switchgear (300). 20
11. The safety assembly (100) as claimed in any of the previous claims, wherein the socket (130) is configured to lie proximal to the middle section (300b) of the switchgear (300). 25
12. A switchgear (300) comprising a safety assembly (100) according to any of the previous claims; 30

at least one electrical component switchable between an ON position, an OFF position and an EARTH position; and 35
an interlocking mechanism (200) coupled to the at least one electrical component in the switchgear (300), wherein the interlocking mechanism (200) comprising a shutter (128) positioned adjacent to a socket (130), wherein the shutter (128) is operable to allow or restrict access to the socket (130); 40
wherein a first end (108a) of the actuator (108) is coupled to the cam (104) and a second end (108b) of the actuator (108) is coupled to the shutter (128) of the interlocking mechanism (200). 45
13. The switchgear (300) as claimed in claim 12, wherein the socket (130) is configured to lie proximal to the middle section (300b) of the switchgear (300). 50

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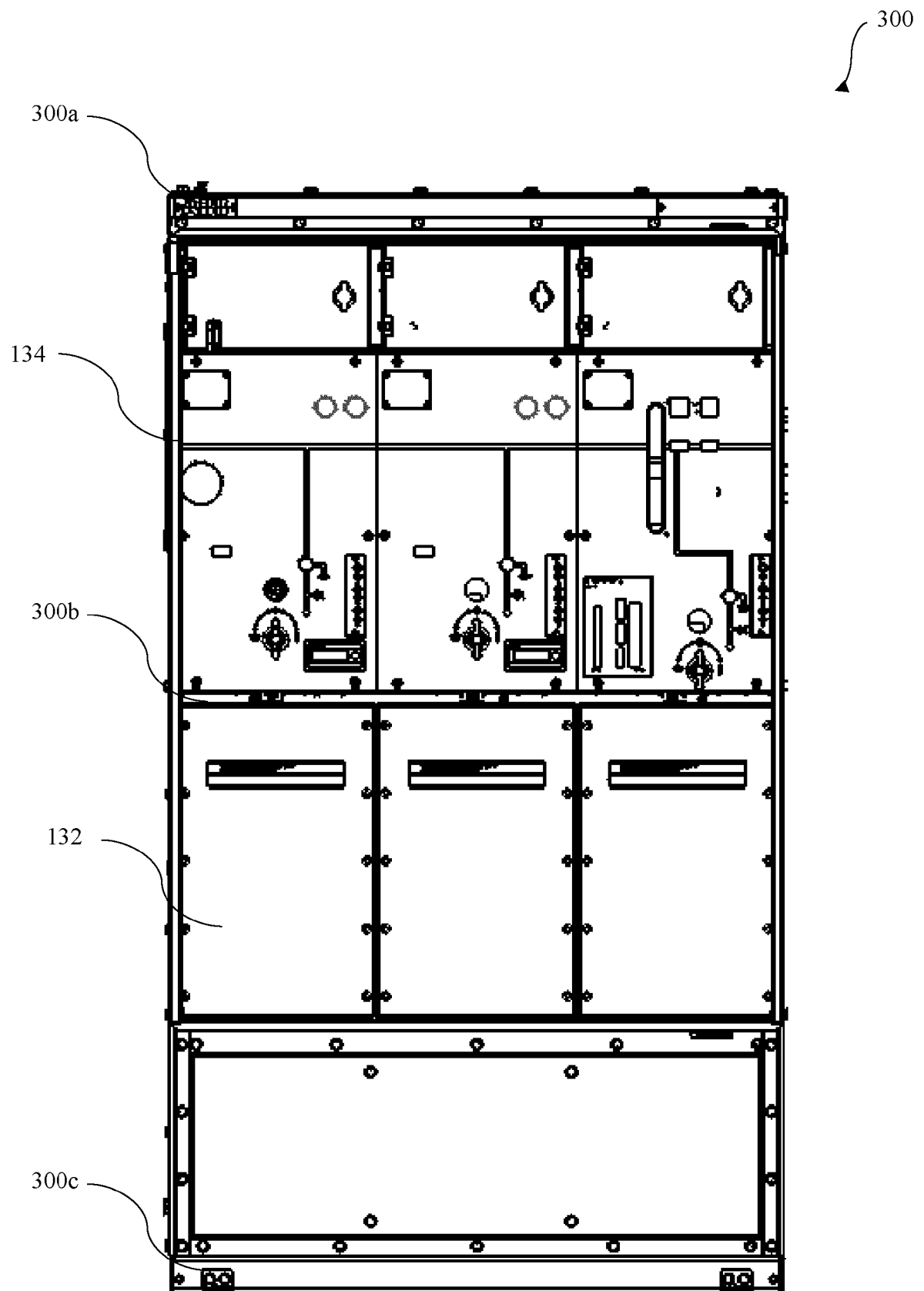


Figure 1

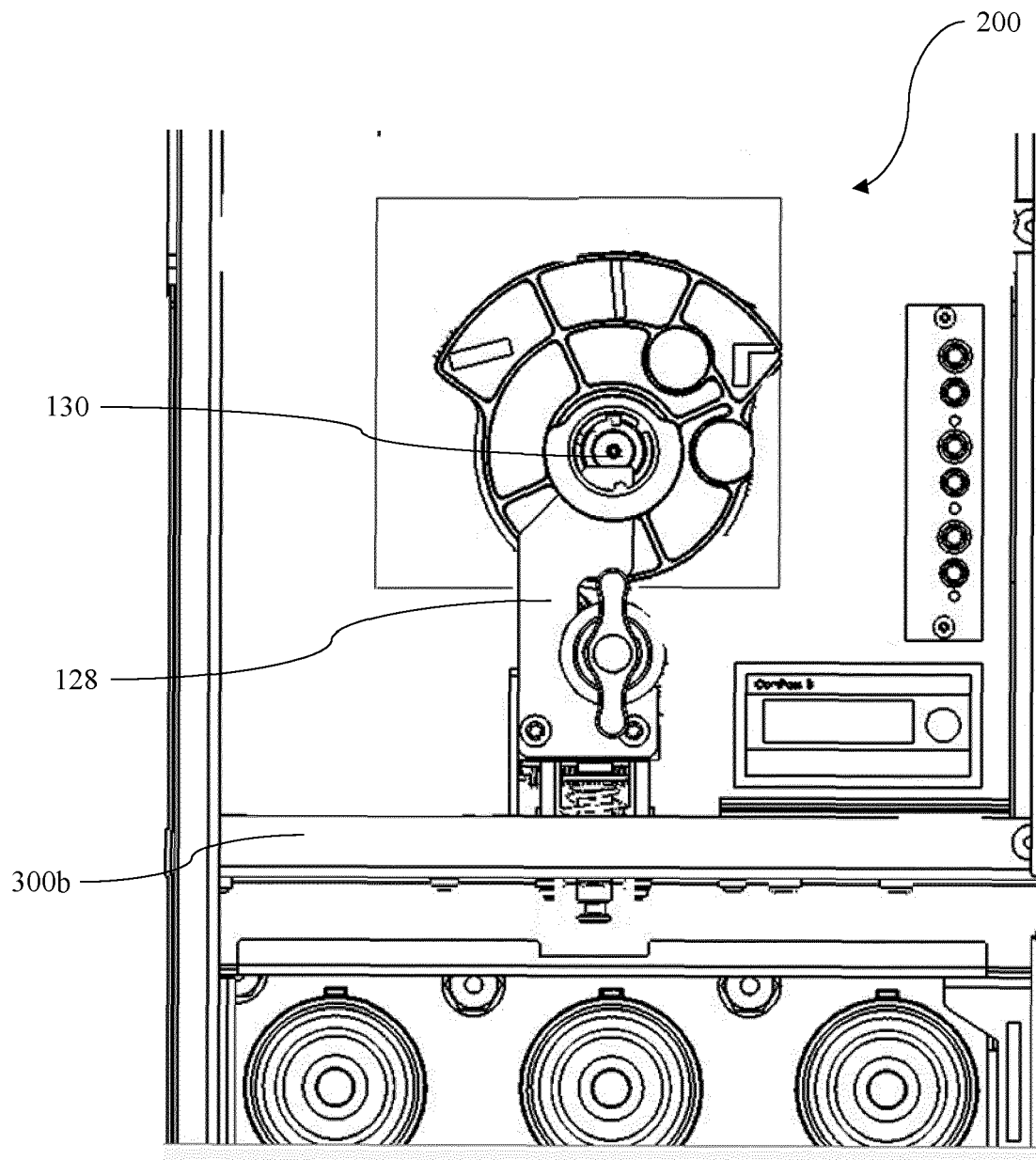


Figure 2

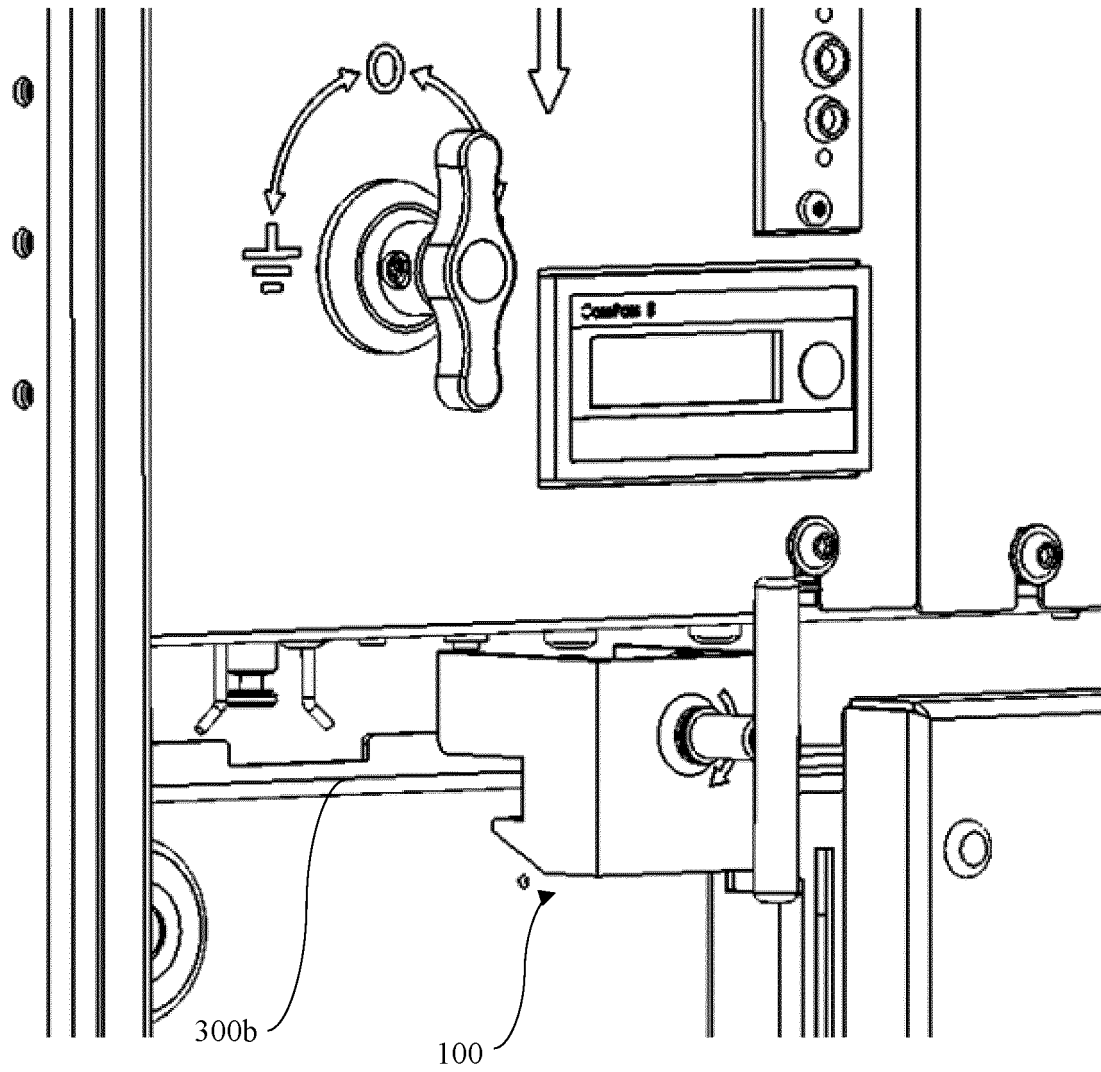


Figure 3

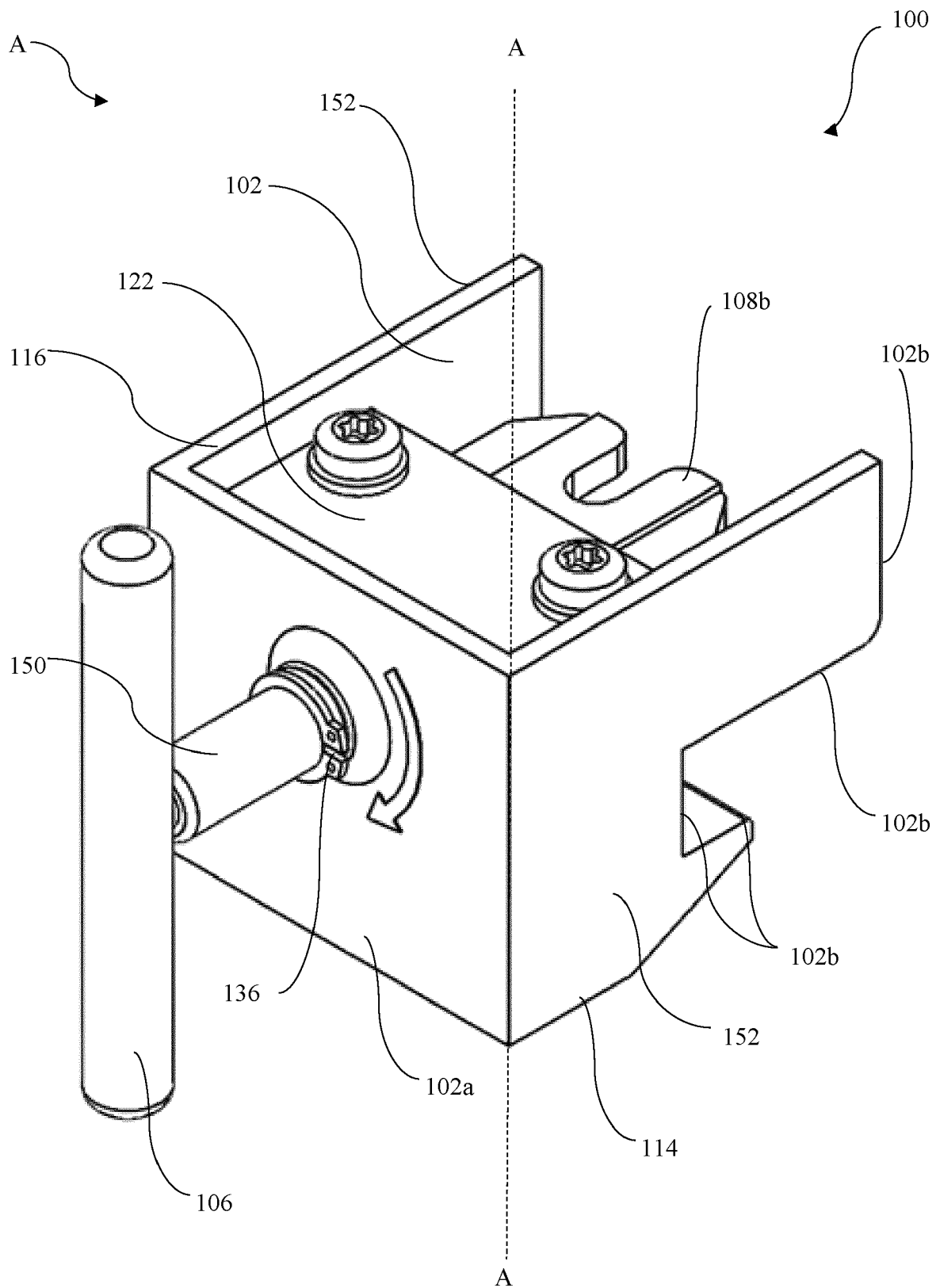


Figure 4

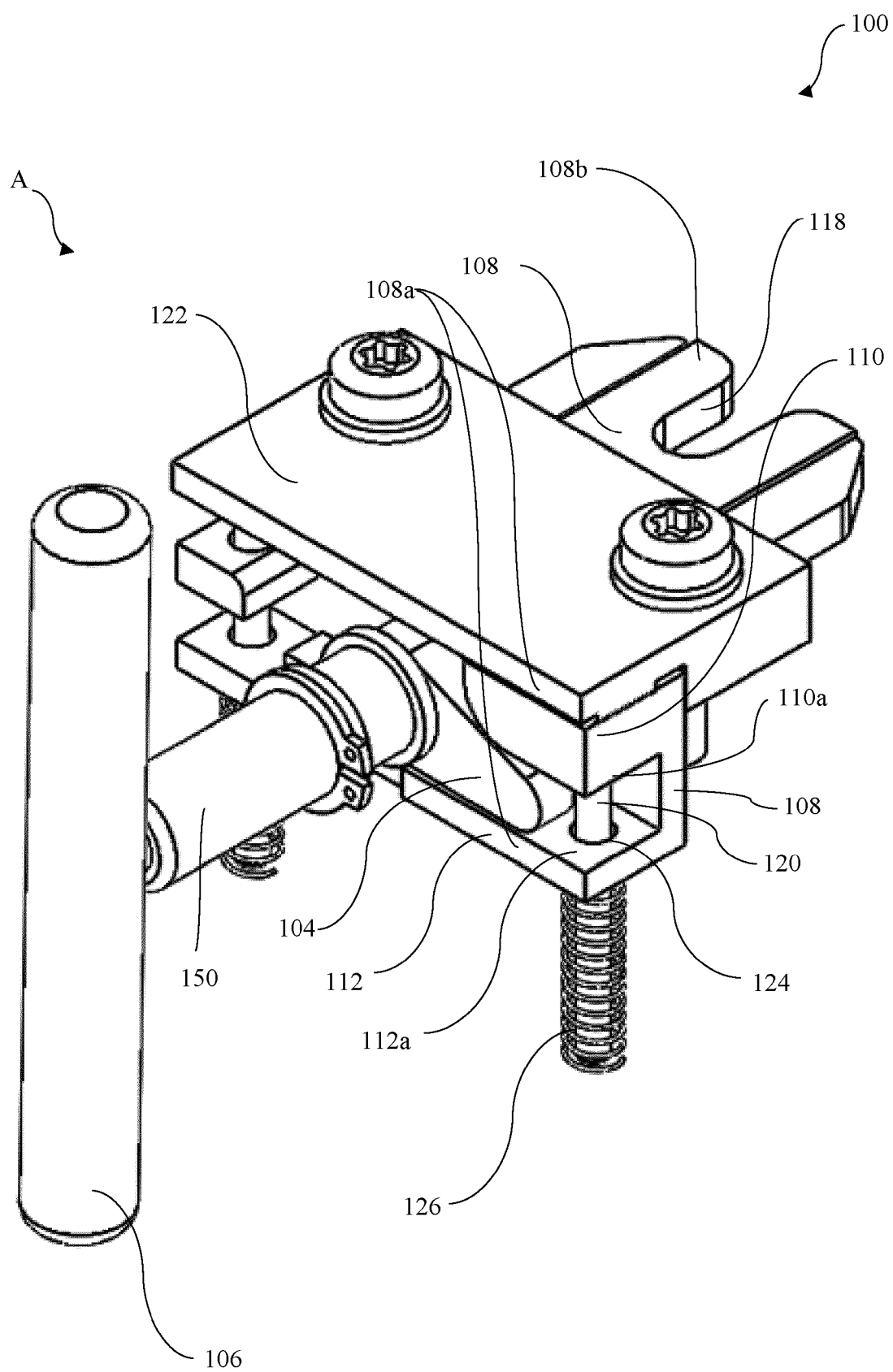


Figure 5

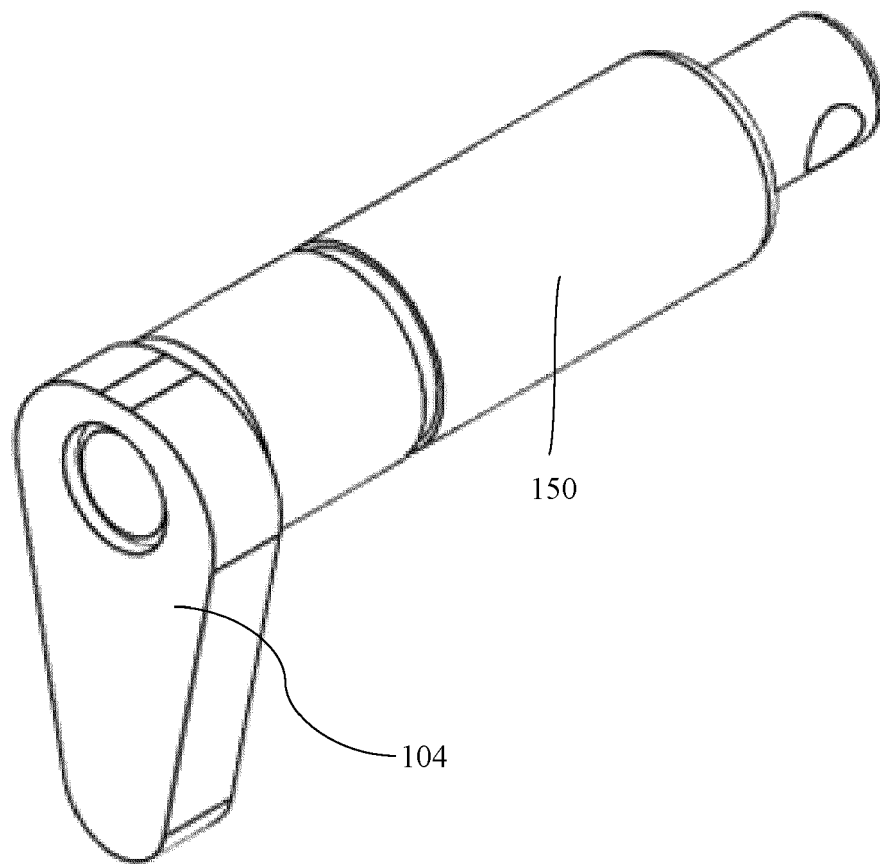


Figure 6

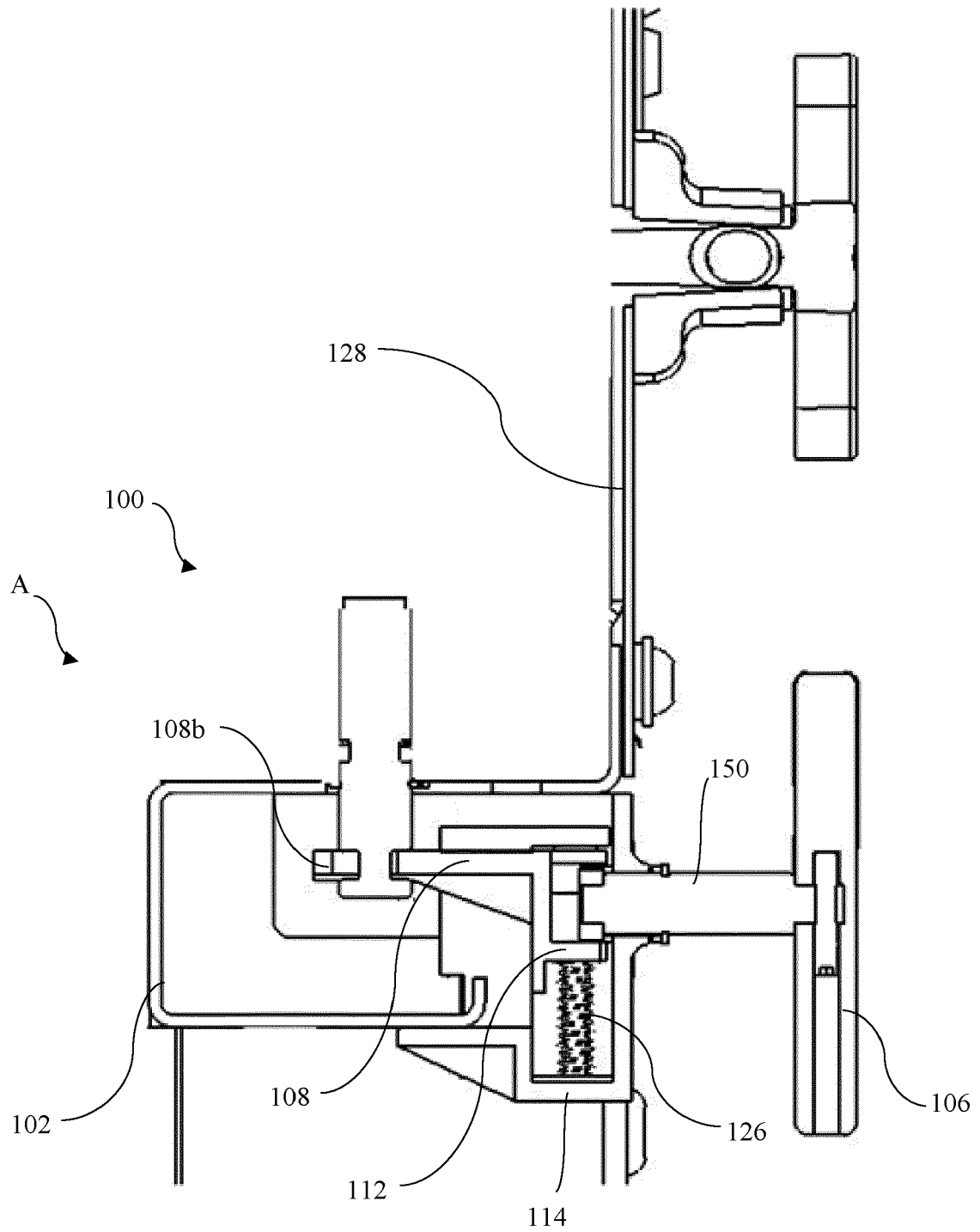


Figure 7

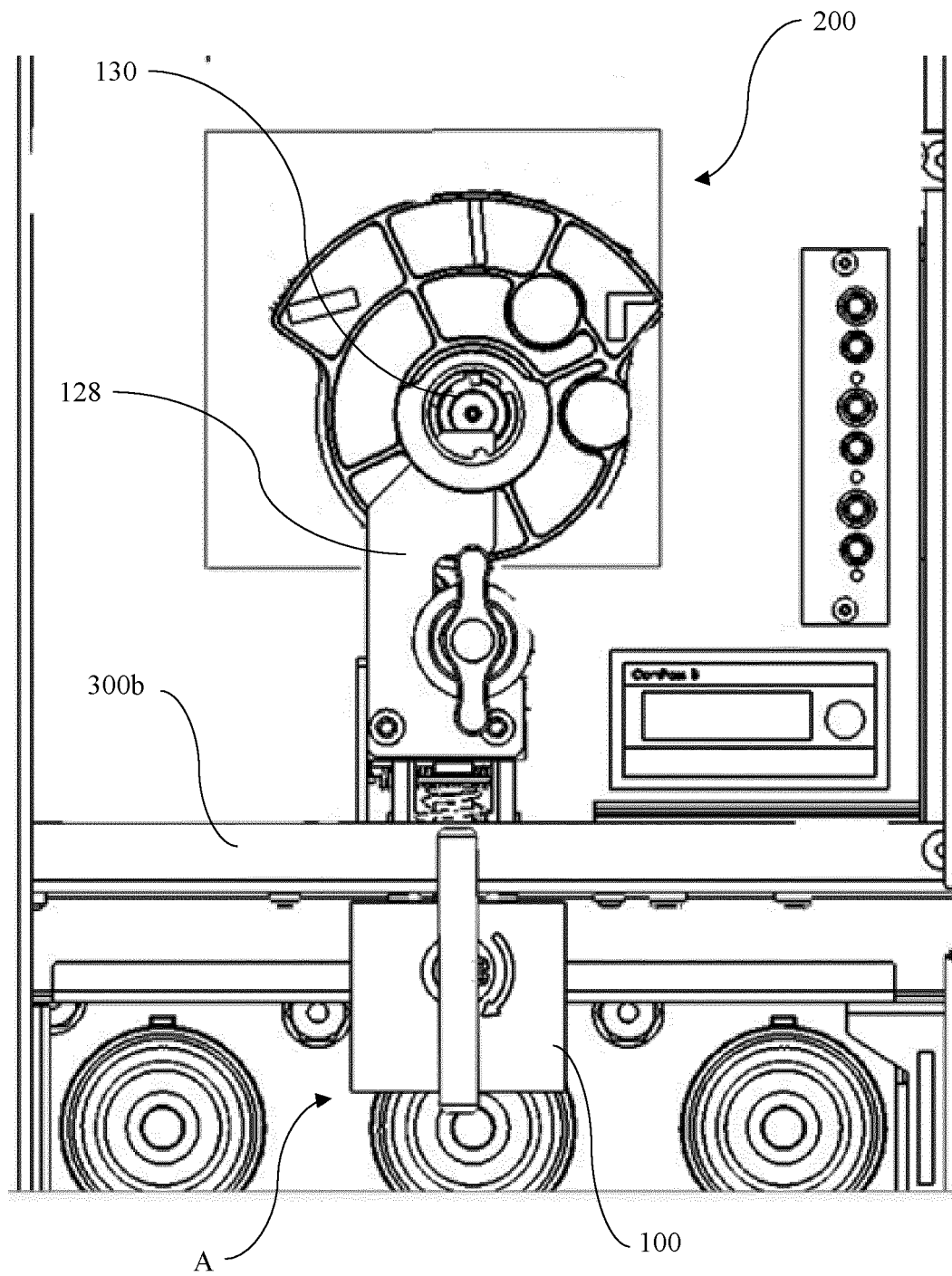


Figure 8

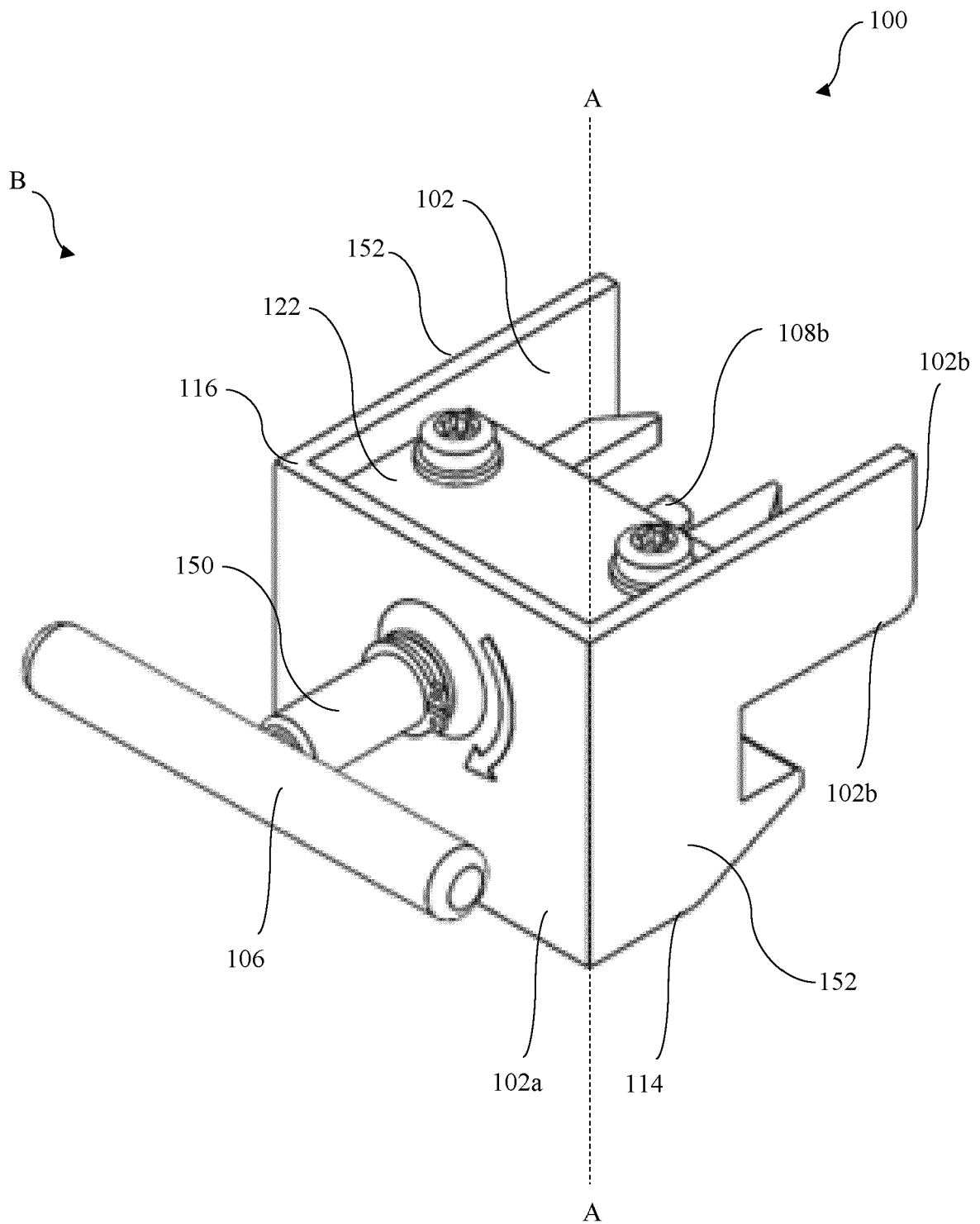


Figure 9

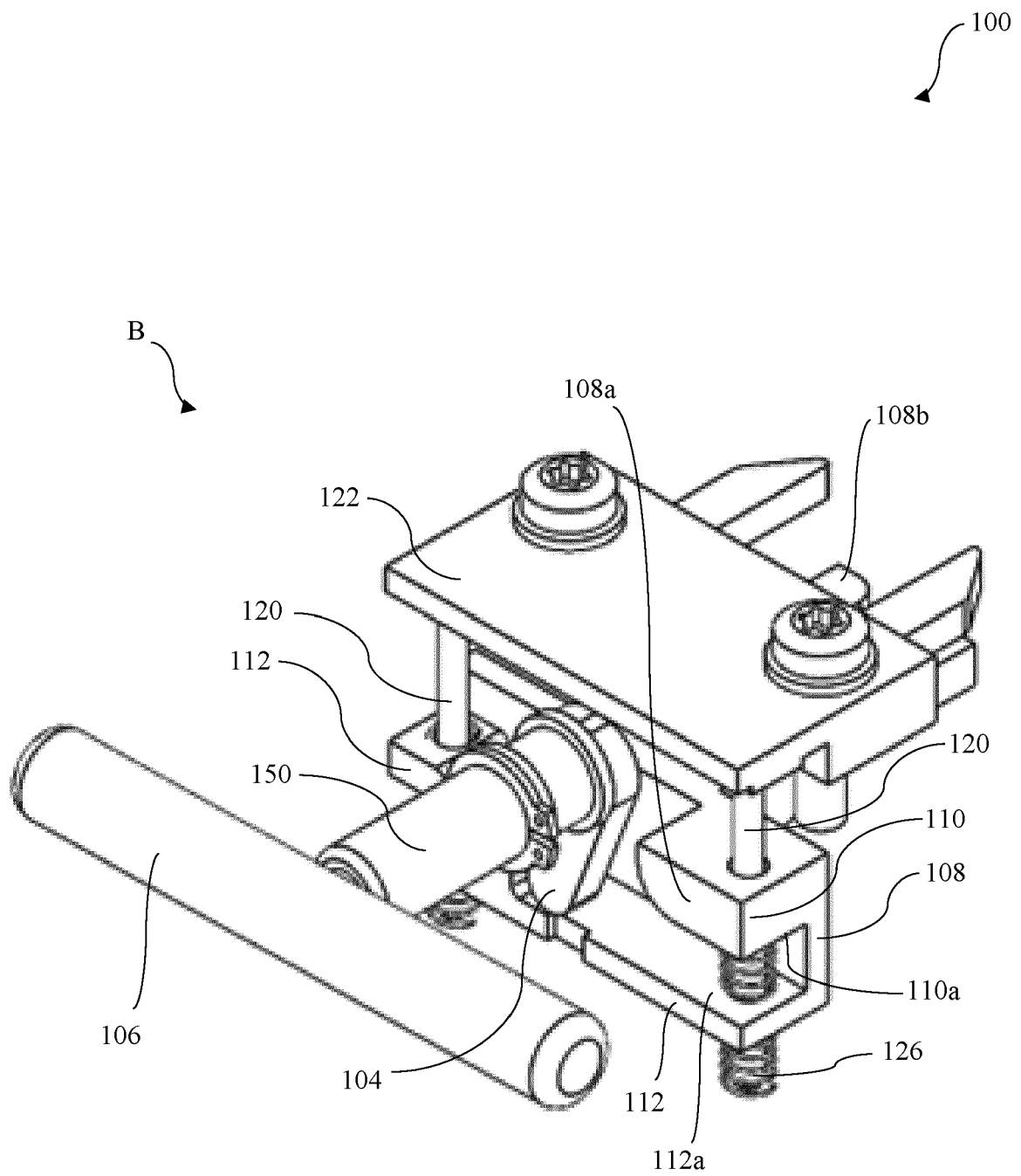


Figure 10

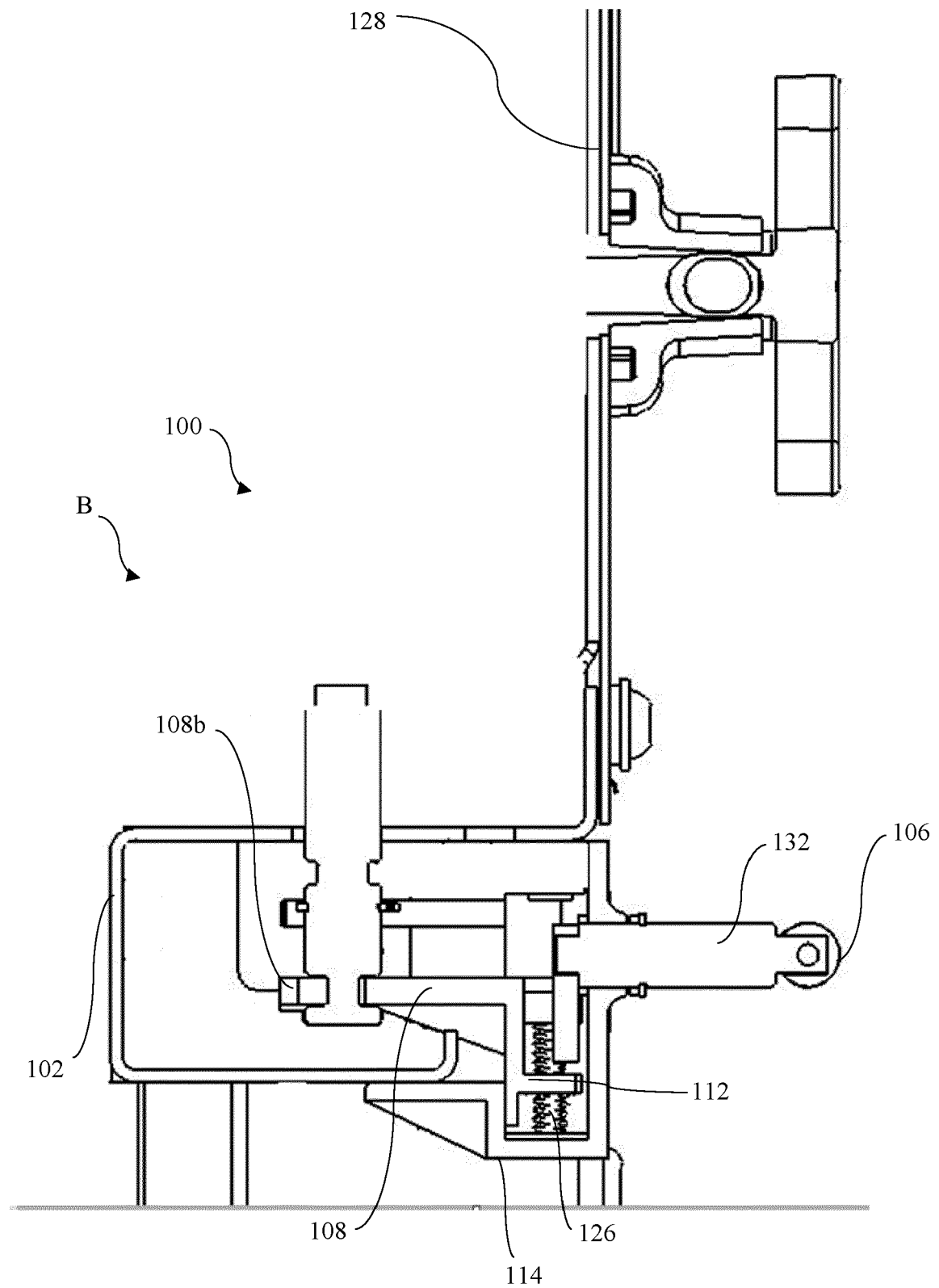


Figure 11

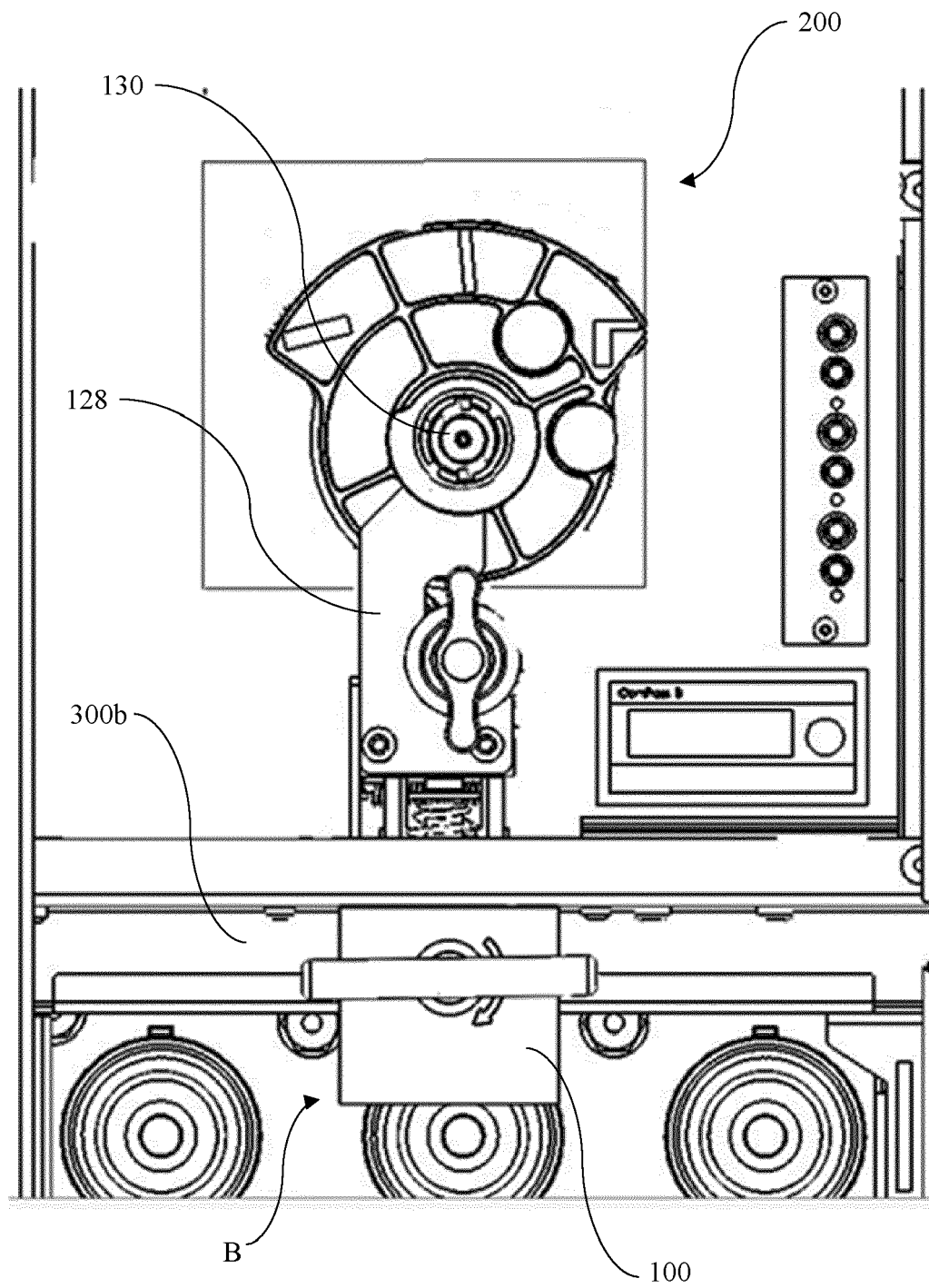


Figure 12



EUROPEAN SEARCH REPORT

Application Number

EP 24 17 1107

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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)
A	CN 112 582 201 A (ABB SCHWEIZ AG) 30 March 2021 (2021-03-30) * figures 2,3,6-10 * -----	1-13	INV. H01H9/22 H01H33/48
A	US 2020/176204 A1 (DELPOZZO ANDREA [IT] ET AL) 4 June 2020 (2020-06-04) * paragraph [0079]; claim 1; figures 1-9 * -----	1-13	ADD. H01H31/00
A	EP 2 270 823 B1 (ABB TECHNOLOGY AG [CH]) 8 February 2012 (2012-02-08) * paragraph [0010]; figures 1-15 * -----	1-13	
A	DE 196 17 575 A1 (ABB PATENT GMBH [DE]) 7 May 1997 (1997-05-07) * column 1, lines 39-54; figures 2,3 * -----	1	
			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 11 September 2024	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 24 17 1107

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
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 112582201 A	30-03-2021	CN 112582201 A	30-03-2021
		EP 4006936 A1	01-06-2022
		US 2022172908 A1	02-06-2022
US 2020176204 A1	04-06-2020	CN 110753986 A	04-02-2020
		EP 3444830 A1	20-02-2019
		US 2020176204 A1	04-06-2020
		WO 2019034349 A1	21-02-2019
EP 2270823 B1	08-02-2012	AT E545142 T1	15-02-2012
		BR PI1010200 A2	20-02-2018
		CN 102473537 A	23-05-2012
		EP 2270823 A1	05-01-2011
		ES 2381242 T3	24-05-2012
		US 2012119856 A1	17-05-2012
		WO 2011000744 A1	06-01-2011
DE 19617575 A1	07-05-1997	NONE	