CIRCUIT BREAKER WITH LIVE-STATE INFORMATION MEASURING INSTRUMENT

A conductor (34) is clamped/ fixed to a terminal portion (33) of the circuit breaker main body (1) by clamping members (35). A current-supply information measuring unit (30) including a Hall element (38) for detecting magnetic fluxes generated by a current flowing through the conductor (34) and converting them into an electric signal, contact jigs (41) for detecting a phase voltage by contacting to the conductor (34), an electronic circuit portion (43) for processing a voltage signal detected by the contact jigs (41) and the electric signal of the Hall element (38), and an outputting means (40) for outputting a processed result is detachably attached to a terminal portion (33) of the circuit breaker main body (1). Accordingly, the circuit breaker in which an instrument current transformer (18) is not built can display current-supply information which are supplied to a load protected by the circuit breaker main body (1).
Description

Technical Field

[0001] The present invention relates to a circuit breaker with a current-supply information measuring unit having a current-supply information measuring unit which is fitted to the circuit breaker to display or collect current-supply information supplied to a load that is protected by this circuit breaker.

Background Art

[0002] FIG.15 is a side view of a circuit breaker with a current-supply information measuring unit shown in Patent Application Publication (KOKAI) Hei 11-8930 in the prior art. FIG.16 is a block diagram of a circuit configuration in FIG.15. In Figures, 1 is a circuit breaker main body, 2 is a current-supply main conductor for supplying a current to a load, 3 is an on/off contact for turning on/off of a load current flowing through the current-supply main conductor 2, and 4 is a current transformer for detecting a load current flowing through the current-supply main conductor 2.

[0003] 5 is a rectifying circuit for rectifying an output of the current transformer 4, 6 is a peak value converting circuit for converting a voltage of an output from the rectifying circuit, and then detecting an instantaneous maximum value of the load current flowing through the current-supply main conductor 2 after an A/D converting process, 7 is an instantaneous time-interval circuit for outputting a signal when an output of the peak value converting circuit 6 exceeds a predetermined value, and 8 is a short time-interval circuit for executing an inverse-time operation according to a magnitude of the output of the peak value converting circuit 6 at the level lower than an operation output of the instantaneous time-interval circuit 7 to then output a signal.

[0004] 9 is an effective value converting circuit for obtaining an effective value equivalent to an effective value of the load current flowing through the current-supply main conductor 2 after the output of the rectifying circuit 5 is subjected to voltage conversion and A/D converting processes, 10 is a long time-interval circuit that does not cause the circuit breaker main body 1 to execute a breaking operation at the rated current and executes the inverse-time operation at the rated current or more, according to a magnitude of an output of the effective value converting circuit 9. 11 is a trigger circuit that receives any signal from the effective value converting circuit, the short time-interval circuit 8, and the long time-interval circuit 10 and cuts off the current-supply to a load by cutting off the on/off contact 3 via an electromagnetic coil 12.

[0005] 13 is a pre-alarm detecting circuit 13 that supplies an output to a pre-alarm outputting circuit 14 at a predetermined current value, which is slightly lower than the rated current, to turn on a pre-alarm display lamp 15. Thus, service interruption caused by the breaking operation of the circuit breaker main body 1 is notified beforehand by informing that the load current comes close to a breaking operation of the circuit breaker main body 1, and thus the sudden service interruption can be prevented. 16 is a power source circuit for converting an external power source 17 into a control power source of the pre-alarm display lamp 15.

[0006] 18 is a measuring current transformer for detecting the load current flowing through the current-supply main conductors 2 separately from the current transformer 4 that detects the overcurrent, and 19 is a transformer for detecting a voltage between the current-supply main conductors 2. The measuring current transformer 18 and the transformer 19 are installed in the inside of the circuit breaker main body 1. 20 is a current-supply information measuring unit, 21 is a current A/D converting circuit for converting an analog output from the measuring current transformer 18 to a digital output, and 22 is a voltage A/D converting circuit 22 for converting the analog output from the transformer 19 into the digital output. After this output signal is processed by a multiplying circuit and an integrating circuit, the signal is sent to a display portion 23 installed on an upper surface of the circuit breaker main body 1 via a cable 24, and the current-supply information supplied to the load is displayed.

[0007] In Patent Application Publication (KOKAI) Hei 9-198989, the circuit breaker that detects the load current by the Hall element is set forth.

[0008] In the circuit breaker with the current-supply information measuring unit constructed as above in the prior art, the measuring current transformer 18 must be installed previously in the inside of the circuit breaker main body 1 to measure the load current. Also, the current-supply information measuring unit 20 must be installed on the upper surface or a side surface of the circuit breaker main body 1 and the cable 24 for connecting the circuit breaker main body 1 and the current-supply information measuring unit 20 is needed. Therefore, there are the problems that an outer dimension is increased and a cost is also increased.

[0009] The present invention has been made to overcome the above problems, and it is an object of the present invention to provide a circuit breaker with a current-supply information measuring unit that is capable of installing a current-supply information measuring unit into a circuit breaker, in which an instrument current transformer is not built, as the additional fixture since there is no necessity to install previously a measuring current transformer in the inside of a circuit breaker main body, and is also capable of displaying a voltage, a current, a power, an electric energy, a temperature of clamping screws, the breaking number of times, etc. without cables for connecting the circuit breaker and the current-supply information measuring unit.
Disclosure of the Invention

[0010] A circuit breaker with a current-supply information measuring unit according to the present invention comprises a circuit breaker main body for turning on/off a load current; a conductor clamped/fixed to a terminal portion of the circuit breaker main body by clamping members; a current-supply information measuring unit including a case portion in which a Hall element for detecting magnetic fluxes generated by the load current and converting them into an electric signal, an electronic circuit portion for processing the electric signal of the Hall element, and an outputting means for outputting a processed result are installed; wherein the current-supply information measuring unit is arranged or constructed attachably and detachably in vicinity of the circuit breaker main body.

[0011] Also, the circuit breaker with a current-supply information measuring unit further comprises contact jigs that come into contact with the conductor or the clamping members to detect a phase voltage, and wherein a voltage signal detected by the contact jigs and the electric signal from the Hall element are processed by the electronic circuit portion.

[0012] Also, the circuit breaker with a current-supply information measuring unit further comprises a first core for leading the magnetic fluxes generated by the load current to the Hall element and a second core for leading the magnetic fluxes to cooperate with the first core.

[0013] Also, the first core is for leading the magnetic fluxes generated by the load current to the Hall element provided in the circuit breaker main body, and the second core for leading the magnetic fluxes to cooperate with the first core is installed in the case portion.

[0014] Also, the first core is formed to have a substantial U-shape and the second core is provided on both end surfaces of the first core to have an air gap, and the Hall element is arranged in this air gap.

[0015] Also, the first core and the second core are formed to have a substantial U-shape and an air gap is provided to any one of jointed portions of the first core and the second core, and the Hall element is arranged in this air gap.

[0016] Also, the first core and the second core are jointed to enclose the conductor on an outside of the circuit breaker main body.

[0017] Also, the first core is installed in a split case and the second core is installed in the case portion, and the split case is inserted into a fitting hole provided in the case portion.

[0018] Also, the conductor has a substantial U-shape portion, and the substantial U-shape portion is arranged to enclose the Hall element.

[0019] Also, jointed portions of the first core and the second core have a concave shape and a convex shape respectively.

[0020] Also, a temperature of the contact portion is measured by using the contact jigs and output by the outputting means.

[0021] Also, a vibration sensor is provided in the case portion, and an on/off operation number of times of a circuit breaker is counted and output by an outputting means.

Brief Description of the Drawings

[0022] FIG.1 is a perspective view of a circuit breaker with a current-supply information measuring unit in an embodiment 1 of the present invention.

[0023] FIG.2 is a sectional view taken along a II-II line shown in FIG.1.

[0024] FIG.3 is a sectional view taken along a III-III line shown in FIG.1.

[0025] FIG.4 is a perspective exploded view of a pertinent portion of a circuit breaker with a current-supply information measuring unit in an embodiment 2 of the present invention.

[0026] FIG.5 is a sectional view of the circuit breaker with the current-supply information measuring unit in the embodiment 2 of the present invention, taken along the same position as FIG.2.

[0027] FIG.6 is a sectional view of the circuit breaker with the current-supply information measuring unit in the embodiment 2 of the present invention, taken along the same position as FIG.3.

[0028] FIG.7 is a perspective view, viewed from the load side, of the circuit breaker with the current-supply information measuring unit in the embodiment 2 of the present invention, from which the current-supply information measuring unit and conductors are removed.

[0029] FIG.8 is a partial perspective view showing mutual positions of conductors, a first core, a second core, a first printed board, and a Hall element in the circuit breaker with the current-supply information measuring unit in the embodiment 2 of the present invention.

[0030] FIG.9 is a partial enlarged view showing mutual positions of a first core, a second core, a first printed board, and a Hall element in a circuit breaker with a current-supply information measuring unit in an embodiment 3 of the present invention.

[0031] FIG.10 is a partial perspective view of the neighborhood of clamping screws in a circuit breaker with a current-supply information measuring unit in an embodiment 4 of the present invention.

[0032] FIG.11 is a sectional view of a circuit breaker with a current-supply information measuring unit in an embodiment 5 of the present invention, taken along the same position as FIG.2.

[0033] FIG. 12 is a perspective view showing a relationship among a case portion, a first core, and a second core in the circuit breaker with the current-supply information measuring unit in the embodiment 5 of the present invention.

[0034] FIG.13 is an enlarged view of a jointed portion between the first core and the second core in the circuit breaker with the current-supply information measuring unit.
unit in the embodiment 5 of the present invention. The current-supply information measuring unit in the embodiment 6 of the present invention, taken along the same position as FIG.2. [0036] FIG.15 is a side view of a circuit breaker with a current-supply information measuring unit in the prior art. [0037] FIG.16 is a block diagram of a circuit configuration in FIG.15.

Best Modes for Carrying Out the Invention

Embodiment 1

[0038] FIG.1 is a perspective view of a circuit breaker with a current-supply information measuring unit in embodiment 1 of the present invention. FIG.2 is a sectional view taken along a II-II line shown in FIG.1. FIG.3 is a sectional view taken along a III-III line shown in FIG.1. [0039] In FIG.1, 1 is a circuit breaker main body, 30 is a current-supply information measuring unit, and 31 is a fitting screw for installing and fixing the current-supply information measuring unit 30 to the circuit breaker main body 1. In FIG.2 and FIG.3, 32 is a case portion in which parts constituting the current-supply information measuring unit 30 are installed and which consists of an insulating mold case 32a and a cover 32b. 33 is a terminal portion which connects load side wirings to the circuit breaker main body 1, 34 is a conductor which is clamped and fixed to the terminal portion 33 by clamping screws 35 that are formed of conductive material as a clamping member. [0040] 38 is a Hall element which is electrically connected to a first printed board 39a by the soldering. 39b is a second printed board on a surface (upper surface of FIG.3) of which a display 40 as an outputting means is mounted and on an opposite surface (right surface of FIG.2) of which a contact jig 41 whose top end comes into contact with a surface of the conductor 34 is mounted and which is arranged in the case portion 32. [0041] 39c is a third printed board on which a voltage converter 42, that converts a signal input from the contact jig 41 into a voltage signal used to process in an electronic circuit portion described later, is mounted. [0042] 39d is a fourth printed board on a surface of which an electronic circuit portion 43 constituting a current A/D converting circuit (not shown), a voltage A/D converting circuit (not shown), etc. is mounted. In this case, the first printed board 39a, the second printed board 39b, the third printed board 39c, and the fourth printed board 39d are electrically connected by jumper lines 44, and the circuit parts constituting the electronic circuit portion 43 are mounted directly on the printed board 39a, the second printed board 39b, and the third printed board 39c except the fourth printed board 39d. [0043] The current-supply information measuring unit 30 constructed as above can be easily fitted to the circuit breaker main body 1 by the fitting screws 31. The current-supply information measuring unit 30 may be arranged at the terminal portion 33 on the power source side of the circuit breaker main body 1 and in the case portion 32. Also, since the case portion 32 is formed to have an L-shaped sectional shape, the first printed board 39a and the second printed board 39b can be installed effectively in the case portion 32. In addition, since the case portion 32 comes into contact with both the circuit breaker main body 1 and the conductors 34, it has good stability. [0044] FIG.14 is a sectional view of a circuit breaker with a current-supply information measuring unit in an embodiment 6 of the present invention, taken along the same position as FIG.2. [0045] FIG.15 is a side view of a circuit breaker with a current-supply information measuring unit in the prior art. [0046] FIG.16 is a block diagram of a circuit configuration in FIG.15.

Embodiment 1

[0047] Also, since the current-supply information-measuring unit 30 is arranged on the terminal portion 33 which is positioned at a lower position than a surface of the circuit breaker main body 1 (the left side direction in FIG.2), it is not protruded to the surface side of the circuit breaker main body 1 and no unevenness appears on the external appearance. Also, since the case portion 32 is formed to have an L-shaped sectional shape, the first printed board 39a and the second printed board 39b can be installed effectively in the case portion 32. In addition, since the case portion 32 comes into contact with both the circuit breaker main body 1 and the conductors 34, it has good stability. [0048] FIG.14 is a sectional view of a circuit breaker with a current-supply information measuring unit in an embodiment 6 of the present invention, taken along the same position as FIG.2. [0049] FIG.15 is a side view of a circuit breaker with a current-supply information measuring unit in the prior art. [0050] FIG.16 is a block diagram of a circuit configuration in FIG.15.

Embodiment 1

[0051] As described above, according to the circuit breaker with the current-supply information measuring unit of the present invention, there is no necessity to install previously the measuring current transformer 18 in the inside of the circuit breaker main body 1 and the circuit breaker with the current-supply information measuring unit without the cables can be obtained. [0052] As described above, according to the circuit breaker with the current-supply information measuring unit of the present invention, there is no necessity to install previously the measuring current transformer 18 in the inside of the circuit breaker main body 1 and the circuit breaker with the current-supply information measuring unit without the cables can be obtained. [0053] Also, since the current-supply information-measuring unit 30 is arranged on the terminal portion 33 which is positioned at a lower position than a surface of the circuit breaker main body 1 (the left side direction in FIG.2), it is not protruded to the surface side of the circuit breaker main body 1 and no unevenness appears on the external appearance. Also, since the case portion 32 is formed to have an L-shaped sectional shape, the first printed board 39a and the second printed board 39b can be installed effectively in the case portion 32. In addition, since the case portion 32 comes into contact with both the circuit breaker main body 1 and the conductors 34, it has good stability.
Embodiment 2

[0050] FIG. 4 is a perspective exploded view of a pertinent portion of a circuit breaker with a current-supply information measuring unit in an embodiment 2 of the present invention. FIG. 5 is a sectional view taken along the same position as FIG. 2. FIG. 6 is a sectional view taken along the same position as FIG. 3. FIG. 7 is a perspective view viewed from the load side after the current-supply information measuring unit and conductors are removed. FIG. 8 is a partial perspective view showing mutual positions of conductors, a first core, a second core, a first printed board, and the Hall element.

[0051] In Figures, 36a is a first core which is formed of magnetic substance, e.g., iron and which is formed like a substantial U-shape to have an opening end 37 opened on the upper surface side of the circuit breaker main body 1 (shown in FIG. 7), and is arranged in the circuit breaker main body 1 to enclose the terminal portion 33 and the conductor 34. 36b is a second core which is formed of magnetic substance, e.g., iron and which is jointed to the first core 36a while holding an air gap 37a defined strictly at the center position of the opening end 37 of the first core 36a, and is arranged in the case portion 32 (shown in FIG. 8).

[0052] In this manner, the first core 36a and the second core 36b constitute a continuous magnetic circuit. In this case, same numbers are affixed to same parts as the embodiment 1 of the present invention or equivalent parts, and their explanation will be omitted.

[0053] A current-supply information measuring unit 300 constructed as above can be easily fitted to the circuit breaker main body 1 by fitting screws 31, and the current-supply information are measured by following procedures.

[0054] When the load current is supplied from the terminal portion 33 to the conductor 34, the magnetic fluxes are generated in the circumferential direction of the conductor 34 based on the Ampere’s law. The magnetic fluxes are concentrated by the first core 36a and the second core 36b constituting the magnetic circuit in the circumferential direction of the conductor 34 and are intersected with them (indicated by B in FIG. 6). When the magnetic fluxes are intersected with the Hall element 38 arranged in the air gap 37a, the Hall element 38 generates the voltage in proportion to the intersected magnetic flux, and the voltage is input into the current A/D converting circuit (not shown) via the first printed board 39a. The current-supply information are displayed on the display 40 according to the similar procedures to the embodiment 1.

[0055] According to the above-mentioned circuit breaker with the current-supply information measuring unit of the present invention, the magnetic fluxes generated in the circumferential direction of the conductor 34 are concentrated by the first core 36a and the second core 36b constitute the magnetic circuit in the circumferential direction of the conductor 34 and are intersected with the Hall element 38. Therefore, the load current flowing through the conductors 34 can be detected without fail.

[0056] The first core 36a and the second core 36b may be formed integrally like a substantial C-shape. The first core 36a and the second core 36b may be arranged in either the circuit breaker main body 1 or the case portion 32.

Embodiment 3

[0057] FIG. 9 is a partial enlarged view showing mutual positions of a first core, a second core, a first printed board, and a Hall element in the circuit breaker with the current-supply information measuring unit in an embodiment 3 of the present invention. In FIG. 9, a first core 136a and a second core 136b are series-connected and arranged, and an air gap 137a is provided to one of the jointed portions. The Hall element 138 is electrically connected to a first printed board 139a and fixed thereto such that it can be positioned in the almost middle of the air gap 137a. The first core 136a, the second core 136b, and the first printed board 139a are arranged in the case portion 32 and the circuit breaker main body 1 by the similar method to the above embodiment 2, and execute their operations in the similar procedures.

[0058] According to the above-mentioned circuit breaker with the current-supply information measuring unit of the present invention, the air gap 137a is formed not to divide the second core 136b. Therefore, a configuration is simple and also dimension management of the air gap 137a is easy.

Embodiment 4

[0059] FIG. 10 is a partial perspective view of the neighborhood of clamping screws in a circuit breaker with a current-supply information measuring unit in an embodiment 4 of the present invention. In FIG. 10, a clamping screw 135 is clamped onto a terminal portion 33 and projected to pass through an insulating tube 237, and a wiring on the load side can be connected to a top end portion 135a. A first core 236a has a lower end portion whose shape is extended like the substantial U-shape in the direction perpendicular to the projected direction of the clamping screw 135 not to contact to the clamping screw 135 and an insulating tube 237. The first core 236a, the second core 236b, and the first printed board 239a are arranged in the case portion 32 and the circuit breaker main body 1 by the similar method to the above embodiment 2, and execute their operations in the similar procedures.

[0060] According to the above-mentioned circuit breaker with the current-supply information measuring unit of the present invention, this circuit breaker can meet the system in which wirings on the load side are applied in the bottom surface direction (the right side direction in FIG. 2) of the circuit breaker main body 1.
A/D converting circuit (not shown) via the first printed element 38 arranged in the air gap 37a, the Hall element intersected with them (indicated by C in FIG. 11. Where circumferential direction of the conductor 34 and are in second core 336b constituting the magnetic circuit in the fluxes are concentrated by the first core 336a and the conductor 34 based on the Ampere’s law. The magnetic are generated in the circumferential direction of the conductor 34 or the conductor 34 that is the conductive portion other than the clamping screws 35. The convex jointed portions 336a10 and the concave jointed portion 336b10 of the second core 336b can be easily fitted to each other. When the convex jointed portions 336a10 provided to both ends of the first core 336a are fitted to a pair of concave jointed portion 336b10 of the second core 336b respectively, the first core 336a and the second core 336b are arranged to surround the conductor 34, and thus the continuous magnetic circuit can be formed.

The current-supply information measuring unit 301 constructed as above can be easily fitted to the circuit breaker main body 1 by the fitting screws 31, and the current-supply information can be measured according to following procedures.

When the load current is supplied from the terminal portion 33 to the conductor 34, the magnetic fluxes are generated in the circumferential direction of the conductor 34 based on the Ampere’s law. The magnetic fluxes are concentrated by the first core 336a and the second core 336b constituting the magnetic circuit in the circumferential direction of the conductor 34 and are intersected with them (indicated by C in FIG. 11. Where the magnetic flux is obliquely illustrated in explanation). When the magnetic fluxes are intersected with the Hall element 38 arranged in the air gap 37a, the Hall element 38 generates the voltage in proportion to the intersected magnetic flux, and the voltage is input into the current A/D converting circuit (not shown) via the first printed board 139a. The current-supply information are displayed on the display 40 according to the similar procedures to the embodiment 1. Also, the temperature detected by the contact jigs 41 is converted into the electric signal by the temperature sensor 45, and then the temperature of the clamping screws 35 is displayed by the display 40. In addition, the vibration caused by the breaking operation executed when the overcurrent is supplied to the circuit breaker main body 1 is detected by the vibration sensor 46 provided to the second printed board 139b, and the breaking number of times is displayed.

According to the circuit breaker with the current-supply information measuring unit constructed as above, there is no necessity to provide previously the first core 336a in the inside of the circuit breaker main body 1, and the current-supply information measuring unit can be installed into the standard circuit breaker, in which the instrument current transformer 18 is not built, as the additional fixture. Also, the trouble because of looseness of the screws can be sensed previously by displaying the temperature of the clamping screws 35, and also maintenance management of the circuit breaker main body 1 can be facilitated by displaying the breaking number of times.

The temperature may be detected by bringing the contact jigs 41 into contact with the terminal portion 33 or the conductor 34 that is the conductive portion other than the clamping screws 35. In the above explanation, the case where the current-supply information are displayed by the display 40 is described. But the information may be collected at the remote place by providing a communicating means in place of the display 40 to send out the current-supply information to the remote place.

In addition, the temperature sensor 45 and the vibration sensor 46 may be provided to the current-supply information measuring unit in the embodiment 1, the embodiment 2, the embodiment 3, and the embodiment 4. The convex jointed portions 336a10 and the concave jointed portion 336b10 may be provided to the first core and the second core in the embodiment 2, the embodiment 3, and the embodiment 4 and are jointed to each other.

In FIG.14, 302 is a current-supply information measuring unit. The Hall element 38, a first printed board 239a on which the voltage converter 42 and the electronic circuit portion 43 are mounted, the display 40. In addition, the temperature sensor 45 and the vibration sensor 46 may be provided to the current-supply information measuring unit in the embodiment 1, the embodiment 2, the embodiment 3, and the embodiment 4. The convex jointed portions 336a10 and the concave jointed portion 336b10 may be provided to the first core and the second core in the embodiment 2, the embodiment 3, and the embodiment 4 and are jointed to each other.

Embodiment 6

FIG.14 is a sectional view of a circuit breaker with a current-supply information measuring unit in an embodiment 6 of the present invention, taken along the same position as FIG.2.

In FIG.14, 302 is a current-supply information measuring unit. The Hall element 38, a first printed board 239a on which the voltage converter 42 and the electronic circuit portion 43 are mounted, the display 40 (not shown), the contact jigs 41 whose top ends come into contact with the clamping screws 35, and a second printed board 239b on which the temperature sensor 45
and the vibration sensor 46 are mounted are installed in a case portion 232 consisting of a mold case 232a and a cover 232b.

**[0073]** 134 is a conductor which has a substantial U-shaped portion 134a and is clamped and fixed to the terminal portion 33 of the circuit breaker main body 1 by the clamping screws 35, and is arranged at the position such that the Hall element 38 mounted on the first printed board 239a can be enclosed by the substantial U-shaped portion 134a.

**[0074]** The current-supply information measuring unit 302 constructed as above can be easily fitted to the circuit breaker main body 1 by the fitting screws 31, and the current-supply information can be measured according to following procedures.

**[0075]** When the load current is supplied from the terminal portion 33 to the conductor 34, the magnetic fluxes are generated in the circumferential direction of the conductor 34 based on the Ampere's law. The magnetic fluxes are generated by respective straight portions of the substantial U-shaped portion 134a of the conductor 34 (indicated by D, E and F), and the composite magnetic fluxes intersects with the Hall element 38. The Hall element 38 generates the voltage in proportion to the intersected magnetic flux, and the voltage is input into the current A/D converting circuit (not shown) via the first printed board 139a. The current-supply information are displayed on the display 40 according to the similar procedures to the embodiment 1.

**[0076]** According to the circuit breaker with the current-supply information measuring unit constructed as above, the composite magnetic fluxes of the magnetic fluxes generated by respective straight portions of the substantial U-shaped portion 134a intersect with the Hall element 38. Therefore, the load current flowing through the conductor 134 can be detected without fail.

**Industrial Applicability**

**[0077]** As described above, according to the circuit breaker with the current-supply information measuring unit of the present invention, since the current-supply information measuring unit can be detachably attached to the terminal portion of the circuit breaker main body, there is no necessity to provide previously the measuring current transformer in the inside of the circuit breaker main body and no cable is needed. Therefore, the circuit breaker with the current-supply information measuring unit which has a small external dimension and is low in cost can be provided.

**[0078]** Also, the trouble caused by the looseness of the clamping screws can be sensed in advance by displaying the temperature of the clamping screw portions on the display.

**[0079]** In addition, since the breaking number of times can be displayed by detecting the vibration generated when the breaking operation is executed because of the supply of the overcurrent, the maintenance management of the circuit breaker main body can be facilitated.

**[0080]** The current-supply information measuring unit of the present invention may be installed into the equipment, that is fitted to the distribution line through which the load current is supplied, other than the circuit breaker.

**Claims**

1. A circuit breaker with a current-supply information measuring unit comprising:

   a circuit breaker main body for turning on/off a load current;
   a conductor clamped/fixed to a terminal portion of the circuit breaker main body by clamping members;
   a current-supply information measuring unit including a case portion in which a Hall element for detecting magnetic fluxes generated by the load current and converting them into an electric signal, an electronic circuit portion for processing the electric signal of the Hall element, and an outputting means for outputting a processed result are installed;
   wherein the current-supply information measuring unit is arranged or constructed attachably and detachably in vicinity of the circuit breaker main body.

2. A circuit breaker with a current-supply information measuring unit according to claim 1, further comprising contact jigs that come into contact with the conductor or the clamping members to detect a phase voltage, and
   wherein a voltage signal detected by the contact jigs and the electric signal from the Hall element are processed by the electronic circuit portion.

3. A circuit breaker with a current-supply information measuring unit according to claim 1, further comprising a first core for leading the magnetic fluxes generated by the load current to the Hall element and a second core for leading the magnetic fluxes to cooperate with the first core.

4. A circuit breaker with a current-supply information measuring unit according to claim 3, wherein the first core is for leading the magnetic fluxes generated by the load current to the Hall element provided in the circuit breaker main body, and the second core for leading the magnetic fluxes to cooperate with the first core is installed in the case portion.

5. A circuit breaker with a current-supply information measuring unit according to claim 4, wherein the first core is formed to have a substantial U-shape.
and the second core is provided on both end surfaces of the first core to have an air gap, and the Hall element is arranged in this air gap.

6. A circuit breaker with a current-supply information measuring unit according to claim 4, wherein the first core and the second core are formed to have a substantial U-shape and an air gap is provided to any one of jointed portions of the first core and the second core, and the Hall element is arranged in this air gap.

7. A circuit breaker with a current-supply information measuring unit according to claim 3, wherein the first core and the second core are jointed to enclose the conductor on an outside of the circuit breaker main body.

8. A circuit breaker with a current-supply information measuring unit according to claim 7, wherein the first core is installed in a split case and the second core is installed in the case portion, and the split case is inserted into a fitting hole provided in the case portion.

9. A circuit breaker with a current-supply information measuring unit according to claim 1, wherein the conductor has a substantial U-shape portion, and the substantial U-shape portion is arranged to enclose the Hall element.

10. A circuit breaker with a current-supply information measuring unit according to claim 3, wherein jointed portions of the first core and the second core have a concave shape and a convex shape respectively.

11. A circuit breaker with a current-supply information measuring unit according to claim 2, wherein a temperature of the contact portion is measured by using the contact jigs and output by the outputting means.

12. A circuit breaker with a current-supply information measuring unit according to claim 1, wherein a vibration sensor is provided in the case portion, and an on/off operation number of times of a circuit breaker is counted and output by an outputting means.
FIG. 1

POWER SOURCE SIDE

LOAD SIDE
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
   Int.Cl* H01H73/00, H01H73/12, H01H83/02

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)
   Int.Cl* H01H73/00, H01H73/12, H01H83/02

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>X</td>
<td>JP, 5-47869, U (Siemens AG.), 25 June, 1993 (25. 06. 93), Claims 1 to 8 (Family: none)</td>
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<td>JP, 63-137435, U (Fuji Electric Co., Ltd.), 9 September, 1988 (09. 09. 88), Figs. 1 to 3 (Family: none)</td>
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[X] Further documents are listed in the continuation of Box C. □ See patent family annex.

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Date of the actual completion of the international search 14 September, 1999 (14. 09. 99)
Date of mailing of the international search report 28 September, 1999 (28. 09. 99)

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**International application No.**
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<tr>
<th>Category*</th>
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<tbody>
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<td>Y</td>
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</tbody>
</table>

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