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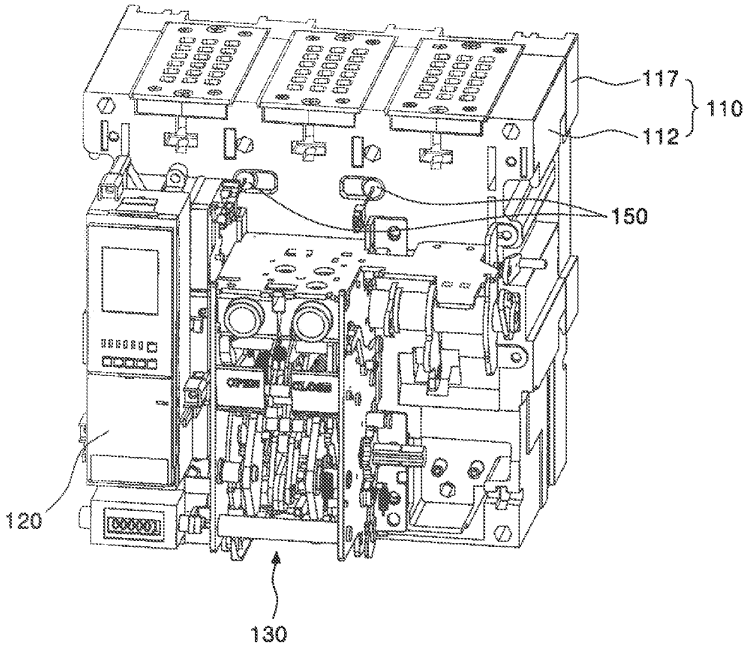
(54) Circuit breaker with temperature sensor

(57) The air circuit breaker having a temperature sensor comprises: a temperature sensor sensing a temperature by being inserted into a sensor insertion hole formed the base mold; and a temperature display indicating a value detected by the temperature sensor as a temperature of the conduction unit, whereby the temperature inside the breaker is always monitored to prevent the damage caused by over-heating of the conduction unit.

FIG. 3



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Description

TECHNICAL FIELD

[0001] The following description relates generally to an air circuit breaker having a temperature sensor capable of sensing the temperature of an air circuit breaker by connecting a movable contactor and a stationary contactor to thereby prevent damage to the air circuit breaker caused by abnormal heating of a conduction unit comprising a current conduction circuit.

BACKGROUND ART

[0002] Generally, a circuit breaker is an electric protecting apparatus installed between an electric source and load units in order to protect the load units such as a motor and a transformer and an electric line from an abnormal current (a large current caused by i.e., short circuit and a ground fault) generated at an electric circuit such as a power transmission/distribution line and private power transforming facilities. In addition, the circuit breaker insulated by insulation at a breaker may manually open or close an electric line under normal use state, and open or close the line from a remote distance using an electric manipulation unit outside a metal container and automatically break the line during over-current and short-circuit to protect the power facilities and load units.

[0003] The air circuit breaker operates in such a manner that a stationary contactor and a movable contactor which is movable to a closing position at which the movable contactor contacts the stationary contactor to close the circuit and to a breaking (trip) position at which the movable contactor is separated from the stationary contactor to open the circuit.

[0004] The circuit breaker may be classified into an air circuit breaker, a hydraulic circuit breaker and a spring circuit breaker according to manipulation method. The circuit breaker may be also classified into an air circuit breaker (ACB) for distinguishing are by blowing air, and a gas circuit breaker (GCB) for distinguishing are by blowing gas according to extinguishing medium of arc generated in the course of separating the movable contactor from the stationary contactor by manipulation of the breaker.

[0005] FIG. 1 is a perspective view illustrating a schematic construction of a conventional air circuit breaker and FIG.2 is a side view illustrating a schematic inner construction of the air circuit breaker.

[0006] Referring to FIGS. 1 and 2, the typical air circuit breakers may largely include a conduction unit (40) constituting a conduction circuit by connecting a movable contact point of a movable contactor (42) and a stationary contact point of a stationary contactor (44), a base mold (10) provided with the conduction unit (40) therein, a detection unit (20) detecting an accident current and an open/close mechanism (30) operating the movable contactor (42) in response to a detection signal of the detection unit (20). The air circuit breaker is mounted with a conduction unit (40) for each phase, i.e., an R phase (13) conduction unit, an S phase (14) conduction unit and a T phase (15) conduction unit, as shown in FIG.1.

[0007] Now, the conduction circuit of the air circuit breaker will be described with reference to FIG.2. The stationary contactor (44) of the conduction unit (41) is connected to an upper terminal (46) through which current is introduced into the breaker, and the current introduced into the upper terminal (46) flows to a lower terminal (47) via the movable contactor (42). When the conduction circuit of the air circuit breaker is closed, the current flows to the conduction unit (40) to increase the temperature of the air circuit breaker due to generated heat of conductors including the contact points.

[0008] When the temperature of the air circuit breaker increases, there is a high likelihood of the breaker being erroneously operated due to damage caused by the raised temperature. As a result, the IEC and KS (Korean Standard) requires that a temperature rise of an air circuit breaker be limited, and a manufacturer make a breaker to comply with the IEC or KS requirements.

[0009] However, there is many a case where the temperature of a breaker rises due to abnormal heating of the conduction unit (40) even if the air circuit breaker meets the requirements. When the air circuit breaker generates a heat above the normal requirement, the breaker itself gets damaged and wreaks havoc on the power transmission/distribution line due to failure to break the accidental current. Therefore, it is essential that the temperature of the conduction unit at the air circuit breaker be monitored in real time to prevent damage caused by the abnormal heating.

[0010] One of the methods for monitoring the temperature of the conduction unit at the air circuit breaker is to measure the temperature by intermittently photographing an upper terminal and a lower terminal using an infrared thermal imaging camera from outside of the air circuit breaker. However, this method suffers from a disadvantage that it is difficult to measure an inner temperature of the air circuit breaker although an external temperature is measurable.

[0011] An installation of a temperature sensor for checking the temperature of the conduction unit of the air circuit breaker may be considered a possible solution but it is not that easy to install a temperature sensor at the upper terminal and the lower terminal where the current flows, such that there has existed no air circuit breaker mounted with a temperature sensor capable of sensing an abnormal heating in real time.

TECHNICAL SOLUTION

[0012] The present invention has been disclosed to solve the aforementioned disadvantages and it is an object of the present invention to provide an air circuit breaker having a temperature sensor capable of monitoring the temperature of the air circuit breaker at all times,

thereby preventing damage of the air circuit breaker caused by an abnormal heating of a conduction unit constituting a conduction circuit in which a movable contactor and a stationary contactor are connected.

[0013] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

[0014] In one general aspect, an air circuit breaker composed of a base mold provided therein with a conduction unit constituting a conduction circuit by connecting a movable contact point of a movable contactor and a stationary contact point of a stationary contactor, a detection unit detecting an accident current, and an open/close mechanism operating the movable contactor in response to a detection signal of the detection unit, comprises: a temperature sensor sensing a temperature by being inserted into a sensor insertion hole formed the base mold, and a temperature display indicating a value detected by the temperature sensor as a temperature of the conduction unit.

[0015] Implementations of this aspect may include one or more of the following features. The temperature sensor may be electrically connected to the temperature display via an external connector.

[0016] The air circuit breaker may further include a resilient member connected to the temperature sensor, such that the temperature sensor is fixedly inserted into a sensor insertion hole.

[0017] The temperature display may include an input terminal electrically connected to the temperature sensor, a compensation unit respectively compensating the temperature of the movable contactor of the conduction unit, the temperature of the upper terminal connected to the stationary contactor of the conduction unit and the temperature of the lower terminal connected to the movable contactor based on the value detected by the temperature sensor, and a display indicating the respective compensated temperatures.

[0018] The temperature display may further include an output terminal for outputting to an outside the value detected by the temperature sensor and the compensated temperatures.

[0019] The air circuit breaker may further include a warning device for warning to the outside that the value detected by the temperature sensor has surpassed a predetermined reference temperature, if the value detected by the temperature sensor surpasses a predetermined reference temperature

[0020] The warning device may include a temperature set-up unit for setting up the reference temperature, an over-heat detection unit determining whether the value detected by the temperature sensor has surpassed the reference temperature set up by the temperature set-up unit, and an over-heat notifying unit for notifying that the value detected by the temperature senor has surpassed the reference temperature as a result of the determination by the over-heat detection unit that the value detected by the temperature senor has surpassed the reference temperature.

[0021] The temperature set-up unit is a DIP (Dual Inline Package) switch capable of selecting a desired reference temperature level out of reference temperature levels classified into various steps.

[0022] The over-heat detection unit may include an Analog-to-Digital Converter (ADC) converting the value detected by the temperature sensor to a digital value, and the over-heat notifying unit may include a digital display indicating the temperature converted to the digital value by the ADC.

[0023] The over-heat detection unit may generate a control signal in response to the temperature converted to the digital value by the ADC, and the digital display may include a plurality of LEDs (Light Emitting Devices) to display the temperature by turning on and off the plurality of LEDs in response to the control signal generated by the over-heat detection unit.

[0024] The plurality of LEDs may include an LED-based 7-segment display group where respective segments are turned on and off to display the digital numbers in response to the control signal from the over-heat detection unit.

ADVANTAGEOUS EFFECTS

[0025] The air circuit breaker having a temperature sensor according to the present invention may enable to monitor the temperature of the air circuit breaker at all times via the temperature sensor and temperature display, thereby preventing damage thereto caused by an abnormal heating of a conduction unit constituting a conduction circuit and avoiding an accidental current caused by an erroneous operation of the air circuit breaker.

[0026] The warning device may immediately notify to a user a failure where the temperature detected by the temperature sensor has surpassed the reference temperature to thereby allow the user to address the accidental situation.

[0027] The user may be allowed to set up the reference temperature based on the current temperature in response to the load and to accurately check the state of the air circuit breaker at all times.

[0028] As a result, the air circuit breaker may protect power systems from overload caused by over-current exceeding a critical value, protect the user from the hazard of fire caused by over-heating inside the air circuit breaker, and prolong the life of the air circuit breaker by using the breaker on a stable basis.

DESCRIPTION OF DRAWINGS

[0029]

FIG. 1 is a perspective view illustrating a schematic configuration of a conventional air circuit breaker.

FIG.2 is a side view illustrating a schematic inner configuration of the air circuit breaker of FIG.1.

FIG. 3 is a perspective view illustrating a schematic configuration of an air circuit breaker having a temperature sensor according to an exemplary implementation.

FIG.4 is a schematic configuration of a temperature sensor according to an exemplary implementation.

FIG.5 is a perspective view illustrating a state of the temperature sensor being coupled to a resilient member according to an exemplary implementation.

FIG.6 is a perspective view illustrating a front base mold formed with a sensor insertion hole for mounting a temperature sensor to the air circuit breaker according to an exemplary implementation.

FIG. 7 is a perspective view illustrating a rear base mold coupled to the front base mold in FIG.5.

FIG.8 is a side view schematically illustrating an air circuit breaker having a temperature sensor according to an exemplary implementation.

FIG.9 is a plan view illustrating a temperature display according to an exemplary implementation.

FIG. 10 is a schematic block diagram illustrating configuration of a warning device according to an exemplary implementation.

FIG.11 is a plan view illustrating a temperature setting unit according to an exemplary implementation.

BEST MODE

[0030] The object, the construction for achieving the object, and an operational effect of the air circuit breaker according to the present invention will be clearly understood through the following description on the implementations of the present invention made with reference to the accompanying drawings.

[0031] FIG. 3 is a perspective view illustrating a schematic configuration of an air circuit breaker having a temperature sensor according to an exemplary implementation, FIG.4 is a schematic configuration of a temperature sensor according to an exemplary implementation, FIG. 5 is a perspective view illustrating a state of the temperature sensor being coupled to a resilient member according to an exemplary implementation, FIG.6 is a perspective view illustrating a front base mold formed with a sensor insertion hole for mounting a temperature sensor to the air circuit breaker according to an exemplary implementation, FIG. 7 is a perspective view illustrating a rear base mold coupled to the front base mold in FIG.5, FIG. 8 is a side view schematically illustrating an air circuit breaker having a temperature sensor according to an exemplary implementation, FIG.9 is a plan view illustrating a temperature display according to an exemplary implementation, FIG. 10 is a schematic block diagram illustrating configuration of a warning device according to an exemplary implementation and FIG.11 is a plan view illustrating a temperature setting unit according to an exemplary implementation.

[0032] First, the configuration of an air circuit breaker having a temperature sensor will be described.

A base mold (110) may include a front base mold (112) and a rear base mold (117) and be provided therein with a conduction unit (140).

[0033] FIG. 6 refers to the front base mold (112) and FIG. 7 refers to the rear base mold (117). The base mold (110) is so formed as to have an inner space at places where each phase (R, S, T phase) is situated. The base mold (110) may be made of insulation material such as plastic and the like.

[0034] Each phase (R phase, S phase, T phase) of 3-phase alternating current breaker is provided with the conduction unit (140) as shown in FIG.3.

[0035] The conduction unit (140) may include a movable contactor (142) having a movable contact point and a stationary contactor (144) having a stationary contact point as shown in FIG.8. The stationary contactor (144) may be connected to an upper terminal (146) into which current is introduced, and the movable contactor (142) may be connected to a lower terminal (147) to constitute a conduction circuit.

[0036] A detection unit (120) may be provided at a front surface of the base mold (110) to detect an accidental current such as over-current or short-circuited current.

[0037] An open/close mechanism (130) is provided at a front surface of the base mold (110) to operate the movable contactor (142) of the conduction unit in response to a detection signal from the detection unit (120).

[0038] A temperature sensor (150) may include a sensor unit (152) for measuring temperatures, an electric lead line (154) extended from the sensor unit (152), and a connector (156) connected to the lead line (154) for access to a temperature display (160), as illustrated in FIG.4. Although the temperature sensor (150) may be directly connected to the temperature display (160), a connector (160) of the temperature sensor (150) is preferably connected to a connection terminal (172) of an external connector (170) as the air circuit breaker is typically mounted with the external connector (170) as shown in FIG.8. In other words, the external connector (170) is connected to an input terminal (162) of the temperature display (160) to allow the temperature sensor (150) and the temperature display (160) to be electrically connected.

[0039] The temperature sensor (150) may be disposed inside the air circuit breaker for measuring temperature of the conduction unit (140). As it is difficult to directly measure the temperature of the conduction unit (140), a temperature nearby may be measured for consideration as the temperature of the conduction unit (140). To this end, an experimental data may be obtained on relationship between the temperature of the conduction unit (140) and a temperature where the temperature sensor (150) is installed. As a result, the temperature where the temperature sensor (150) is located may be considered the temperature of the conduction unit (140) based on the experimental data.

[0040] The temperature sensor (150) in the three phase (R, S, T) air circuit breaker may be installed at a base mold between R phase and S phase, and at a base mold between S phase and T phase. This is because, as described above, an accurate temperature cannot be measured due to circulating air at the inner space if the temperature sensor (150) is disposed at the inner space as each base mold (110) has the inner space per phase. Therefore, as depicted in FIG.6, two sensor insertion holes (115) insertable by the temperature sensor (150) may be formed at the first rib partition (113) of a front base mold formed between R phase and S phase, and at a second rib partition (114) of the front base mold formed between S phase and T phase, and the temperature sensor (150) may be inserted into the two holes. The sensor insertion hole (115) may be formed deep enough to enable the measurement of temperature inside the breaker. The sensor insertion hole (115) may be formed at an inlet side thereof with a guide groove (116) to prevent the electrical lines of the temperature sensor (150) from being interfered with other elements of the breaker.

[0041] Preferably, the temperature sensor (150) may be formed in such a manner that a sensor unit (152) is inserted into a rubbery resilient member (158) to be partially exposed from the resilient member (158) as shown in FIG.5. The temperature sensor (150) coupled with the resilient member (158) may be fixedly inserted into the sensor insertion hole (115) as illustrated in FIGS.3 and 8.

[0042] The temperature display (160) electrically connected to the temperature sensor (150) is a device for displaying measurement values by compensating the values by the temperature of the conduction unit (140), whereby a user can monitor the temperature inside the air circuit breaker in real time.

[0043] Referring to FIG.9, the temperature display (160) may include an input terminal (162) electrically connected to the temperature sensor (150), a compensator (not shown) compensating the value measured by the temperature sensor (150) by the temperature of the conduction unit, and a display unit (164) displaying the compensated temperature of the conduction unit.

[0044] The compensator (not shown) may work in such a way as to consider the value measured by the temperature sensor (150) as the temperature of the conduction unit using the experimental data. At this time, preferably, the values measured by the temperature sensor (150) are respectively considered as the temperature of the movable contactor (142) at the conduction unit, the temperature of the upper terminal (146) and the temperature of the lower terminal and displayed on the display unit (164).

[0045] Preferably, the temperature display (160) may further include an output terminal for outputting the measured temperatures to the outside, whereby the inner temperature of air circuit breaker can be monitored in real time from the site where the breaker is located and from a remote distance as well.

MODE FOR INVENTION

[0046] Meanwhile, referring to FIG.10, the air circuit breaker having a temperature sensor may further include a warning device (200) warning that the value detected by the temperature sensor (150) has surpassed a predetermined reference temperature if the value detected by the temperature sensor (150) is greater than the predetermined reference temperature. The warning device (200) may comprise any structure, preferably in plural structure, for notifying the impending danger to users in real time, and notifying wirelessly to a user in a distant place.

[0047] As shown in FIG.9, the warning device (200) mounted along with the temperature display (160) may warn to the outside that the value detected by the temperature sensor (150) has surpassed a predetermined reference temperature if the value detected by the temperature sensor (150) is greater than the predetermined reference temperature, may visually warn the user by way of an LED lamp (167), and may audibly warn via a speaker. The warning device (200) may include a temperature set-up unit (210), an over-heat detection unit (220) and an over-heat notifying unit (230), as illustrated in FIG.10.

[0048] The temperature set-up unit (210) may be manipulated by a user and set up a reference temperature that is compared with the values detected by the temperature sensor (150). In other words, the temperature set-up unit (210) may select (turn on) number 1 from a DIP (Dual Inline Package) switch where reference temperature level is classified from number 1 to number 4 per step , and set up the reference temperature by turning off the other numbers, as illustrated in FIG.11. To be more specific, the temperature set-up unit may select a desired reference temperature level out of reference temperature levels classified into various steps using the DIP switch.

[0049] The over-heat detection unit (220) may determine whether the value detected by the temperature sensor (150) has surpassed the reference temperature set up by the temperature set-up unit (210). The over-heat detection unit (220) may further include an ADC (Analog-to-Digital Converter. 225) that converts an analog temperature value detected by the temperature sensor (150) to a digital value. Successively, the over-heat detection unit (220) may determine whether the temperature digitally converted by the ADC (225) has surpassed the reference temperature set up by the temperature set-up unit (210).

[0050] The over-heat detection unit (220) may generate a control signal in response to the temperature digitally converted by the ADC (225). The control signal may function as a signal for controlling a digital display (described later. 235), where the digital display (235) displays the temperature in response to the control signal.

[0051] As a result of the determination by the over-heat detection unit (220), if the value detected by the temperature sensor (150) has surpassed the set-up reference

temperature, the over-heat notifying unit (230) may notify the fact to the outside. The over-heat notifying unit (230) may include a warning sound generator (not shown) generating a warning sound, or a light on-off unit (not shown) turning on or off a light to notify to the user that the air circuit breaker has been over-heated by the temperature inside the breaker having surpassed the set-up reference temperature.

[0052] The over-heat notifying unit (230) may further include a digital display (235), and the digital display (235) may display the digitally-converted temperature by the ADC (225) of the over-heat detection unit (220) to allow the user to be informed of the temperature inside the air circuit breaker.

[0053] The digital display (235) may display the temperature using a single color LED, a tri-color LED or an LED-based 7-segment display group.

[0054] Now, the digital display (235) mounted with the single color LED, the tri-color LED or the LED-based 7-segment display group will be described in detail.

[0055] The digital display (235) may be mounted with a plurality of single color LEDs (red, green, blue included) and turn on or off a plurality of predetermined LEDs out of the plurality of single color LEDs in response to the control signal generated by the over-heat detection unit (220), or turn on or off the predetermined color LEDs (red, green or blue) for display of the temperature. The digital display (235) may be disposed with a tri-color LED and turn on or off a predetermined color LED out of the tri-color LED in response to the control signal generated by the over-heat detection unit (220) for display of the temperature. The turning on or off of the predetermined color using the single color LED or the tri-color LED in the above description is applicable to a case where colors are pre-defined by classifying the temperatures per step.

[0056] The digital display (235) may be disposed with at least one or more LED-based 7-segment displays, and turn on or off a relevant segment of the LED-based 7-segment displays according to the control signal generated by the over-heat detection unit (220) for displaying the temperatures in digital numbers.

[0057] To be more specific, the digital display (235) may serve to notify the user the accurate state inside the air circuit breaker, even if the warning sound generator or light on-off unit of the over-heat notifying unit (230) fails to function properly. The digital display (235) may notify the user a current temperature inside the air circuit breaker to allow the user to set up a reference temperature based on a temperature commensurate to a current load volume, if the user sets up the reference temperature inside the air circuit breaker via the temperature set-up unit (210).

INDUSTRIAL APPLICABILITY

[0058] The warning device (200) thus configured and mounted on the air circuit breaker can break the power supply to load systems when an over-current exceeding a critical value is generated inside the air circuit breaker, and monitor the temperature inside the breaker at all times to protect the user against the dangerous fire, thereby allowing the user to use the breaker stably for a long time.

[0059] As the present concept may be implemented in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described implementations are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.

Claims

1. An air circuit breaker composed of a base mold (110) provided therein with a conduction unit (140) constituting a conduction circuit by connecting a movable contact point of a movable contactor (142) and a stationary contact point of a stationary contactor (144), a detection (120) unit detecting an accident current, and an open/close mechanism (130) operating the movable contactor (142) in response to a detection signal of the detection unit (120), the breaker **characterized by**: a temperature sensor (150) sensing a temperature by being inserted into a sensor insertion hole (115) formed the base mold (110), and a temperature display (160) indicating a value detected by the temperature sensor (150) as a temperature of the conduction unit (140).

2. The breaker as claimed in claim 1, **characterized in that** the temperature sensor (150) is electrically connected to the temperature display (160) via an external connector (170).

3. The breaker as claimed in claim 1, further **characterized by** a resilient member (158) connected to the temperature sensor (150), such that the temperature sensor (150) is fixedly inserted into a sensor insertion hole (115).

4. The breaker as claimed in claim 1, **characterized in that** the temperature display (160) includes an input terminal electrically connected to the temperature sensor (150), a compensation unit respectively compensating the temperature of the movable contactor (142) of the conduction unit (140), the temperature of the upper terminal connected to the stationary contactor (144) of the conduction unit (140) and the temperature of the lower terminal connected to the movable contactor (142) based on the value detected by the temperature sensor (150); and a dis-

play unit (164) indicating the respective compensated temperatures.

5. The breaker as claimed in claim 4, **characterized in that** the temperature display (160) further includes an output terminal for outputting to an outside the value detected by the temperature sensor (150) and the compensated temperatures.

6. The breaker as claimed in claim 1, further **characterized in that** a warning device (200) for warning to the outside that the value detected by the temperature sensor (150) has surpassed a predetermined reference temperature, if the value detected by the temperature sensor (150) surpasses a predetermined reference temperature

7. The breaker as claimed in claim 6, **characterized in that** the warning device (200) includes a temperature set-up unit (210) for setting up the reference temperature, an over-heat detection unit (220) determining whether the value detected by the temperature sensor (150) has surpassed the reference temperature set up by the temperature set-up unit (210); and an over-heat notifying unit (230) for notifying that the value detected by the temperature senor (150) has surpassed the reference temperature as a result of the determination by the over-heat detection unit (230) that the value detected by the temperature senor (150) has surpassed the reference temperature.

8. The breaker as claimed in claim 7, **characterized in that** the temperature set-up unit (210) is a DIP (Dual Inline Package) switch capable of selecting a desired reference temperature level out of reference temperature levels classified into various steps.

9. The breaker as claimed in claim 7, **characterized in that** the over-heat detection unit (220) includes an Analog-to-Digital Converter (ADC. 225) converting the value detected by the temperature sensor (150) to a digital value, and the over-heat notifying unit (230) comprises a digital display (235) indicating the temperature converted to the digital value by the ADC (225).

10. The breaker as claimed in claim 9, **characterized in that** the over-heat detection unit (220) generates a control signal in response to the temperature converted to the digital value by the ADC (225), and the digital display (235) includes a plurality of LEDs (Light Emitting Devices) to display the temperature by turning on and off the plurality of LEDs in response to the control signal generated by the over-heat detection unit (220).

11. The breaker as claimed in claim 10, **characterized in that** the plurality of LEDs includes an LED-based 7-segment display group where respective segments are turned on and off to display the digital numbers in response to the control signal from the over-heat detection unit (220).

FIG. 1

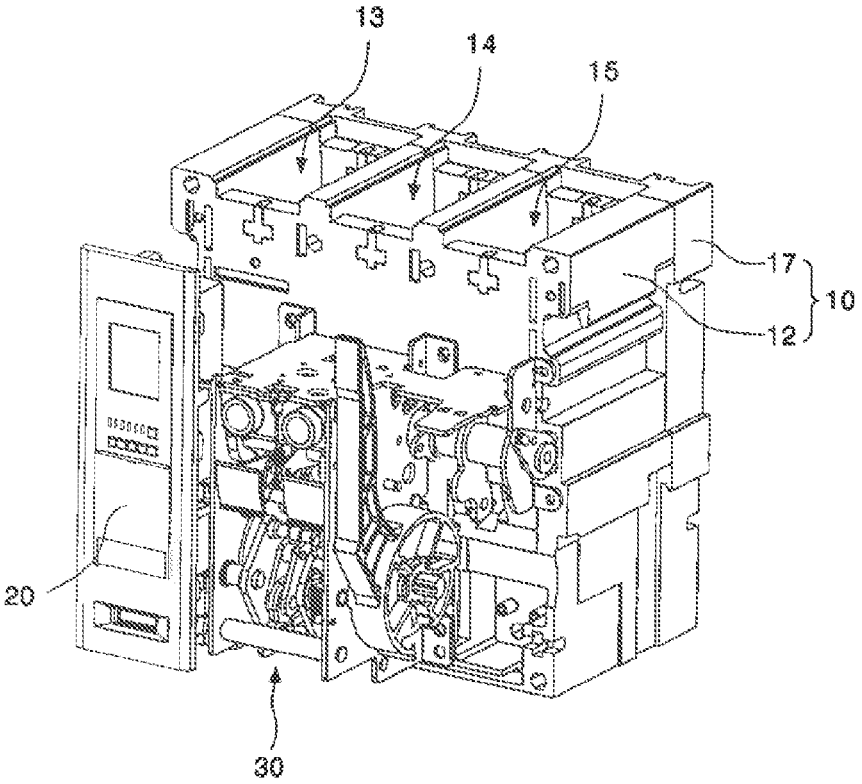


FIG. 2

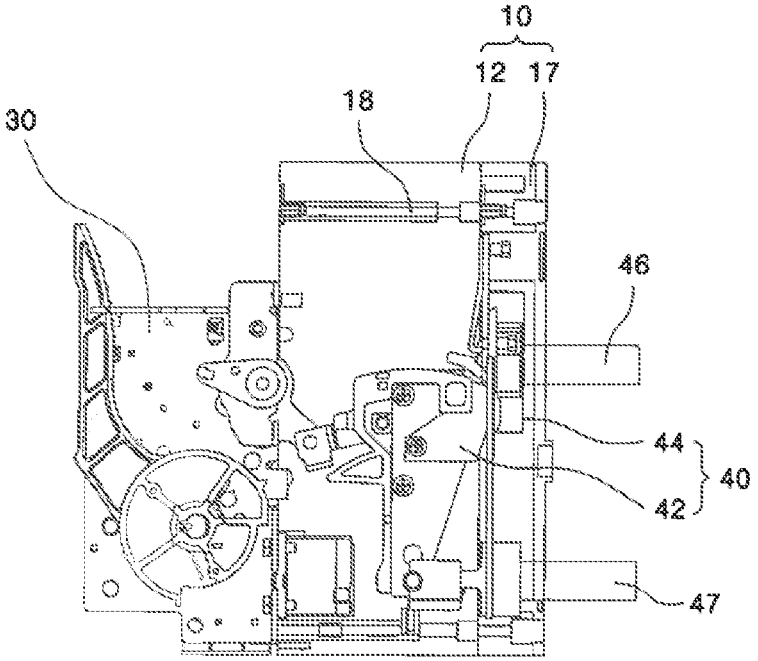


FIG. 3

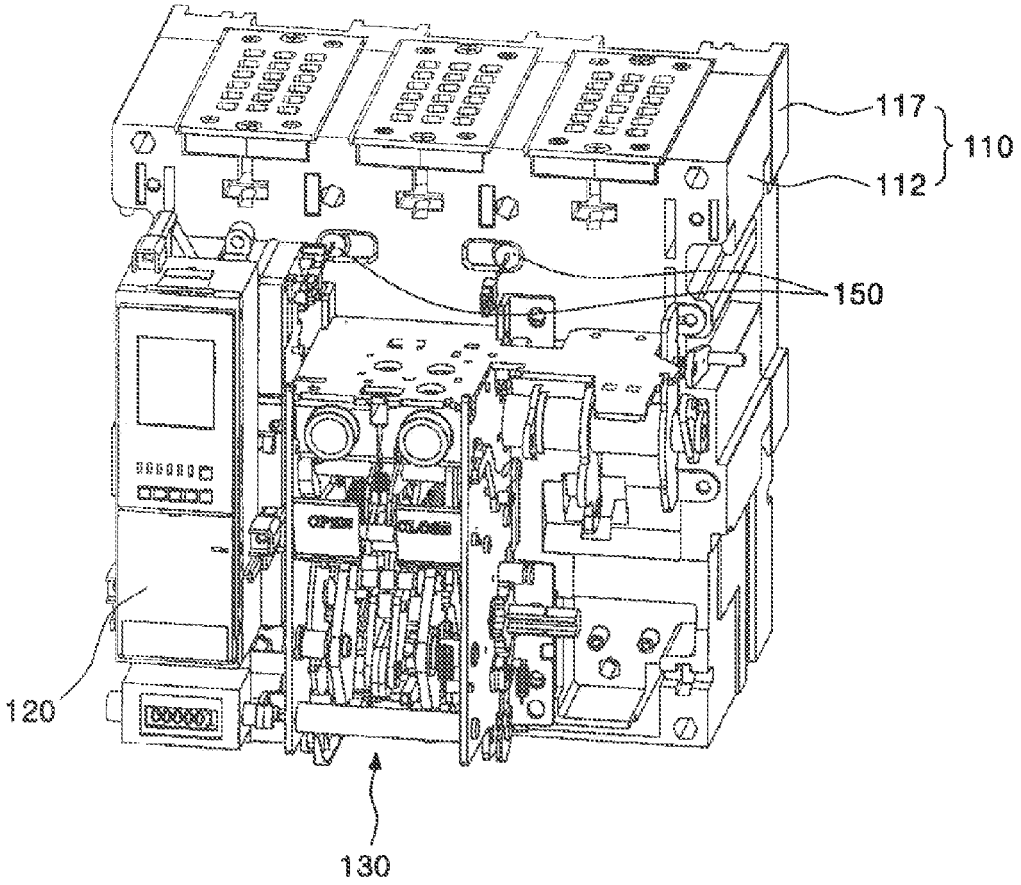


FIG. 4

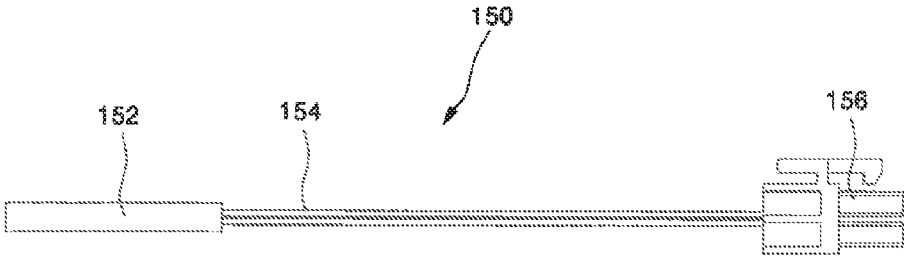


FIG. 5

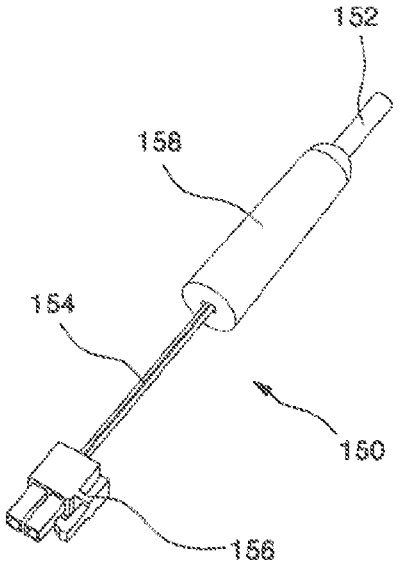


FIG. 6

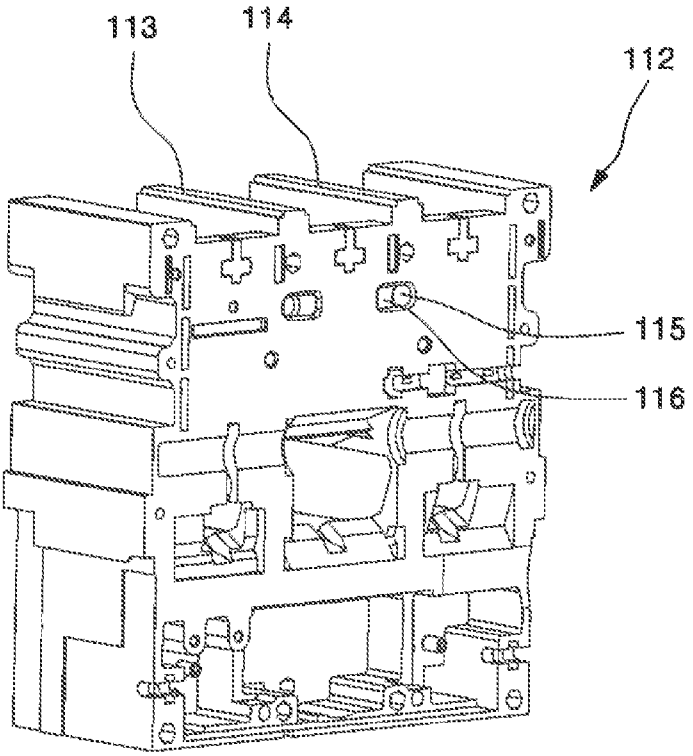


FIG. 7

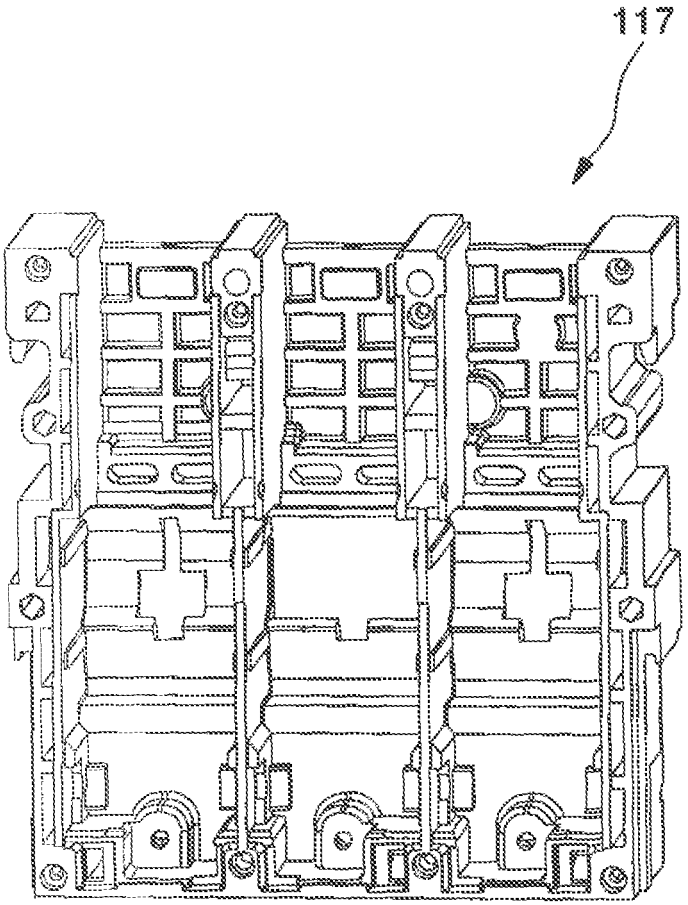


FIG. 8

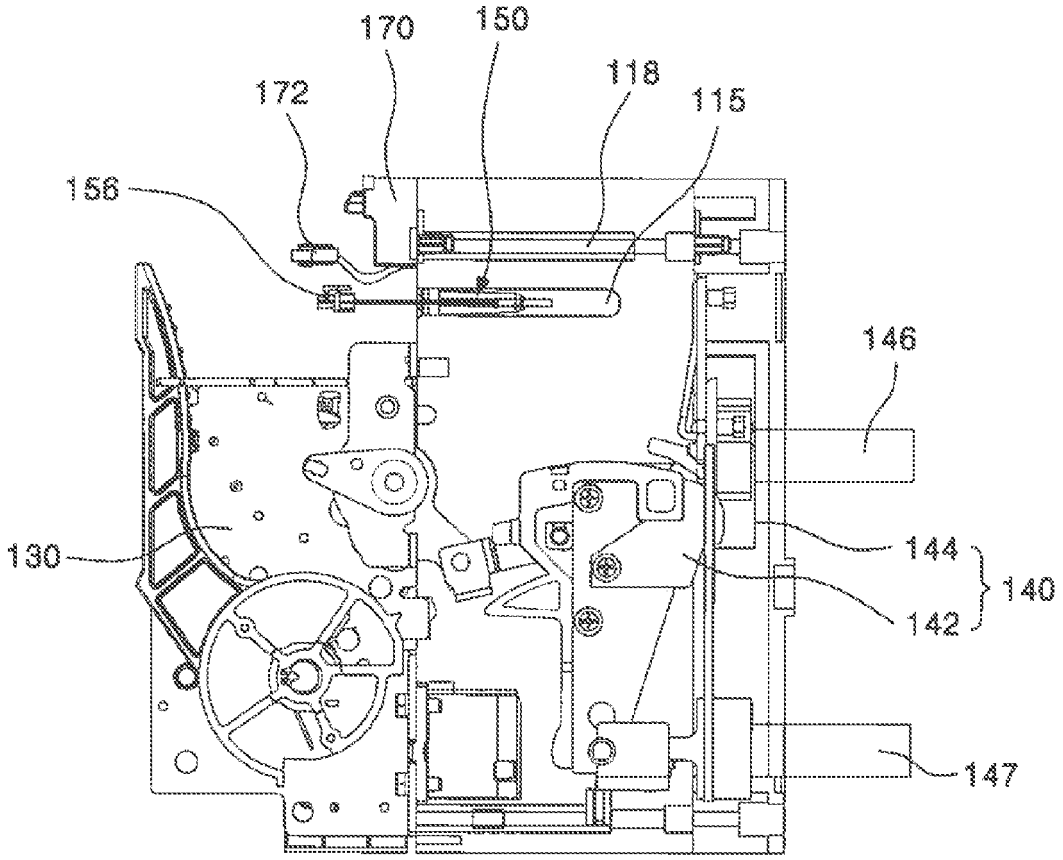
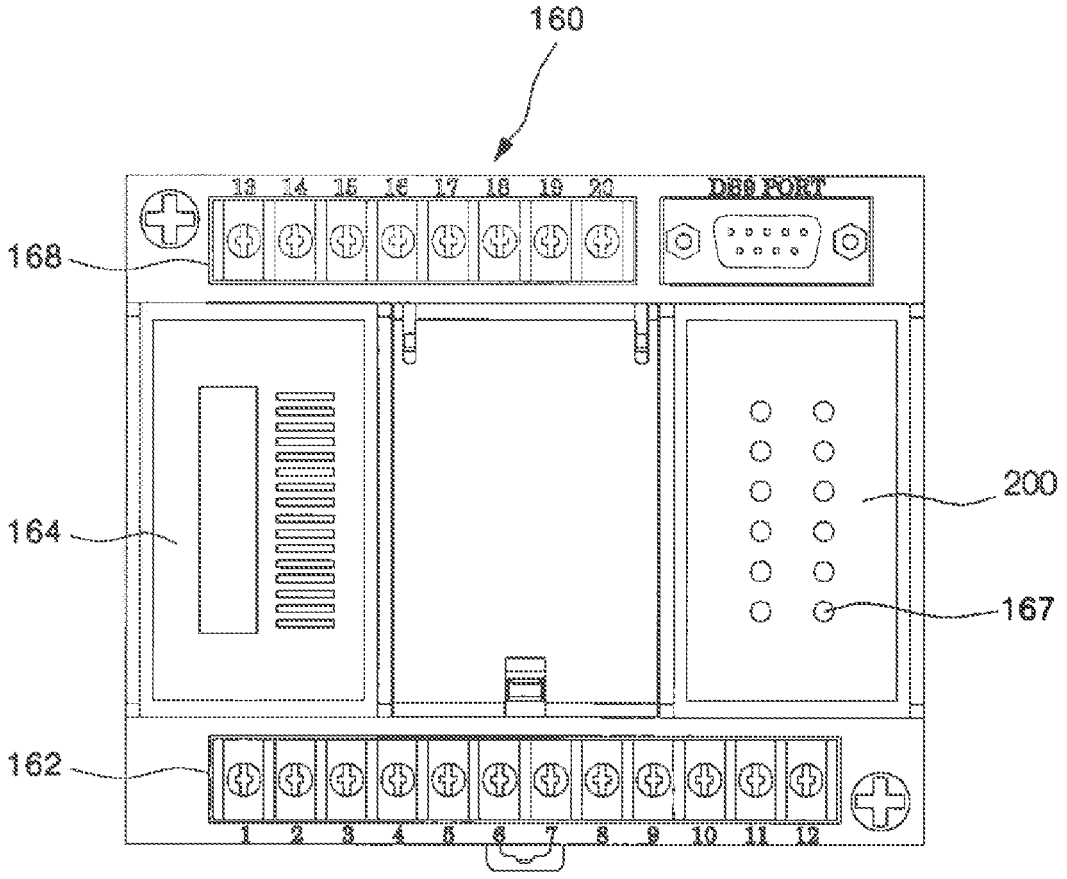


FIG. 9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162
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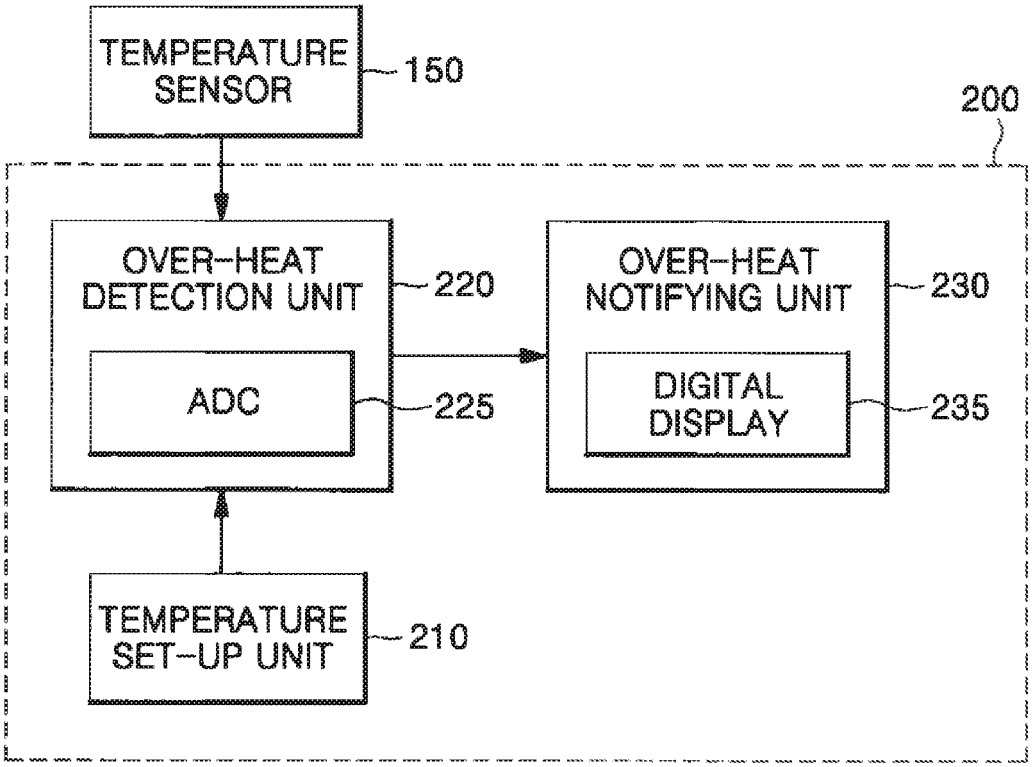
FIG. 10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200
OVER-HEAT DETECTION UNIT
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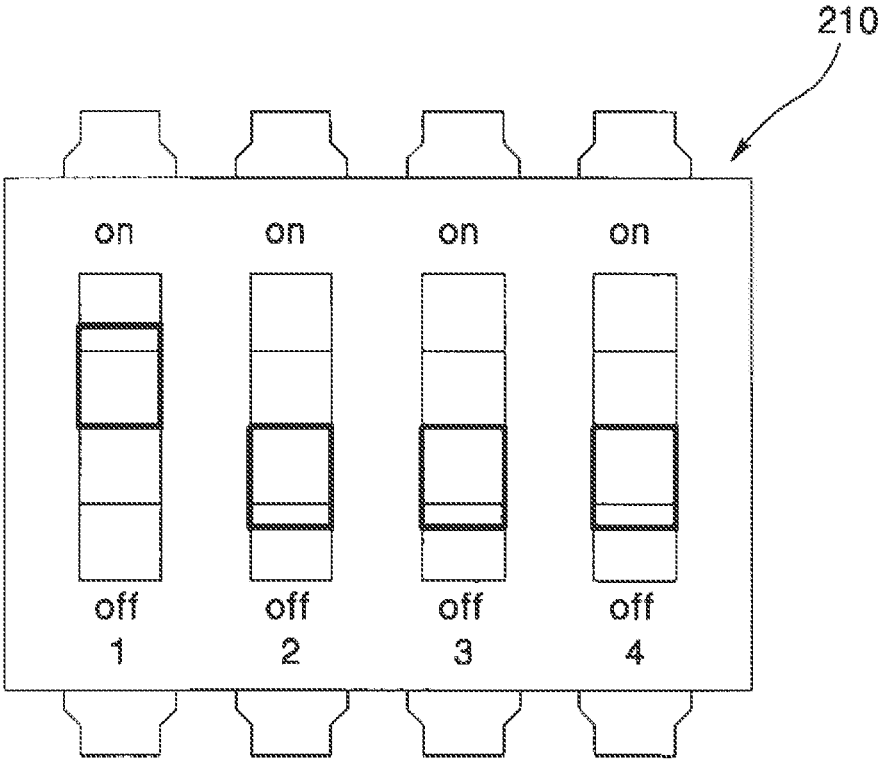
ADC
225
OVER-HEAT NOTIFYING UNIT
230
DIGITAL DISPLAY
235
TEMPERATURE SET-UP UNIT
210

FIG. 11



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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 October 2008	Overdijk, Jaco

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1

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