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(54) LOW-VOLTAGE POWER DISTRIBUTION DEVICE AND METHOD FOR CONTROLLING LOW-VOLTAGE POWER DISTRIBUTION DEVICE TRIPPING

(57) The present disclosure relates to a method for a low-voltage power distribution device and a method for controlling a low-voltage power distribution device tripping. The low-voltage power distribution device comprising a detection unit configured to send a closed state signal to the control unit when the low-voltage power distribution device is in a closed state; and a control unit, which is coupled to the detection unit and configured to enable the low-voltage power distribution device to switch from the closed state to the open state for tripping upon receiving the closed state signal and satisfying the tripping condition. A method for controlling a low-voltage power distribution device tripping, wherein the method comprising: detecting whether the low-voltage power distribution device is in a closed state; detecting whether a tripping condition associated with the low-voltage power distribution device are satisfied; in response to the low-voltage power distribution device being in the closed state and the tripping condition being satisfied, causing the low-voltage power distribution device to perform a tripping action in order to enable the low-voltage power distribution device to switch from a closed state to an open state.

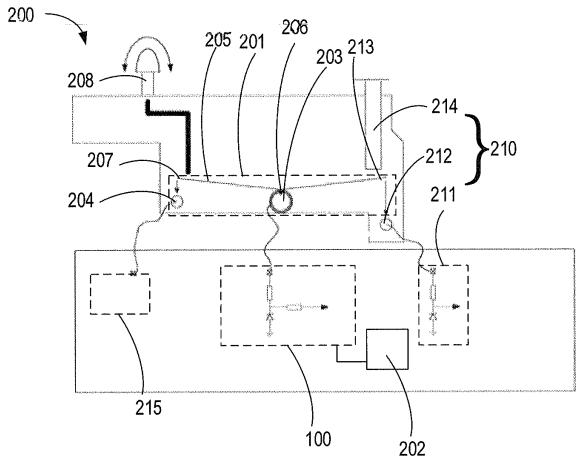

FIG. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This disclosure claims the priority of the Chinese patent application with application No. 201711086939.4, filed on November 7, 2017.

FIELD

[0002] The present disclosure relates to power distribution devices, and more specially, to low-voltage power distribution devices.

BACKGROUND

[0003] At present, various low-voltage power distribution devicees (also known as low-voltage power distribution accessory products), such as leakage protectors, arc fault protectors and overvoltage/undervoltage protectors etc., are connected between the main power supply and the load circuit to protect the main power supply or the load circuit from leakage, arc and overvoltage/undervoltage and further guarantee safe use of the main power supply or the load circuit. Some low-voltage power distribution devicees can provide one or more of the above functions. Conventional low-voltage power distribution device has a closed state and an open state. In the closed state, the low-voltage power distribution device connects the main power supply to the load circuit; in the open state, the low-voltage power distribution device disconnects the main power supply from the load circuit. The low-voltage power distribution device generally is provided with a control circuit board which can control a tripping mechanism to trip in case of faults like leakage, arc and overvoltage/undervoltage, such that the low-voltage power distribution device is switched from the open state to the closed state, thereby preventing the above faults from damaging the power supply or the load.

[0004] The low-voltage power distribution device usually adopts a connection approach of an upper incoming line, i.e., an incoming line connecting the main power supply is connected from an upper interface of the low-voltage power distribution device while a lower interface of the low-voltage power distribution device is connected to the load circuit. Accordingly, in case of the above fault in the circuit or the low-voltage power distribution device, the low-voltage power distribution device cutting off the power supply of the control circuit board while triggering the tripping. A variety of low-voltage power distribution devicees employing the connection approach of the lower incoming line are also developed to satisfy various needs of the uses, for example, the users are forced to connect the main power supply to the load circuit via the lower incoming line due to different reasons. The lower incoming line, just as the name implies, means that the main power supply is connected to the lower interface of the low-voltage power distribution device, and the load circuit is connected to the upper interface. However, because the interior circuits of the low-voltage power distribution device are not adjusted correspondingly, different problems occur when the low-voltage power distribution device adopts the connection approach of the lower incoming line.

SUMMARY

[0005] An aspect of the present disclosure discloses a method for controlling tripping of a low-voltage power distribution device the method comprises detecting whether the low-voltage power distribution device is in a closed state; detecting whether a tripping condition associated with the low-voltage power distribution device are met; in response to the low-voltage power distribution device being in the closed state and the tripping condition being met, causing the low-voltage power distribution device to perform a tripping action in order to enable the low-voltage power distribution device to switch from a closed state to an open state.

[0006] In some embodiments, the tripping condition comprises at least one of overvoltage, undervoltage, short circuit, leakage, and arc fault.

[0007] In some embodiments, the method further comprises in response to the tripping condition being met, providing an alert signal to users.

[0008] In a second aspect of the present disclosure, there is provided a low-voltage power distribution device. The low-voltage power distribution device comprises a detection unit configured to send a closed state signal to a control unit when the low-voltage power distribution device is in a closed state; and a control unit coupled to the detection unit and configured to enable the low-voltage power distribution device to switch from the closed state to an open state for tripping upon receiving the closed state signal and meeting a tripping condition.

[0009] In some embodiments, the low-voltage power distribution device further comprises a power supply configured to supply power to at least the detection unit; a connection assembly, coupled to the detection unit and operable to connect the detection unit to the power supply in the closed state.

[0010] In some embodiments, the connection assembly comprises a first conductive contact coupled to the detection unit, a second conductive contact coupled to the power supply, and a conductive member comprising a first contact portion and a second contact portion, the first contact portion coupled to the first conductive contact, the second contact portion adapted to contact the second conductive contact in the closed state to communicate the detection unit with the power supply.

[0011] In some embodiments, the low-voltage power distribution device further comprises a handle capable of switching between a closed position and an open position in response to an user's operation, thereby switching the low-voltage power distribution device between the closed state and the open state; and a driving member

pivotally provided in the low-voltage power distribution device, and operable to rotate from a first position to a second position in response to the handle switching from the open position to the closed position, so that the second contact portion contacts the second conductive contact.

[0012] In some embodiments, the conductive member further comprises a third contact portion, and the low-voltage power distribution device further comprises a test assembly, the test assembly comprising: a test unit used to test a validity of low-voltage power distribution device; a test contact coupled to the test unit; and a test button adapted to drive the third contact portion to contact the test contact in response to a press of a user, thereby communicating the test unit with the power supply in a case of the second contact portion contacting the second conductive contact.

[0013] In some embodiments, the first conductive contact, the second conductive contact and the test contact are conductive pins provided respectively at different positions in the low-voltage power distribution device.

[0014] In some embodiments, the conductive member is a torsion spring, and the first contact portion is a spiral portion of the torsion spring, the second contact portion is a first free end extending from the spiral portion of the torsion spring, and the third contact portion is a second free end extending from the spiral portion of the torsion spring.

[0015] Further features of the present disclosure will become apparent from the following description of example embodiments with reference to the drawings.

[0016] It should be understood that the content described in the Summary is neither intended to limit key or important features of the embodiments of the present disclosure nor to limit the scope of the present disclosure. Other features of the present disclosure will become readily understood from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Through the following detailed description with reference to the drawings, the above and other objectives, features, and advantages of example embodiments of the present disclosure will become more apparent. In the drawings, various embodiments of the present disclosure will be described in an example and non-limiting manner, in which:

FIG. 1 shows a simplified structural diagram of a detection unit and a test assembly of a low-voltage switchgear according to an example embodiment of the present disclosure;

FIG. 2 shows a side view of a low-voltage switchgear in a closed state according to an example embodiment of the present disclosure;

FIG. 3 shows a side view of a low-voltage switchgear in an open state according to an example embodiment of the present disclosure;

FIG. 4 shows an exploded perspective view of a part of a low-voltage switchgear according to an example embodiment of the present disclosure;

FIG. 5 shows an exploded perspective view of a part of a low-voltage switchgear according to an example embodiment of the present disclosure; and

FIG. 6 shows a flow block diagram of a method of controlling tripping of a low-voltage power distribution device according to an example embodiment of the present disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

[0018] The principles of the present disclosure will now be described with reference to various example embodiments shown in the drawings. It should be understood that the description of these embodiments is merely to enable those skilled in the art to better understand and further implement the present disclosure, and is not intended to limit the scope of the present disclosure in any way. It should be noted that similar or same reference numerals can be used in the figures when possible, and similar or same reference numerals can indicate similar or same functions. Those skilled in the art will readily recognize that from the following description, alternative embodiments of the structures and methods illustrated herein may be employed without departing from the principles of the present disclosure described herein.

[0019] As used herein, the term "include" and its various variations may be understood as open-ended terms, which means "including but not limited to. The term "based on" may be understood as "based at least in part on." The term "one embodiment" may be understood as "at least one embodiment". The term "another embodiment" may be understood as "at least one other embodiment".

[0020] A low-voltage power distribution device is generally provided with a control circuit board, on which a detecting module is provided for detecting faults, such as leakage, arc and undervoltage/overvoltage etc., and sending detection results in the form of electrical signals to a control unit. The control unit will determine, according to the signals, presence of a tripping condition that causes the low-voltage distribution device to trip in the circuit, so as to send a tripping trigger signal that triggers a tripping mechanism to trip. The tripping mechanism performs a tripping action based on the tripping trigger signal. In certain low-voltage power distribution devicees, it is also possible that the detecting module is not disposed on the control circuit board and instead powered by an individual power supply.

[0021] Under certain situations of the low-voltage power distribution device, especially when its connection is

performed with a lower incoming line, the low-voltage power distribution device continues to use the control circuit board employed when using an upper incoming line, which causes many problems. For example, the lower incoming line refers to connecting a main power supply to a lower interface of the low-voltage power distribution device; in such case, although the control circuit board, upon detecting the above faults, can control the tripping mechanism to perform the tripping action to disconnect the main power supply from a load circuit, the control circuit board is still charged as the main power supply is connected from the lower interface after the tripping (i.e., in the open state of the low-voltage power distribution device).

[0022] The control circuit board can achieve various functions as long as it is charged. That is, the control units still can send, according to the tripping condition, the tripping trigger signals to the tripping mechanism which performs a tripping action based on the signals. In this event, however, the low-voltage power distribution device in the open state will not respond to the tripping action. In other words, the tripping mechanism will always perform useless operations in this case, which usually leads to burnout of the tripping mechanism and further damages the entire low-voltage power distribution device.

[0023] In view of the above problem, some low-voltage power distribution devicees with the lower incoming line disable the fault detecting mechanism after the tripping, to avoid the burnout of the tripping mechanism. In such case, if the faults in the circuit still exist, users also can perform a closing operation. As the fault detecting mechanism is disabled at this moment, the control unit will not receive fault signals from the fault detecting mechanism and accordingly will not send a tripping trigger signal. The tripping mechanism therefore will not perform actions. That is, in case of circuit faults, the circuit is still connected and the low-voltage power distribution device warns the users of the faults just by a flickering alarm light. Although the damage to the tripping mechanism and even to the low-voltage power distribution device is avoided in the above scenario, it may bring more serious problems. For example, users may fail to notice the flickering alarm light and continue to perform other work, which may damage the load in the circuit and further threaten users' safety.

[0024] Embodiments of the present disclosure provide an improved low-voltage power distribution device 200 and a method of controlling tripping of the low-voltage power distribution device 200 to solve or at least partially solve the above-mentioned and other potential problems of the conventional solutions.

[0025] The improvement of the low-voltage power distribution device 200 and the method of controlling tripping of the low-voltage power distribution device 200 according to an example embodiment of the present disclosure will be described in detail below with reference to FIGs. 1 to 6. FIG. 1 shows a simplified structural diagram of a detection unit and a test assembly of a low-voltage switchgear according to an example embodiment of the present disclosure. The improved low-voltage power distribution device 200 will be described below in conjunction with FIG. 1.

[0026] In general, the low-voltage power distribution device 200 of the present disclosure comprises a detection unit 100, and a control unit 202. The detection unit 100 is provided in the low-voltage power distribution device 200 and is used to provide a closed state signal when the low-voltage power distribution device 200 is in the closed state. The closed state signal may be an electrical signal, or may be other type of digital or analog signal. The control unit 202 is coupled to the detection unit 100. It is to be understood that the control unit 202 may be directly coupled to the detection unit 100, or may be coupled to the detection unit 100 through a filter circuit or a modulation circuit. In other words, the closed state signal of the detection unit 100 may be directly sent to the control unit 202, or may be sent to the control unit 202 after filtering or modulation.

[0027] After receiving the closed state signal, if the tripping condition still exists in the circuit, the control unit 202 will control the low-voltage power distribution device 200 to trip. It is to be understood that the low-voltage power distribution device according to the present disclosure will trigger the tripping signal only if the control unit 202 receives the closed state signal and the tripping condition is met. That is to say, in the open state, even if the tripping condition still exists, the control unit 202 will not trigger any signal because the closed state signal is not detected or received, so the tripping mechanism will not perform any action. Therefore, a closed-loop control can be achieved in the low-voltage distribution device 200 by setting the detection unit 100 to indicate the closed state. The control unit 202 can perform a clearer judgment on the state of the low-voltage distribution device 200, thereby avoiding the electric device 200 and the load circuit from damage.

[0028] In some embodiments, the above functions may be implemented in the following manner. The low-voltage power distribution device 200 may further comprise a power supply 215 to supply power to at least the detection unit 100. The detection unit 100 only provides a closed state signal when it is powered, that is, connected to the power supply 215. In some embodiments, the power supply 215 may be a step-down module provided in the low-voltage power distribution device 200. The step-down module lowers the voltage of the main power supply to provide power to the detection unit 100. In some embodiments, the power supply 215 may also be a battery or the like.

[0029] The low-voltage power distribution device 200 may further comprise a connection assembly 201 coupled to the detection unit 100. The connection assembly 201 can be operated to connect the detection unit 100 to the power supply 215 when the low-voltage power distribution device is in a closed state, so that the detection

unit 100 is powered to provide a closed state signal.

[0030] Since the connection assembly 201 connects the power supply 215 with the detection unit 100 only in the closed state, the detection unit 100 sends a closed state signal to the control unit 202. After the low-voltage power distribution device 200 is tripped, the detection unit 100 and the power supply 215 are disconnected. Therefore, at this time, the detection unit 100 cannot provide the closed state signal because it is not powered. This realizes the detection of the closed state through a simple detection unit 100 and the connection assembly 201. The conventional low-voltage power distribution device basically does not need to be changed to achieve the above-mentioned detection function, thereby saving costs while increasing reliability of the low-voltage power distribution devices.

[0031] In some embodiments, as shown in FIG. 1, the detection unit 100 may be a circuit. The circuit can send out an electrical signal at the output when connected to the power supply 215, and the control unit 202 confirms that the low-voltage power distribution device 200 is in the closed state upon receiving the electrical signal. It is to be understood that the detection unit 100 may also take any other form which can provide a closed state signal when connected to the power supply 215.

[0032] In some embodiments, the low-voltage power distribution device may further comprise a tripping mechanism (not shown). The control unit 202 performs the tripping action by providing a trip trigger signal to the tripping mechanism. In some embodiments, the detection unit 100, the power supply 215, the connection assembly 201, the control unit 202, and the tripping mechanism may be provided on a control circuit board (not shown) in the low-voltage distribution device. The control circuit board may be an integrated circuit board or separate structures, and each module is respectively arranged in different separate structures to control each unit or module more accurately.

[0033] The details of the connection assembly 201 will be described below with reference to FIG. 1 and FIGs. 2 to 5. In some embodiments, as shown in FIG. 1, the connection assembly 201 comprises two conductive contacts (referred to as a first conductive contact 203 and a second conductive contact 204 for convenience of description) and a conductive member 205. The first conductive contact 203 is coupled to the detection unit 100, and the second conductive contact 204 is coupled to the power supply 215. A portion of the conductive member 205 (referred to as the first contact portion 206 for convenience of description) is coupled to the first conductive contact 203, while another portion (referred to as the first contact portion 207 for convenience of description) is operable to contact the second conductive contact 204 in a closed state, thereby connecting the detection unit 100 and the power supply 215.

[0034] The following will describe how to make the second contact portion 207 contact the second conductive contact 204 to achieve the conduction of the circuit in the closed state with reference to FIGs. 2 and 3. FIG. 2 shows a side view of the low-voltage switchgear in the closed state according to an example embodiment of the present disclosure; FIG. 3 shows a side view of the low-voltage switchgear in the open state according to an example embodiment of the present disclosure. As can be seen from the figure, in some embodiments, the low-voltage power distribution device 200 may have a handle 208 and a driving component 209. The handle 208 can be switched in two positions (referred to as a closed position and an open position for convenience of description) in response to a user's operation. When the handle 208 is in the closed position, the low-voltage power distribution device 200 is in the closed state, and when the handle 208 is in the open position, the low-voltage power distribution device 200 is in the open state.

[0035] The driving component 209 is pivotally provided in the low-voltage power distribution device 200. When the handle is switched from the open position as shown in FIG. 3 to the closed position as shown in FIG. 2, the driving component 209 can be driven to rotate from the first position P1 to the second position P2. During this process, the driving component 209 forces the second contact portion 207 to contact the second conductive contact 204, so that the second contact portion 207 contacts the second conductive contact 204 to connect the detection unit 100 to the power supply 215 in the closed state.

[0036] As described above, the low-voltage power distribution device 200 is switched from the closed state to the open state by a tripping action to disconnect the main power supply from the load circuit. It is to be understood that the low-voltage power distribution device 200 may also be switched from the closed state to the open state through the handle 208. Whether the low-voltage power distribution device 200 is switched from the closed state to the open state due to the tripping action or the operation of the handle 208, the position of the handle 208 will be switched from the closed position to the open position accordingly. The driving member 209 therefore also rotates from the second position P2 back to the first position P1. At this time, the second contact portion 207 is not pressed by the driving member 209, thereby to disconnect the contact with the second conductive contact 204 to disconnect the detection unit 100 from the power supply 215.

[0037] In some embodiments, as shown in FIGs. 1, 2 and 3, the conductive member 205 may further comprise a third contact portion 213, and the low-voltage power distribution device 200 further comprises a test assembly 210. The test assembly 210 can test the validity of the low-voltage power distribution device 200, for example. In some embodiments, the test assembly 210 comprises a test unit 211, a test contact 212 and a test button 214. In some embodiments, the test unit 211 may be a circuit connected to a corresponding module to be tested. The test unit 211 is coupled to the test contact 212, and in response to a press of a user, the test button 214 can

drive the third contact portion 213 to contact the test contact 212, thereby connecting the test unit 211 to the power supply 215 to supply power to the test unit 211 in a closed state, i.e., when the second contact portion 207 is in contact with the second conductive contact 204.

[0038] As shown in FIG. 1, the test unit 211 may be a circuit that performs a test function. It is to be understood that the test unit 211 may also take any other form as long as it can fulfill the test functions.

[0039] As shown in FIGs. 4 and 5, in some embodiments, the first conductive contact 203, the second conductive contact 204, and the test contact 212 are conductive pins provided in the low-voltage power distribution device, respectively. The three conductive contacts adopt the form of conductive pins so that the conductive contacts can act as a fulcrum or a pivot of the movement of certain components while enabling the conductive function. The three conductive pins, that is, the first conductive contact 203, the second conductive contact 204, and the test contact 212 may be made of metal materials.

[0040] It is to be understood that, in some embodiments, the first conductive contact 203, the second conductive contact 204, or the test contact 212 for example, may be any other forms of contact structures which are arranged individually in the low-voltage power distribution device 200 and can implement circuit conduction.

[0041] In some embodiments, as shown in FIG. 4, the conductive member 205 may be a torsion spring. The torsion spring generally has a spiral portion and at least two free ends extending from the spiral portion (referred to as a first free end and a second free end for convenience of description). In some embodiments, the spiral portion of the torsion spring serves as the first contact portion 206, the second contact portion 207 may be a first free end, and the third contact portion 213 may be a second free end. Considering the structural requirements in the low-voltage power distribution device 200, the first free end and the second free end may have appropriate lengths, and may be bent or deformed so that the torsion spring can adapt to the arrangement of first conductive contact 203, the second conductive contact 204 and the test contact 212 in the low-voltage power distribution device 200.

[0042] In some embodiments, the low-voltage power distribution device 200 also includes an alarming mechanism (not shown), which can send an alarm to users when the fault detecting mechanism detects the tripping condition in the circuit. For example, the alarming mechanism may send a light alarm, a sound alarm or a combination thereof according to the tripping condition to warn the users of the faults in need of immediate maintenance in the circuit.

[0043] The structural improvements of the low-voltage power distribution device are described in detail above in conjunction with FIGs. 1 to 5. In order to better solve some problems of the conventional low-voltage power distribution device, it is required to improve the control logic of the control unit 202, which is reflected in the method of controlling tripping of the low-voltage power distribution device 200.

[0044] Referring to FIG. 6, FIG. 6 shows a flow block diagram 600 of a method of controlling tripping of a low-voltage power distribution device according to an example embodiment of the present disclosure.

[0045] At block 601, it is detected whether the low-voltage power distribution device 200 is in a closed state. In some embodiments, the closed state may be detected by the detection unit 100 as described above, that is, block 601 may be performed by the detection unit 100. The detection unit 100 provides the closed state information to the control unit 202 in the closed state. Of course, it is to be understood that, in some embodiments, the block 601 may also be executed by any other component or unit capable of detecting the closed state.

[0046] At block 602, it is detected whether a tripping condition associated with a low-voltage power distribution device is met. In some embodiments, this block 602 may be performed by the fault detecting mechanism described above. The failure detecting mechanism provides a tripping condition signal to the control unit 202 when it detects that the tripping condition is met. In some embodiments, the content at block 602 may also be performed by the control unit 202.

[0047] It is to be noted that although block 601 is described before block 602, it does not mean that it can only be performed in the order described by the two blocks 601 and 602, and the method can be performed in other orders. For example, block 601 and block 602 can be performed simultaneously, or the content of block 602 is executed first, and then the content of block 601 is executed.

[0048] At block 604, in response to the low-voltage power distribution device 200 being in the closed state and the tripping condition being met, the low-voltage power distribution device is caused to perform a tripping action to switch the low-voltage power distribution device from the closed state to the open state. In some embodiments, the block 604 may be performed by the control unit 202 described above. In some embodiments, the block 604 may send a trip trigger signal to the tripping mechanism by the control unit 202 to cause the low-voltage power distribution device 200 to be tripped.

[0049] It can be seen that according to the method, low-voltage power distribution device 200 is tripped only if both the closed state and the tripping condition are satisfied. In this way, a closed-loop control can be achieved during the tripping control. For example, at block 605, when the low-voltage power distribution device 200 is in the open state, the tripping action will not be performed, so that null operation and burnout will not occur to the components such as the tripping mechanism, etc. related to the tripping action. At this time, at block 606, the control unit 202 is already in a standby state without triggering a signal such as a tripping signal.

[0050] In addition, if it is detected that the low-voltage power distribution device 200 is in the closed state when

the tripping condition is met, the low-voltage power distribution device will also be tripped and switched from the closed state to the open state. This ensures the safe use of the load circuit and the low-voltage power distribution device 200.

[0051] In some embodiments, the above method can be applied to a low-voltage power distribution device adopting the lower incoming line. Of course, it is to be understood that this method can also be applied to any other low-voltage power distribution device that needs to detect the closed state. In some embodiments, the above-mentioned tripping conditions may include, but are not limited to, at least one of overvoltage, undervoltage, short circuit, leakage, and arc fault of the circuit.

[0052] In some embodiments, for example at block 603, an alert signal is provided to the user in response to the tripping condition being met. The user will repair the circuit or low-voltage power distribution device according to the alarm signal, thereby eliminating the fault that triggers the tripping condition. This further ensures the safe use of the low-voltage power distribution device 200.

[0053] Although some specific embodiments of the present disclosure have been shown in detail through examples, those skilled in the art should understand that the above examples are intended to be example only and not to limit the scope of the present disclosure. Those skilled in the art should understand that the above-described embodiments may be modified without departing from the scope and essence of the present disclosure. The scope of the present disclosure is defined by the appended claims.

[0054] In the description and the following claims, the terms "comprising" and "including" are understood to include the stated ingredient or group of ingredients, but do not exclude any other ingredient or group of ingredients, unless the context requires otherwise.

[0055] References to any prior art in this description are not and should not be taken as an admission that the prior art constitutes common general knowledge.

[0056] It should be understood that the following claims are only temporary claims and are examples of possible claims, and are not intended to limit the scope of the claims to any future patent applications based on this application. Components may be added or deleted in the example claims in the future to further define or redefine the present disclosure.

Claims

1. A method (600) for controlling tripping of a low-voltage power distribution device (200), comprising:

   detecting (601) whether the low-voltage power distribution device (200) is in a closed state;
   detecting (602) whether a tripping condition associated with the low-voltage power distribution device (200) is met;
   in response to the low-voltage power distribution device (200) being in the closed state and the tripping condition being met, causing the low-voltage power distribution device (200) to perform (604) a tripping action in order to enable the low-voltage power distribution device (200) to switch from the closed state to an open state.

2. The method of claim 1, wherein the tripping condition comprises at least one of overvoltage, undervoltage, short circuit, leakage, and arc fault.

3. The method of claim 1, further comprising:
   in response to the tripping condition being met, providing (603) an alert signal to users.

4. A low-voltage power distribution device (200), comprising:

   a detection unit (100) configured to send a closed state signal to a control unit (202) when the low-voltage power distribution device (200) is in a closed state; and
   the control unit (202) coupled to the detection unit (100) and configured to enable the low-voltage power distribution device (200) to switch from the closed state to an open state for tripping upon receiving the closed state signal and meeting a tripping condition.

5. The low-voltage power distribution device (200) of claim 4, further comprising:

   a power supply (215) configured to supply power to at least the detection unit (100);
   a connection assembly (201) coupled to the detection unit (100) and operable to connect the detection unit (100) to the power supply (215) in the closed state.

6. The low-voltage power distribution device (200) of claim 5, wherein the connection assembly (201) comprises:

   a first conductive contact (203) coupled to the detection unit (100),
   a second conductive contact (204) coupled to the power supply (215), and
   a conductive member (205) comprising a first contact portion (206) and a second contact portion (207), the first contact portion (206) coupled to the first conductive contact (203), the second contact portion (207) adapted to contact the second conductive contact (204) in the closed state to connect the detection unit (100)to the power supply (215).

7. The low-voltage power distribution device (200) of claim 5, further comprising:

a handle (208) capable of switching between a closed position and an open position in response to a user's operation, thereby switching the low-voltage power distribution device (200) between the closed state and the open state; and
a driving member (209) pivotally provided in the low-voltage power distribution device (200), and operable to rotate from a first position (PI) to a second position (P2) in response to the handle (208) switching from the open position to the closed position, so that the second contact portion (207) contacts the second conductive contact (204).

8. The low-voltage power distribution device (200) of claim 5, wherein the conductive member (205) further comprises a third contact portion (213), and the low-voltage power distribution device (200) further comprises a test assembly (210), and wherein the test assembly (210) comprises:

a test unit (211) adapted to test a validity of low-voltage power distribution device (200);
a test contact (212) coupled to the test unit (211); and
a test button (214) adapted to drive the third contact portion (213) to contact the test contact (212) in response to a press of a user, thereby communicating the test unit (211) with the power supply (215) in a case of the second contact portion (207) contacting the second conductive contact (204).

9. The low-voltage power distribution device (200) of claim 8, wherein the first conductive contact (203), the second conductive contact (204) and the test contact (212) are conductive pins provided respectively at different positions in the low-voltage power distribution device (200).

10. The low-voltage power distribution device (200) of claim 9, wherein the conductive member (205) is a torsion spring, and the first contact portion (206) is a spiral portion of the torsion spring, the second contact portion (207) is a first free end extending from the spiral portion of the torsion spring, and the third contact portion (213) is a second free end extending from the spiral portion of the torsion spring.

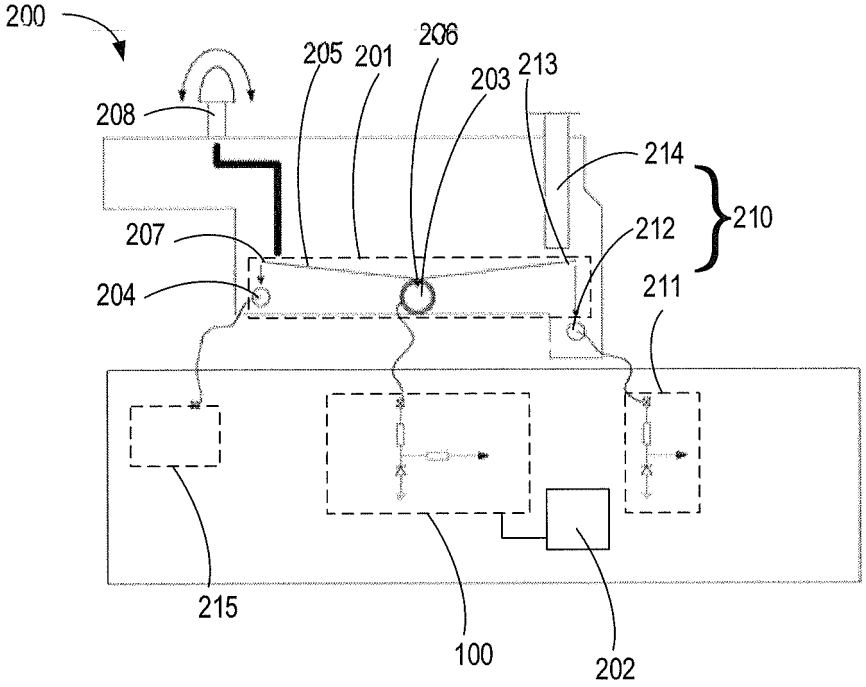

FIG. 1

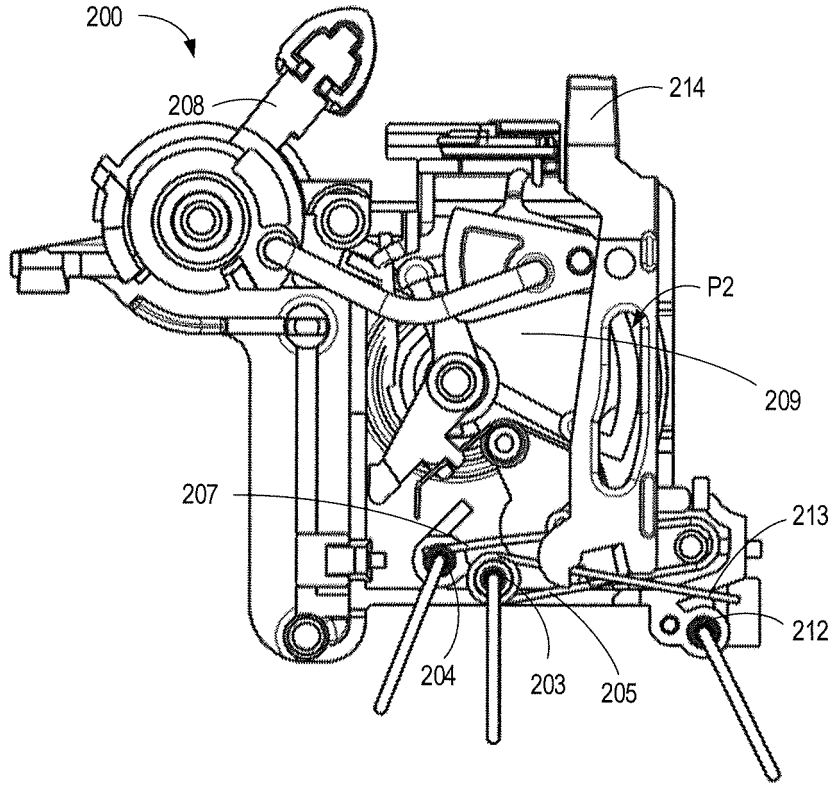

FIG. 2

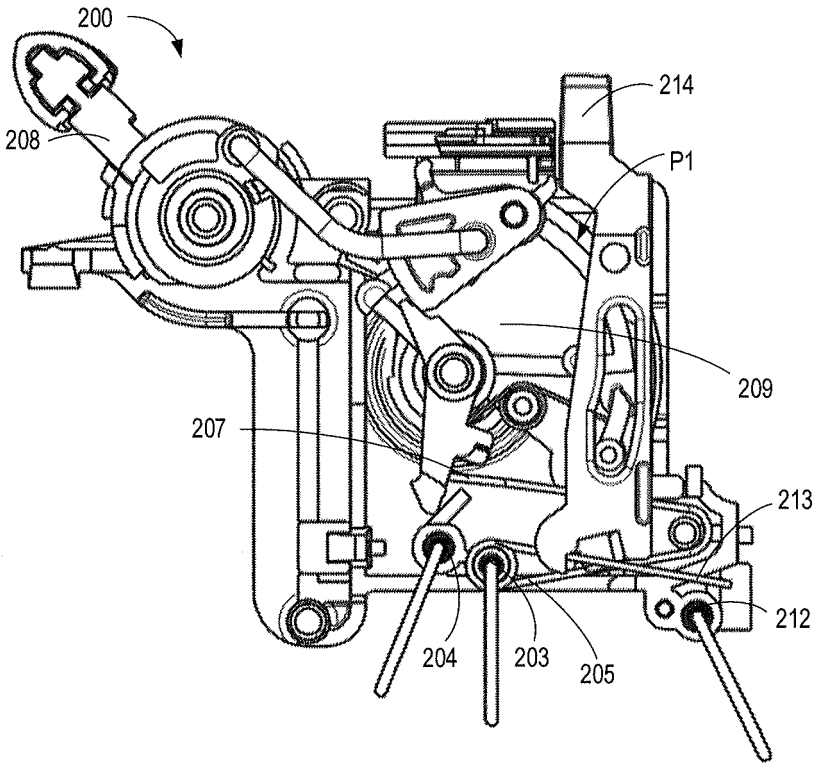

FIG. 3

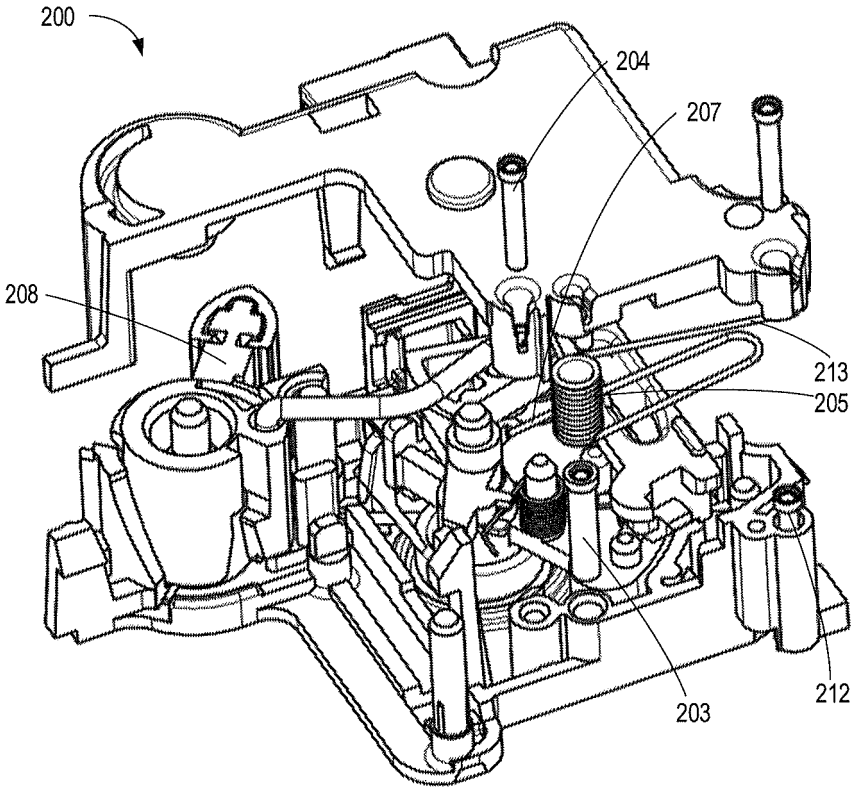

FIG. 4

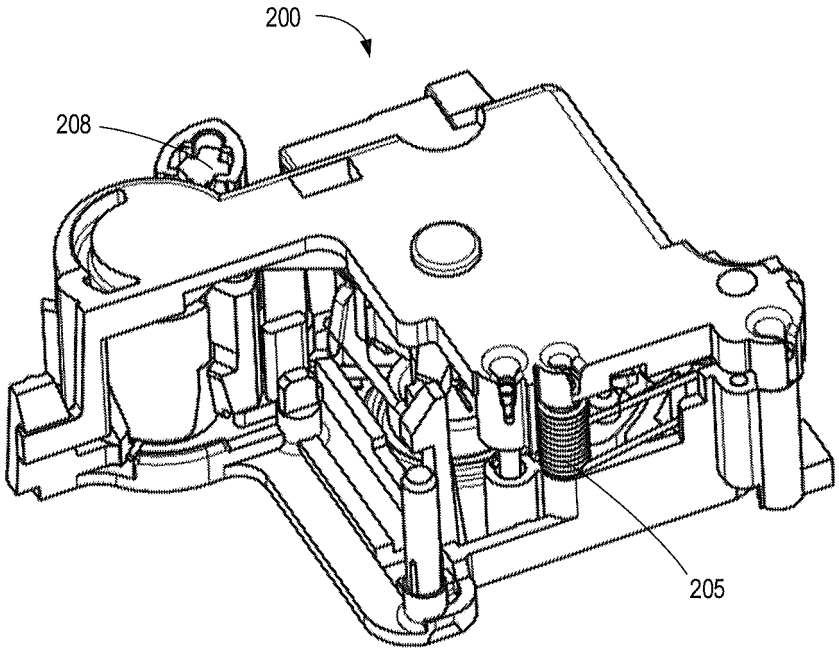

FIG. 5

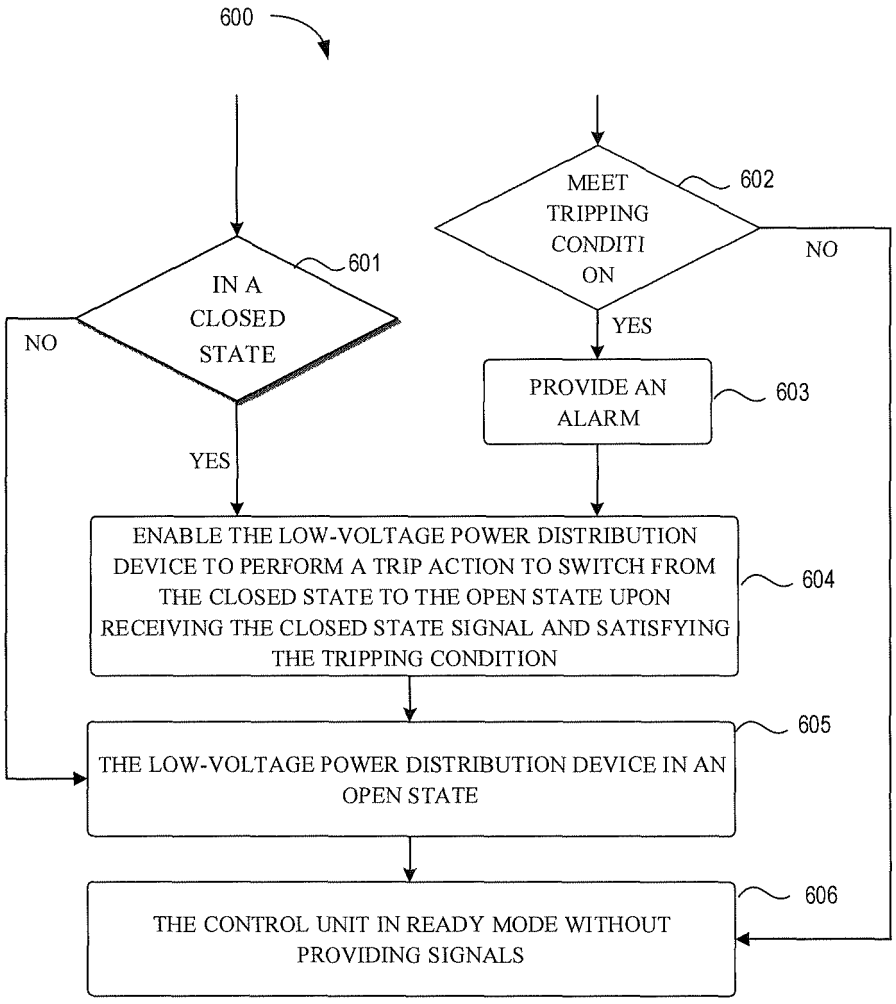
600
601
IN A CLOSED STATE
NO
YES
602
MEET TRIPPING CONDITION
NO
YES
603
PROVIDE AN ALARM
604
ENABLE THE LOW-VOLTAGE POWER DISTRIBUTION DEVICE TO PERFORM A TRIP ACTION TO SWITCH FROM THE CLOSED STATE TO THE OPEN STATE UPON RECEIVING THE CLOSED STATE SIGNAL AND SATISFYING THE TRIPPING CONDITION
605
THE LOW-VOLTAGE POWER DISTRIBUTION DEVICE IN AN OPEN STATE
606
THE CONTROL UNIT IN READY MODE WITHOUT PROVIDING SIGNALS

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/114395

A. CLASSIFICATION OF SUBJECT MATTER

H01H 71/04(2006.01)i; H01H 71/08(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

VEN, CNABS, CNKI: 脱扣, 合闸, 检测, 控制, 保护器, tripping, switch on, detect, control, protector

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 207367899 U (SCHNEIDER ELECTRIC INDUSTRIES SAS) 15 May 2018 (2018-05-15) description, paragraphs 20-50, and figures 1-5	1-10
A	CN 205666217 U (DELIXI ELECTRIC CO., LTD.) 26 October 2016 (2016-10-26) description, paragraphs 5-14, and figures 1 and 2	1-10
A	CN 202307751 U (SCHNEIDER ELECTRIC INDUSTRIES SAS) 04 July 2012 (2012-07-04) entire document	1-10
A	JP 2004127950 A (MATSUSHITA ELECTRIC WORKS LTD) 22 April 2004 (2004-04-22) entire document	1-10

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 January 2019	**22 January 2019**
Name and mailing address of the ISA/CN **State Intellectual Property Office of the P. R. China (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2018/114395

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 207367899 U	15 May 2018	None	
CN 205666217 U	26 October 2016	None	
CN 202307751 U	04 July 2012	None	
JP 2004127950 A	22 April 2004	JP 4036195 B2	23 January 2008

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201711086939 **[0001]**