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(54) **OVERHEATING COUNTERMEASURE METHOD FOR ELECTRICAL OUTLET, AND ELECTRICAL OUTLET**

(57) The present invention is an overheating countermeasure method for an electrical outlet 10A that comprises a blade receiving spring block 42a in which a plug blade S of an insertion plug P is inserted thereto and removed therefrom. The blade receiving spring block 42a is provided with a temperature sensor 54, which detects heat generation between the blade receiving spring block 42a and the plug blade S, or detects heat generation of the insertion plug P inserted into the plug blade S, via the plug blade S of the insertion plug P. In a case where the detected heat generation has reached a prescribed temperature or higher, notification of an abnormality and/or cutting off of the power supply to the blade receiving spring block 42a is performed.

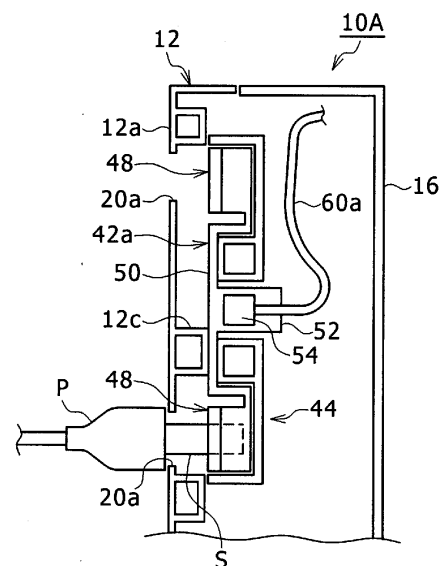


FIG. 16

Description

TECHNICAL FIELD

[0001] The present disclosure relates to an overheating countermeasure method for an electrical outlet, and to an electrical outlet.

BACKGROUND

[0002] As electric current is always flowing through an electrical outlet for supplying electric power to a household electrical appliance, such as a refrigerator, that continuously requires electric power, the household electrical appliance is likely to generate heat when its insertion plug, for example, is in an abnormal condition. Specifically, heat generation may occur when the insertion plug is not correctly inserted into the electrical outlet, which increases resistance, for example, between a plug blade of the insertion plug and a blade receiving unit of the electrical outlet. Heat generation may also occur due to deterioration of the insertion plug itself over time or due to thermal degradation of electric lines within the plug, such as undercaulking of the electric lines. Here, known conventional techniques that focus on heat generation within an electrical outlet include an electrical outlet including a temperature sensor component and configured to notify abnormality stepwise (see Patent Document 1).

CITATION LIST

PATENT LITERATURE

[0003] [Patent Document 1] Japanese Utility Model Registration No. 3190957

SUMMARY

[TECHNICAL PROBLEM]

[0004] Patent Document 1 listed above discloses that a configuration including a temperature sensor component in contact with a power source electrical outlet module enables detection of abnormal heat generation associated with poor heat radiation and circuit deterioration. However, no techniques have been known that detect abnormal heat generation between a plug blade of the insertion plug and a blade receiving unit of the electrical outlet or within the insertion plug, caused by an excessive number of insertions and removals of the insertion plug or application of unintended load to the insertion plug. Also, there have been no techniques that focus on deformation of an electrical outlet cover member disposed in contact with the insertion plug, caused by the abnormal heat generation described above.

[0005] Embodiments of the disclosure are directed toward providing an overheating countermeasure method and an overheating detecting electrical outlet, for over-

heating in an insertion plug and overheating between a plug blade of the insertion plug and a blade receiving unit of an electrical outlet, that take into consideration deformation of an electrical outlet cover member, for example.

[SOLUTION TO PROBLEM]

[0006] In accordance with an aspect of the disclosure, an overheating countermeasure method for an electrical outlet is an overheating countermeasure method for an electrical outlet including a blade receiving unit through which a plug blade of an insertion plug is inserted and removed. The method includes, with a temperature sensor disposed on the blade receiving unit, detecting heat generation between the blade receiving unit and the plug blade, or detecting heat generation of the insertion plug inserted in the plug blade, via the plug blade of the insertion plug; and, when the heat generation that is detected reaches a predetermined temperature or a higher temperature, performing notification of abnormality and/or interruption of power supply to the blade receiving unit.

[0007] In accordance with another aspect of the disclosure, an electrical outlet includes a blade receiving unit through which a plug blade of an insertion plug is inserted and removed. The electrical outlet includes a temperature sensor in contact with the blade receiving unit and configured to detect heat generation between the blade receiving unit and the plug blade or to detect heat generation of the insertion plug inserted in the plug blade, via the plug blade of the insertion plug; a notification unit configured to notify abnormality and/or an interruption unit configured to interrupt power supply to the blade receiving unit; and a controller configured to execute notification by the notification unit and/or interruption of power supply by the interruption unit, when the heat generation detected by the temperature sensor reaches a predetermined temperature or a higher temperature.

[ADVANTAGEOUS EFFECTS]

[0008] The overheating countermeasure method for an electrical outlet and the electrical outlet according to the disclosure detect abnormal heat generation within an insertion plug and between a plug blade of the insertion plug and a blade receiving unit of the electrical outlet and perform notification and/or interruption of electric power supply, thereby enhancing safety of electric power supply indoors.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

[FIG. 1] FIG. 1 is an overall perspective view of an electrical outlet according to a first embodiment that is set with a decorative cover.

[FIG. 2] FIG. 2 is a front view of the electrical outlet illustrated in FIG. 1.

[FIG. 3] FIG. 3 is an exploded perspective view of the electrical outlet, with an electrical outlet body cover and an electrical outlet outer cover being removed.

[FIG. 4] FIG. 4 is a front view of the electrical outlet, with the electrical outlet body cover and the electrical outlet outer cover being removed.

[FIG. 5] FIG. 5 is an exploded perspective view of the electrical outlet illustrated in FIG. 4, with a casing being removed.

[FIG. 6] FIG. 6 is a perspective view of the electrical outlet illustrated in FIG. 5, with a body member and an open/close unit housing being removed.

[FIG. 7] FIG. 7 is a side view of the open/close unit in a closed circuit state.

[FIG. 8] FIG. 8 is a side view of the open/close unit in an open circuit state.

[FIG. 9] FIG. 9 is a perspective view illustrating a terminal portion of the electrical outlet in a partially exploded state.

[FIG. 10] FIG. 10 is a perspective view illustrating a temperature sensor mounting structure of the electrical outlet.

[FIG. 11] FIG. 11 is a partially cut plan view of the temperature sensor mounting structure illustrated in FIG. 10.

[FIG. 12] FIG. 12 is an exploded perspective view illustrating a blade receiving spring block and a body member.

[FIG. 13] FIG. 13 is a perspective view illustrating one blade receiving spring block assembled in the body member.

[FIG. 14] FIG. 14 is an exploded perspective view illustrating one blade receiving spring block and the body member.

[FIG. 15] FIG. 15 is an enlarged perspective view illustrating part of the terminal portion.

[FIG. 16] FIG. 16 is a partial cross section illustrating an electrical outlet according to a second embodiment.

DESCRIPTION OF EMBODIMENTS

[0010] Embodiments of the present disclosure will be described below by reference to the drawings. In the following description, specific shapes, materials, numerical values, and directions, for example, are only illustrative for the purpose of facilitating understanding of the disclosure and may be modified as appropriate in accordance with usage, purposes, specifications, and the like. Further, combined use of features of a plurality of embodiments and modification examples in the following description is originally assumed.

[0011] FIG. 1 is an overall perspective view of an electrical outlet 10 according to a first embodiment, which is mounted with a decorative cover. FIG. 2 is a front view of the electrical outlet 10 illustrated in FIG. 1. In FIGs. 1 and 2 (and other drawings), an arrow X indicates a width direction (or left and right direction), an arrow Y indicates

a front and rear direction (or depth direction), and an arrow Z indicates a length direction (or height direction). These three directions are orthogonal to one another. Note that these directions are only examples, and do not substantially define a configuration of the electrical outlet according to the present disclosure.

[0012] As illustrated in FIG. 1 and FIG. 2, the electrical outlet 10 is formed in a rectangular solid having a vertically elongated shape in a front view as seen from the front. The electrical outlet 10 has a dimension defined by the Japanese Industrial Standard (JIS). The electrical outlet 10 is mounted in a state where it is buried in a wall, for example.

[0013] The electrical outlet 10 includes, along its peripheral edge on a front surface, a decorative cover 2 having a rectangular frame shape. The decorative cover 2 is composed of a resin mold, for example. The decorative cover 2, which is disposed along the peripheral edge of the electrical outlet 10, prevents viewing of a hole on the wall in which the electrical outlet 10 is mounted and an attachment (not shown) used to mount the electrical outlet 10 in the hole, thereby enhancing the appearance.

[0014] FIG. 3 is an exploded perspective view of the electrical outlet 10 with an electrical outlet body cover and an electrical outlet outer cover being removed. As illustrated in FIG. 1 to FIG. 3, the electrical outlet 10 includes an electrical outlet body cover (cover member) 12 and an electrical outlet outer cover (cover member) 14. The electrical outlet body cover 12 and the electrical outlet outer cover 14 are both composed of a resin mold.

[0015] The electrical outlet body cover 12 is disposed to cover a front face of the electrical outlet 10 and includes an upper cover 12a and a lower cover 12b. The upper cover 12a covers a front portion of a blade receiving spring block housed within a casing, which will be described below.

[0016] The upper cover 12a includes plug blade insertion portions 18a and 18b in the upper and lower levels, respectively. In the plug blade insertion portion 18a in the upper level, plug blade insertion ports 20a and 20b into which two planar plug blades of the insertion plug (not shown) are inserted are arranged laterally side by side. In the plug blade insertion portion 18b in the lower level, plug blade insertion ports 20a and 20b into which two planar plug blades of the insertion plug are inserted are arranged laterally side by side, and also an earthing terminal insertion port 20c into which a rod shape terminal for earthing is inserted is formed below the space between the plug blade insertion ports 20a and 20b. In the present embodiment, one plug blade insertion port 20a has an opening edge having a substantially D-shaped frame shape as seen in a front view, while the other plug blade insertion port 20b has an opening edge having a rectangular frame shape. However, the plug blade insertion ports are not limited to this example, and these plug blade insertion ports 20a and 20b may have opening edges of the same shape.

[0017] The lower cover 12b forming part of the electrical outlet body cover 12 covers a terminal portion 100 housed within a casing 16. The lower cover 12b includes, on its top surface, letters of "earthing" and "open", and a mark indicating earthing. The lower cover 12b is detachable from the upper cover 12a. Specifically, two attachment pins 13 integrally formed with the lower cover 12b are inserted into attachment holes 15 formed in the upper cover 12a to thereby attach the lower cover 12b to the upper cover 12a. When the lower cover 12b is removed from the electrical outlet 10, the earthing terminal portion of the terminal portion 100 is exposed. This places the electrical outlet 10 in a state where external electrical lines for earthing are connectable.

[0018] The electrical outlet outer cover 14 has a C-shape in a front view and is disposed adjacent to three outer sides, that is, an upper side, a left side, and a lower side, of the electrical outlet body cover 12. The electrical outlet outer cover 14 covers a front face of an open/close unit 70. The electrical outlet outer cover 14 includes an opening portion 14a having a vertically elongated shape and a round through hole 14b located above the opening portion 14a. An operation lever 71 of the open/close unit 70 is disposed in an exposed state within the opening portion 14a. A press switch mounted on a substrate, which will be described below, is disposed inside (that is, behind) the through hole 14b. This structure allows the press switch to be depressed by inserting a thin stick tool or a tip of a pen into the through hole 14b.

[0019] The electrical outlet outer cover 14 includes, above the through hole 14b, indications "POWER" and "ABNORMAL". A region above the indication "POWER" forms a power light portion 14c which lights up in green, for example, during supply of power source to the electrical outlet 10. A region above the indication "ABNORMAL" forms an abnormal light portion 14d which lights up or blinks in red at the time of abnormal heat generation of the electrical outlet 10. While the power light portion 14c and the abnormal light portion 14d are transparent portions where light transmits through a wall of the electrical outlet outer cover 14, they may be formed as translucent windows composed of through holes, respectively.

[0020] FIG. 4 is a front view of the electrical outlet 10 with the electrical outlet body cover 12 and the electrical outlet outer cover 14 being removed. FIG. 5 is an exploded perspective view of the electrical outlet 10 illustrated in FIG. 4 with the casing 16 being removed.

[0021] The electrical outlet 10 includes the casing 16 which is composed of a resin mold, for example. As illustrated in FIGs. 3 and 4, the casing 16 has an outer shape of a rectangular solid, having a bottom face on the back and being opened toward the front.

[0022] As illustrated in FIGs. 3 and 4, the casing 16 includes engaging portions 22 protruding outward on the outer surface thereof along long sides of the casing 16. Each side surface has two engaging portions 22 arranged at an interval. The electrical outlet body cover 12 is attached to the casing 16 by engaging hooks (not

shown) of the electrical outlet body cover 12 with these engaging portions 22.

[0023] As illustrated in FIG. 5, two column portions 26 stand on a bottom face 24 of the casing 16, with an interval between them in the height direction Z. The casing 16 includes a space 28 that houses the open/close unit 70, which is segmented between these column portions 26 and a casing inner face 25a on one side of the casing 16 in the width direction X. The casing 16 further includes a space 30 that houses a blade receiving spring unit 40 and a substrate 120, for example, which is segmented between the column portions 26 and a casing inner surface 25b on the other side.

[0024] The casing 16 further includes, in the lower part of the bottom face 24, a protruding partitioning wall portion 27 having an L shape as viewed from the front. The partitioning wall portion 27 defines a space 32 that houses the terminal portion 100 within the casing 16.

[0025] The casing 16 further includes, on the bottom face 24, a plurality of support protrusions 29. The support protrusions 29 support, with their tip faces, the substrate 120 housed in the casing 16.

[0026] FIG. 6 is a perspective view illustrating the electrical outlet illustrated in FIG. 5, with the body member and the open/close unit housing being removed. As illustrated in FIG. 4 to FIG. 6, the electrical outlet 10 includes the blade receiving spring unit 40, the open/close unit 70, and the substrate 120. The electrical outlet 10 may further include an earthing terminal portion 102.

[0027] The blade receiving spring unit 40 includes two blade receiving spring blocks (blade receiving units) 42a and 42b, a body member 44 supporting these blade receiving spring blocks 42a and 42b, and a fixing member 46 that presses the blade receiving spring blocks 42a and 42b onto the body member 44 for fixing. In a preferable example, the body member 44 and the fixing member 46 are composed of insulative resin molds. The blade receiving spring blocks 42a and 42b may be pinched by a pair of claw portions disposed on the body member 44 and held or fixed.

[0028] A first blade receiving spring block 42a is a terminal member electrically connected with a voltage phase (hereinafter, referred to as L-phase) external power source line that is connected with the terminal portion 100 of the electrical outlet 10. A second blade receiving spring block 42b is a terminal member electrically connected with a neutral phase (hereinafter, referred to as N-phase) external power source line that is connected with the terminal portion 100 of the electrical outlet 10. The blade receiving spring blocks 42a and 42b are produced by machining a metal plate such as sheet copper by punching and folding, for example.

[0029] The blade receiving spring blocks 42a and 42b may have an identical shape. Therefore, in the following, the configuration of the first blade receiving spring block 42a will be mainly described while description of the second blade receiving spring block 42b will be omitted as appropriate.

[0030] The blade receiving spring block 42a includes two pairs of blade receiving springs 48, a coupling portion 50 for mechanically coupling and electrically connecting the blade receiving springs 48, and a connecting terminal portion 52 formed by bending from the edge of the coupling portion 50 along the front and rear direction, all of which are integrally formed.

[0031] A first pair of blade receiving springs 48 in the L-phase blade receiving spring block 42a are disposed inside the plug blade insertion port 20a formed on the right side in the upper level in the upper cover 12a. A second pair of blade receiving springs 48 are disposed inside the plug blade insertion port 20a formed on the right side in the lower level in the upper cover 12a (see FIG. 2).

[0032] The first pair of blade receiving springs 48 in the N-phase blade receiving spring block 42b are disposed inside the plug blade insertion port 20b formed on the left side in the upper level in the upper cover 12a. The second pair of blade receiving springs 48 are disposed inside the plug blade insertion port 20b formed on the left side in the lower level in the upper cover 12a (see FIG. 2).

[0033] As illustrated in FIG. 6, an L-phase conductor 54a is connected, at its first end, by soldering, for example, to the connection terminal portion 52 of the L-phase blade receiving spring block 42a. Further, an N-phase conductor 54b is connected, at its first end, by soldering, for example, to the connection terminal portion 52 (not shown) of the N-phase blade receiving spring block 42b. In a preferable example, the L-phase conductor 54a and the N-phase conductor 54b are composed of an insulating-coated braided copper wire, for example. The L-phase conductor 54a and the N-phase conductor 54b are connected, at their respective second ends, to the open/close unit 70.

[0034] Further, a temperature sensor 54 is disposed on the connection terminal portion 52 of each of the blade receiving spring blocks 42a and 42b with a clip 56 (see FIG. 11). The mounting structure of the temperature sensor 54 will be specifically described below. The temperature sensors 54 measure the temperatures of the blade receiving spring blocks 42a and 42b, respectively, and transmit the measurement results, via signal lines 60a and 60b, respectively, to the substrate 120.

[0035] The substrate 120 is a circuit board having pattern lines, which are not shown, formed therein. A controller 122 is mounted on the substrate 120. The controller 122 determines, based on the measurement results transmitted from the temperature sensors 54, whether or not the temperatures of the blade receiving spring blocks 42a and 42b exceed a predetermined threshold temperature (predetermined temperature). When the temperature of at least one blade receiving spring block 42a or 42b exceeds the predetermined threshold temperature, the controller 122 determines that the electrical outlet 10 is in an overheating state, and transmits an operating signal, via a signal line 60c to the open/close unit which

will be described below.

[0036] The predetermined threshold temperature may be set to 100°C to 150°C, for example, in accordance with the upper limit temperature, for example, of a resin material forming the electrical outlet body cover 12 and the body member 44 of the electrical outlet 10. The predetermined threshold temperature may be changed depending on the environmental temperature (or ambient temperature) at which the electrical outlet 10 is used. The substrate 120 may include a buzzer. Upon determining that the electrical outlet 10 is in an overheating state in which at least one of the blade receiving spring blocks 42a and 42b has a temperature exceeding the predetermined threshold temperature and generates heat, the controller 122 may cause an abnormal light emitting portion 136 to light up or blink and simultaneously cause the buzzer to make a sound for performing notification operation. The resin material forming the cover member such as the electrical outlet body cover 12 and the body member 44, for example, may be a melamine resin, a urea resin, or polybutylene terephthalate (PBT), for example.

[0037] In a preferable example, the controller 122 in the disclosure is composed of a computer which includes, as a main hardware configuration, a processor that operates in accordance with a program. Any type of processor that is capable of implementing functions by execution of a program may be employed. The processor is composed of one or more electronic circuits including a semiconductor integrated circuit (IC) or Large Scale Integration (LSI). A plurality of electronic circuits may be integrated in a single chip or may be mounted in a plurality of chips. A plurality of chips may be collected in a single device or may be provided in a plurality of devices. The program is recorded in a non-transitory computer readable recording medium such as ROM, an optical disc, or a hard disc drive. The program may be prestored in a recording medium or may be supplied to a recording medium via a wide area network including the Internet.

[0038] As illustrated in FIG. 6, two signal lines 62a and 62b extend from a rear side of the substrate 120. Signals indicative of the measurement results supplied by the temperature sensor 54 and the operation state (on/off state) of the open/close unit 70 may be transmitted, via these signal lines 62a and 62b, to a power controller and a panel board disposed externally of the electrical outlet 10.

[0039] While the present embodiment describes an example in which the substrate 120 has a function to detect the overheating state of the electrical outlet 10 as an abnormal state, the disclosure is not limited to this example. The electrical outlet may have a seismoscopic function to interrupt supply of electric power upon detection of an earthquake of a predetermined intensity or more as an abnormal state. In this case, the earthquake intensity may be measured by a seismoscope that is capable of detecting acceleration, such as a gyro sensor, for example, disposed on the substrate or other portions inside the electrical outlet. The seismoscope is connected to

the controller on the substrate via the pattern lines on the substrate or the signal lines. Upon determining occurrence of an earthquake of the predetermined intensity or greater based on an input from the seismoscope, the controller outputs an operation signal to the open/close unit 70. The electrical outlet according to the disclosure may have such a seismoscopic function and the overheating detection function described above in combination or may include the seismoscopic function alone. Further, the electrical outlet according to the disclosure may have a current leakage detection function to interrupt the electric current upon detection of current leakage as an abnormal state, alone or in combination with the overheating detection function and the seismoscopic function described above. To detect the current leakage, the electrical outlet may be configured to include a current sensor and actuate the open/close unit when the electric current flowing in the blade receiving spring block exceeds a predetermined threshold current value.

[0040] Electrical outlets having the seismoscopic function and the current leakage detection function described above can share the electrical outlet constitutional components, other than the substrate, with electrical outlets without these functions, so that productivity of electrical outlets can be increased and manufacturing costs can be reduced.

[0041] As illustrated in FIG. 6, the electrical outlet 10 includes a switch panel 130 on which a press switch 132 is mounted. The press switch 132 is disposed inside the through hole 14b of the electrical outlet outer cover 14 (see FIG. 1 to FIG. 3) such that the press switch 132 can be manipulated by depression from outside of the electrical outlet 10 through the through hole 14b. The switch panel 130 is connected to the substrate 120 via the signal lines. When the press switch 132 is manipulated by depression, the substrate 120 transmits an operation signal to the open/close unit 70 which will be described below. This changes the state of the open/close unit 70 from the closed circuit state to the open circuit state to cause the press switch 132 to blink, indicating the abnormal state. Depression of the press switch 132 in this manner may be employed to check whether or not the electrical outlet 10 operates normally. Depression of the press switch 132 can further stop the buzzer notifying overheating.

[0042] The switch panel 130 includes a power light emitting portion 134 and the abnormal light emitting portion 136 mounted thereon. The power light emitting portion 134 is disposed opposite the inside face of the power light portion 14c of the electrical outlet outer cover 14, and the abnormal light emitting portion 136 is disposed opposite the inside face of the abnormal light portion 14d of the electrical outlet outer cover 14 (see FIG. 2). In a preferable example, the power light emitting portion 134 is composed of a light emitting diode (LED) that emits green light, for example. In a preferable example, the abnormal light emitting portion 136 is composed of a light emitting diode (LED) that emits red light, for example. The power light emitting portion 134 lights up when the

electrical outlet 10 is in a power source supply state. The abnormal light emitting portion 136 lights up or blinks when an abnormal state such as overheating is detected in the electrical outlet 10, as will be described below.

5 These emitting portions 134 and 136 form part of a notification unit with their lighting states being visually recognizable externally of the electrical outlet 10.

[0043] Referring now to FIG. 7 and FIG. 8, the open/close unit 70 will be described. FIG. 7 is a side view of the open/close unit 70 in a closed circuit state, and FIG. 8 is a side view of the open/close unit 70 in an opened state. FIGs. 7 and 8 illustrate the open/close unit 70 with a wall face covering its outer sides in the width direction being removed.

10 **[0044]** As illustrated in FIG. 7, the open/close unit 70 includes a housing 72. An operation lever 71 in its exposed state is rotatably mounted on a front face of the housing 72.

[0045] The open/close unit 70 includes, within the housing 72, a coil 73, a movable iron piece 74, a trigger lever 75, a support lever 76, an operation plate 77, a press spring 78, an operation member 79, pressure-contact springs 80 and 85, an L-phase movable terminal plate 81 and an L-phase movable terminal portion 82, an N phase movable terminal plate 83 and an N-phase movable terminal portion 84, an L-phase fixed terminal plate 86 and an L-phase fixed terminal portion 87, and an N-phase fixed terminal plate 88 and an N phase fixed terminal portion 89.

30 **[0046]** Electric power is supplied to the coil 73 when the coil 73 receives an operation signal from the substrate 120, which causes the coil 73 to generate magnetic force. The movable iron piece 74 is disposed at a location adjacent to the rear (lower portion in FIG. 7) of the coil 73 within the housing 72, such that the movable iron piece 74 can move in the forward and backward direction Y. The movable iron piece 74 is fixed to a first end portion 83a of the N-phase movable terminal plate 83. Here, the second end of the N-phase conductor 54b is electrically and mechanically coupled, by soldering, to the first end portion 83a of the N-phase movable terminal plate 83.

35 **[0047]** The trigger lever 75 has a substantially L shape, and is disposed rotatably about a shaft portion 75a on a side wall face in the width direction of the housing 72. The trigger lever 75 has a first end located at a position which is engageable with the movable iron piece 74.

40 **[0048]** The support lever 76 has a shape extending in the front and rear direction Y, and is disposed rotatably about a shaft portion 76a on the side wall face in the width direction of the housing 72. The support lever 76 has a first end located at a position such that it is engageable with a second end of the trigger lever 75.

45 **[0049]** The operation plate 77 is supported by the support lever 76 with a first end of the operation plate 77 in contact with a second end of the support lever 76. The operation plate 77 is coupled with a second end of the U shape press spring 78 whose first end is coupled with the operation lever 71, such that pressing force of the

press spring 78 urges the first end of the operation plate 77 into pressing contact with the second end of the support lever 76.

[0050] A torsion spring 90 is disposed around the rotation center of the operation lever 71. As will be described below, when the open/close unit 70 operates into a power interruption state, the operation lever 71 rotates by an urging force of the torsion spring 90 to protrude forward from the electrical outlet 10 as illustrated in FIG. 8.

[0051] As illustrated in FIG. 7, the operation member 79 is disposed adjacent to the support lever 76 and the operation plate 77 on the side wall in the width direction of the housing 72 so as to be rotatable about a shaft portion 79a. The operation member 79 has a rear end (the lower end in FIG. 7) that is urged by the pressure-contact spring 80. Thus, the operation member 79 is urged by the pressure-contact spring 80 into counterclockwise rotation in FIG. 7.

[0052] The operation member 79 is engageable with the L-phase movable terminal plate 81 at the substantially center portion thereof in the front and rear direction Y. The L-phase movable terminal plate 81 has a first end to which a second end of the L-phase conductor 54a is electrically and mechanically coupled by soldering, for example. The L-phase movable terminal plate 81 further has a second end to which the L-phase movable terminal portion 82 is fixed by caulking, for example.

[0053] The L-phase movable terminal plate 81 is pressed by the operation member 79 into a clockwise rotated position against the urging force of the pressure-contact spring 85. Thus, when the operation member 79 rotates counterclockwise by the urging force of the pressure-contact spring 80, the L-phase movable terminal plate 81 is released from the pressing force of the operation member 79 and is then pushed upward by the urging force of the pressure-contact spring 85.

[0054] The operation member 79 further presses an intermediate portion of the N-phase movable terminal plate 83. The N-phase movable terminal plate 83 has a second end to which the N-phase movable terminal portion 84 is fixed by caulking, for example. As will be described below, when the operation member 79 rotates counterclockwise, the N-phase movable terminal plate 83 is pushed upward by the rear end (the lower end in FIG. 7) of the operation member 79 to thereby move the N-phase movable terminal portion 84 forward (upward in FIG. 7).

[0055] As illustrated in FIG. 7, the L-phase movable terminal portion 82 is in contact with and electrically connected with the L-phase fixed terminal portion 87 disposed within the housing 72. The L-phase fixed terminal portion 87 is fixed to a first end of the L-phase fixed terminal plate 86 by caulking, for example. The L-phase fixed terminal plate 86 protrudes outward of the housing 72.

[0056] The N-phase movable terminal portion 84 is in contact with and electrically connected with the N-phase

fixed terminal portion 89 disposed within the housing 72. The N-phase fixed terminal portion 89 is fixed to the first end of the N-phase fixed terminal plate 88 by caulking, for example. The N-phase fixed terminal plate 88 protrudes outward of the housing 72.

[0057] The open/close unit 70 configured as described above operates such that, when electric power is supplied to the coil 73 in response to the operation signal from the substrate 120, the movable iron piece 74 is suctioned by the magnetic force of the coil 73 and moves in a direction indicated by an arrow A, as illustrated in FIG. 8.

[0058] This causes the movable iron piece 74 to push the trigger lever 75 at the first end for clockwise rotation. At this time, the support lever 76 is pushed by the second end of the trigger lever 75 and rotates counterclockwise.

[0059] This further causes the first end of the operation plate 77 supported on the upper end of the support lever 76 to be disengaged therefrom, pushing the operation plate 77 into a rearward (downward in FIG. 8) slanted state by the pressing force of the press spring 78. At this time, the reaction force of the press spring 78 and the urging force of the torsion spring 90 cause the operation lever 71 to rotate into a state where an end of the operation lever 71 protrudes on the front face of the electrical outlet 10.

[0060] Disengagement of the operation plate 77 from the support lever 76 causes the operation member 79 which has been pushed clockwise and is supported by the operation plate 77 to rotate counterclockwise by the urging force of the pressure-contact spring 80. This further causes the pressure-contact spring 85 to move, by its urging force, the L-phase movable terminal plate 81 to separate the L-phase movable terminal portion 82 from the L-phase fixed terminal portion 87. Simultaneously, the operation member 79 that is rotating counterclockwise pushes the N-phase movable terminal plate 83 upward to make the N-phase movable terminal portion 84 separate from the N-phase fixed terminal portion 89. Separation of the L-phase movable terminal portion 82 and the N-phase movable terminal portion 84 from the L-phase fixed terminal portion 87 and the N-phase fixed terminal portion 89, respectively, switches the open/close unit 70 from the closed-circuit state to the opened-circuit state. This results in interruption of power supply to the blade receiving spring block 42a and 42b, thereby turning off the electric power supplied from the electrical outlet 10, via the insertion plug, to loads such as household electric equipment. When the abnormal state is released and the operation lever 71 is manually manipulated to return the state illustrated in FIG. 8 back to the state illustrated in FIG. 7, the components within the open/close unit 70 also return from the state illustrated in FIG. 8 to the state illustrated in FIG. 7 to thereby allow the open/close unit 70 to return from the opened-circuit state to the closed-circuit state.

[0061] The configuration of the open/close unit 70 is not limited to the above example, and any circuit breaking mechanisms of known configuration may be employed.

[0062] FIG. 9 is a perspective view illustrating part of the terminal portion 100 of the electrical outlet 10 in an exploded state. The electrical outlet 10 includes the terminal portion 100. The terminal portion 100 is a coupling portion where external power source lines are electrically and mechanically coupled.

[0063] The terminal portion 100 includes the L-phase fixed terminal plate 86, the N-phase fixed terminal plate 88, lock springs 92 and 94, and an unlock member 96. The L-phase fixed terminal plate 86 includes, at the second end extending out of the housing 72 of the open/close unit 70, an L-phase coupling portion 86a that is bent into U shape. The N-phase fixed terminal plate 88 includes, at the second end extending out of the housing 72 of the open/close unit 70, an N-phase coupling portion 88a that is bent into U shape. The lock springs 92 and 94 are disposed inside the respective-phase coupling portions 86a and 88a. Thus, the respective phase coupling portions 86a and 88a turn into instantaneous connection terminals capable of quick connection, by inserting connection terminals of L-phase and N-phase external power source lines therein from rearward.

[0064] The unlock member 96, when being pushed, enables the lock springs 92 and 94 to be separated from the respective phase coupling portions 86a and 88a, respectively, thereby allowing removal of the connection terminals of the L-phase and N-phase external power source lines from the respective phase coupling portions 86a and 88a.

[0065] The terminal portion 100 further includes an earthing terminal portion 102. The earthing terminal portion 102 includes an earthing terminal plate 104 formed by punching and folding a metal plate such as sheet copper, for example. A screw 105 is screwed in a first end of the earthing plate 104 to enable connection of earthing external lines with the earthing terminal portion 102. An earthing blade receiving spring 106 is formed in the second end of the earthing terminal plate 104. The earthing blade receiving spring 106 is disposed inside the earthing terminal insertion port 20c formed in the lower level of the upper cover 12a of the electrical outlet body cover 12. This configuration enables connection, with the earthing terminal plate 104, of the earthing terminal of the insertion plug inserted through the earthing terminal insertion port 20c.

[0066] FIG. 10 is a perspective view illustrating a temperature sensor mounting structure of the electrical outlet. FIG. 11 is a partial cut plan view illustrating the temperature sensor mounting structure illustrated in FIG. 10. FIG. 12 is an exploded perspective view illustrating the blade receiving spring blocks 42a and 42b, and the body member 44. In FIG. 10 to FIG. 12, the fixing member 46 that forms the blade receiving spring unit 40 is not shown.

[0067] As illustrated in FIG. 10 to FIG. 12, the blade receiving spring unit 40 includes the L-phase blade receiving spring block 42a and the N-phase blade receiving spring block 42b, and the body member 44 that supports the blade receiving spring blocks 42a and 42b. The blade

receiving spring blocks 42a and 42b are symmetrical with each other with respect to a line B-B, which is a center line of the blade receiving spring unit 40 in the width direction. Therefore, while only the blade receiving spring block 42a will be described in the following, the description similarly applies to the blade receiving spring block 42b.

[0068] The blade receiving spring block 42a includes two pairs of the blade receiving springs 48, the coupling portion 50 that mechanically couples and electrically connects the blade receiving springs 48 together, and the connection terminal portion 52, which is bent along the front and rear direction Y from an edge of the coupling portion 50, which are integrally formed. The temperature sensor 54 is attached to the connection terminal portion 52.

[0069] In the present embodiment, the temperature sensor 54 is pinched and fixed by the clip 56, which is one example of a pressing member. This configuration allows the temperature sensor 54 to be disposed in close contact with the blade receiving spring block 42a which is a target of temperature measurement. The clip 56 integrally includes a pair of pinching pieces 56a, and a coupling portion 56b coupling the pinching pieces 56a.

[0070] The temperature sensor 54, which is thus pinched by the clip 56, is attached to the connection terminal portion 52, which is a target of temperature measurement, in a close contact state. This configuration results in an increase in accuracy of temperature measurement by the temperature sensor 54. This configuration further enables the blade receiving spring blocks 42a and 42b to be easily assembled on the body member 44 with the temperature sensor 54 being attached to the body member 44 with the clip 56.

[0071] In a preferable example, the temperature sensor 54 is composed of any of a thermistor, a resistance thermometer sensor, and a thermocouple; in this case, the clip 56 is used to attach one of the thermistor, the resistance thermometer sensor, and the thermocouple to the connection terminal portion 52, which is a target of temperature measurement in a close contact state. A heat conductive member may be interposed between the temperature sensor 54 and the connection terminal portion 52. The heat conductive member may be formed of a flexible thin member, such as sheet and grease, having heat conductivity, for example. The heat conductive member places the temperature sensor 54 in a further close contact with the subject of temperature measurement, thus contributing to an increase in the temperature measurement accuracy.

[0072] While in the present embodiment, the clip 56 is used as a pressing member which presses the temperature sensor 54 into close contact with the connection terminal portion 52 which is the subject of temperature measurement, the pressing member is not limited to this example. In place of the clip 56, an urging member such as a coil spring or a flat spring may be used to press the temperature sensor onto the subject of temperature

measurement.

[0073] FIG. 13 is a perspective view illustrating one blade receiving spring block 42a assembled in the body member 44. FIG. 14 is an exploded perspective view illustrating the one blade receiving spring block 42a and the body member 44. In FIG. 13 and FIG. 14, the temperature sensor 54 and the clip 56 are not shown.

[0074] As illustrated FIG. 13 and FIG. 14, the blade receiving spring block 42a includes two pairs of the blade receiving springs 48, the coupling portion 50 mechanically coupling and electrically connecting the blade receiving springs 48 together, and the connection terminal portion 52 which is bent from the edge of the coupling portion 50 along the front and rear direction Y, which are integrally formed. The blade receiving spring 48 includes a pair of opposing blade receiving pieces having respective tip ends which are bent outward to open in a substantially V shape. This configuration allows the blade receiving spring 48 to reliably receive the plug blade of the insertion plug between the pair of blade receiving pieces.

[0075] The blade receiving spring block 42a further integrally includes U-shape bending spring portions 49 disposed, at an interval, on respective sides of the blade receiving spring 48 including the pair of blade receiving pieces. Each bending spring portion 49 includes a bending portion 49a on the side where tip portions of the pair of blade receiving pieces are disposed, and a pair of extending portions 49b extending from the bending portion 49a toward the base end portion of the pair of blade receiving pieces.

[0076] The blade receiving spring block 42a is housed in the body member 44. The body member 44 includes four segmented recess portions 45. Of the inner wall surfaces segmenting the recess portions 45, the wall surfaces located toward the center in the width direction X includes two ribs 47a disposed at an interval and extending in the front and rear direction Y. These ribs 47a enhance the strength of the body member 44.

[0077] Opposing ribs 47b are further formed on opposite inner wall surfaces in the up and down direction Z, of the inner wall surfaces segmenting the recess portions 45. As illustrated in FIG. 13, when the blade receiving spring block 42a is assembled in the body member 44, each rib 47b is pinched with the pair of extending portions 49b of the respective bending spring portions 49 disposed on the respective sides of the blade receiving spring 48 in the up and down direction Z. The bending portion 49a of the bending spring portion 49 is in contact with the edge of the rib 47b.

[0078] The bending portion 49a of the bending spring portion 49 is in contact with the edge of the rib 47b formed in the body member 44 in assembly, as described above, so that the blade receiving spring block 42a can be assembled in a precisely aligned state with respect to the body member 44. Further, the pair of extending portions 49b of the bending spring portion 49 pinching the rib 47b enable firm assembly of the blade receiving spring block

42a with the body member 44.

[0079] When a force in the width direction X acts on the insertion plug which is insertable into and removal from the electrical outlet 10, the pair of blade receiving pieces may plastically deform into an abnormally opened state, which would weaken the contact pressure between the plug blades and the blade receiving pieces. This may generate micro luminous discharge due to contact failure, for example, causing abnormal overheat. The electrical outlet 10 according to the present embodiment, however, with the rib 47b being pinched by the bending spring portion 49 integrally formed with the blade receiving spring 48, prevents or inhibits abnormal opening and deformation of the blade receiving spring 48 formed of the pair of blade receiving pieces even under action of the opening force as described above.

[0080] While in the present embodiment, the rib 47b is formed on each of the two inner wall surfaces opposing in the up and down direction Z and is pinched by the bending spring portion 49, the disclosure is not limited to this configuration. A protruding rib formed on the inner wall surface of the recess portion 45 in the front and rear direction Y (i.e., the bottom face of the recess portion 45) may be pinched by the pair of extending portions of the bending spring portion 49, or a protruding rib formed on the bottom surface may be pinched by the base end portion (i.e., end portion opposite the tip portion) of the pair of blade receiving pieces.

[0081] FIG. 15 is an enlarged perspective view illustrating part of the terminal portion. As illustrated in FIG. 15, the terminal portion may include a printed circuit board 110 for temperature measurement. Temperature sensors 112a and 112b are mounted on the printed circuit board 110. In a preferable example, the temperature sensors 112a and 112b are formed of any of a thermistor, a resistance thermometer sensor, and a thermocouple. The temperature sensors 112a and 112b may be coated with a heat-conductive member and mounted on the printed circuit board 110. In this configuration, the temperature sensors 112a and 112b are joined, via the heat-conductive member, to the L-phase fixed terminal plate 86 and the N-phase fixed terminal plate 88, which are temperature measurement targets. In a preferable example, the heat-conductive member may be a flexible resin having heat conductivity, in which case the temperature sensors 112a and 112b come into closer contact with the temperature measurement targets to achieve enhanced accuracy in temperature measurement. In a preferable example, to ensure more reliable electrical insulation between the L-phase fixed terminal plate 86 and the N-phase fixed terminal plate 88 which are temperature measurement targets, the heat-conductive member may be an insulating resin. A specific example of the heat-conductive member may be an acrylic resin having a low hardness, which is a hyper soft heat dissipation sheet (registered mark) 6500H, 6510H, or 5578H manufactured by 3M, for example.

[0082] The temperature sensor 112a mounted on the

printed circuit board 110 is joined to the L-phase fixed terminal plate 86, and the temperature sensor 112b mounted on the printed circuit board 110 is joined to the N-phase fixed terminal plate 88. The temperature of the L-phase fixed terminal plate 86 measured by the temperature sensor 112a is transmitted, via a signal line 114a, to the substrate 120. Further, the temperature of the N-phase fixed terminal plate 88 measured by the temperature sensor 112b is transmitted, via a signal line 114b, to the substrate 120.

[0083] The controller 122 mounted on the substrate 120 determines whether or not the temperatures of the fixed terminals measured by the temperature sensors 112a and 112b exceed a predetermined threshold temperature. When the temperature of at least one of the fixed terminal plates 86 and 88 exceeds the predetermined threshold temperature, the controller 122 determines that the electrical outlet 10 is in an overheating state, and transmits an operation signal to the open/close unit 70 via the signal line 60c. This causes the open/close unit 70 to operate into the opened state, thereby interrupting power supply to the blade receiving spring blocks 42a and 42b. The predetermined threshold temperature used in this case may be the same temperature as that used in comparison with the temperatures of the blade receiving spring blocks 42a and 42b measured by the temperature sensor 54, or may be set to a higher value.

[0084] While the electrical outlet 10 of the present embodiment includes both the temperature sensor for the blade receiving spring blocks 42a and 42b and the temperature sensor for the fixed terminal plates 86 and 88, it may be the case that the temperature sensor is disposed only for the blade receiving spring blocks 42a and 42b or for the fixed terminal plates 86 and 88.

[0085] Referring now to FIG. 16, an electrical outlet 10A according to the second embodiment will be described. FIG. 16 is a cross sectional view illustrating part of the electrical outlet 10A according to the second embodiment, and corresponds to a cross section C-C of the electrical outlet 10 according to the first embodiment illustrated in FIG. 2. In FIG. 16, the clip 56 pinching the temperature sensor 54 is not shown.

[0086] As illustrated in FIG. 16, the electrical outlet 10A includes the upper cover 12a forming part of the electrical outlet body cover 12. The upper cover 12a is a cover member made of a resin material and having a plug blade insertion port (opening portion) 20a into which a plug blade S of an insertion plug P is inserted.

[0087] The upper cover 12a includes, on its rear side, a protrusion 12c integrally formed with the upper cover 12a. The protrusion 12c of the upper cover is in contact with the coupling portion 50 of the blade receiving spring block 42a. The protrusion 12c may press the blade receiving spring block 42a onto the body member 44 to thereby fix the blade receiving spring block 42a against the body member 44. In this configuration, the fixing member 46 in the electrical outlet 10 according to the first embodiment may be omitted.

[0088] While FIG. 16 does not illustrate the blade receiving spring block 42b, the blade receiving spring block 42b is also in contact with a protrusion 12c formed on the rear side of the upper cover 12a. The protrusion 12c contacting the blade receiving spring block 42b may be integrally formed with the protrusion 12c contacting the blade receiving spring block 42a, or they may be formed separately.

[0089] The remaining configuration of the electrical outlet 10A is similar to that of the electrical outlet 10 according to the first embodiment described above.

[0090] The electrical outlet 10A according to this embodiment is capable of detecting heat generation between the blade receiving spring blocks 42a and 42b and the plug blade S of the insertion plug P, and also detecting heat generation of the insertion plug P inserted into the plug blade S via the plug blade S of the insertion plug P. More specifically, the insertion plug P may fail to be correctly inserted into the electrical outlet 10A, resulting in an increase in resistance between the plug blade S and the blade receiving spring blocks 42a and 42b. In such a case, the temperature sensor 54 can detect the temperature rise caused by heat generation between the blade receiving spring blocks 42a and 42b and the plug blade S of the insertion plug P. Also, degradation of the insertion plug P itself with time or thermal degradation of the plug due to undercaulking of electric wires within the plug may cause abnormal heat generation. In this case, heat is transmitted from the insertion plug P to the blade receiving spring blocks 42a and 42b through the plug blade S of the insertion plug P and the upper cover 12a contacting the insertion plug P. Therefore, abnormal heat generation in the insertion plug P can also be detected by the temperature sensor 54 disposed on the blade receiving spring blocks 42a and 42b.

[0091] In a broader sense, abnormal heat generation includes the following: dust and moisture generate scintillation (micro luminous discharge), which continues and causes insulation degradation; heat generation due to loose connection thermally degrades the insulating material to cause a resin material such as vinyl chloride forming the plug body to precipitate calcium chloride, which absorbs moisture to cause dielectric breakdown; or abnormal heat generation may also occur simply by a tracking phenomenon in which an electrically conducting path is formed due to heat generation caused by structural degradation. The abnormal heat generation as described above is also transmitted to the blade receiving spring blocks 42a and 42b and can be detected by the temperature sensor 54.

[0092] The temperatures of the blade receiving springs 42a and 42b detected by the temperature sensor 54 are transmitted, via the signal lines 60a and 60b, to the controller 122 on the substrate 120. If the temperature of the blade receiving spring block 42a or 42b exceeds the predetermined threshold temperature, the controller 122 mounted on the substrate 120 actuates a buzzer to notify the abnormality and/or transmits an operation signal to

the open/close unit 70 to interrupt power supply to the blade receiving spring blocks 42a and 42b.

[0093] More specifically, the controller 122 derives, from the temperatures of the blade receiving spring blocks 42a and 42b, the temperature of the protrusion 12c in the upper cover 12a that contacts the blade receiving spring blocks 42a and 42b. In the controller 122, the predetermined threshold temperature for determining abnormal overheating is set such that the temperature of the protrusion 12c is below the heat resistant temperature or the upper limit temperature of a resin material forming the upper cover 12a. Specifically, concerning heat transfer in the blade receiving spring blocks 42a and 42b from a location where the temperature sensor 54 is set to a portion contacting the protrusion 12c, the predetermined threshold temperature described above can be determined by thermal analysis in which a value obtained by multiplying the amount of heat value transferred to the blade receiving spring blocks 42a and 42b by the length of heat transfer is divided by the cross section of the heat transfer portion of the blade receiving spring blocks 42a and 42b and the thermal conductivity, respectively. However, the predetermined threshold temperature is not limited to this example; when the electrical outlet 10A is actually assembled and a heater is inserted into the blade receiving spring 48 to heat the blade receiving spring blocks 42a and 42b, a relationship between the temperature of the blade receiving spring blocks 42a and 42b detected by the temperature sensor 54 and the temperature actually measured by the temperature sensor disposed at a location contacting the protrusion 12c may be determined from these temperatures, and, according to this relationship, the above predetermined threshold temperature may be set such that the temperature of the protrusion 12c is below the upper limit temperature of the resin material forming the upper cover 12a. The relationship described above refers to a relationship in which, when the temperature of the blade receiving spring 48 is 110°C, the temperature of the protrusion 12c is 100°C, based on the physical environments such as the amount of heat described above, for example. More specifically, when heating the blade receiving spring 48 with a heater, the heating temperature of the heater is varied to obtain a plurality of plots concerning the temperature relationship between the blade receiving spring 48 and the protrusion 12c, thereby determining a temperature correlation (function) or storing the data as a table.

[0094] In the electrical outlet 10A according to this embodiment, in a preferable example the resin material of the body member 44 has a higher upper limit temperature than does the resin material of the upper cover 12a. Meanwhile, in another preferable example, the resin material of the upper cover 12a has a higher surface hardness and higher tracking resistance than the resin material of the body member 44. Specifically, a urea resin may be used for the upper cover 12a, and a polybutylene terephthalate resin may be used for the body member 44.

[0095] The electrical outlet 10A according to this em-

bodiment may notify users of abnormal heat generation in steps, as follows. Specifically, when the temperature detected by the temperature sensor 54 reaches a first threshold temperature or higher, the buzzer is actuated and the abnormal light emitting portion 136 is lighted, whereas the open/close unit 70 remains unactuated to thereby continue power supply. This enables the user to notice abnormal heat generation of the electrical outlet before the open/close unit 70 operates to interrupt power supply, and to take measures such as temporarily storing data being processed on a personal computer, for example. Thereafter, the user depresses the press switch 132 after eliminating the cause of abnormal heat generation to lower the temperatures of the blade receiving spring blocks 42a and 42b, to allow the buzzer sound to stop and the abnormal light emitting portion 136 to turn off. Further, when the temperature detected by the temperature sensor 54 reaches a second threshold temperature higher than the first threshold temperature in the electrical outlet 10A, the buzzer is operated to sound and the abnormal light emitting portion 136 is made to blink, and also the open/close unit 70 is actuated to interrupt power supply, thereby preventing thermal deformation of the upper cover 12a, for example.

[0096] As described above, in the electrical outlet 10A according to this embodiment, the temperature sensor 54 is disposed on the blade receiving spring blocks 42a and 42b to detect heat generation between the blade receiving spring blocks 42a and 42b and the plug blade S of the insertion plug P and/or detect heat generation of the insertion plug P inserted in the plug blade S via the plug blade S of the insertion plug P. In other words, the electrical outlet 10A performs either one or both of detection of heat generation between the blade receiving spring blocks 42a and 42b and the insertion plug P and detection of heat generation of the insertion plug P inserted into the plug blade S via the plug blade S of the insertion plug P. If the heat generation thus detected reaches the predetermined threshold temperature or higher, an overheating countermeasure to notify abnormality and/or to interrupt power supply to the blade receiving spring blocks 42a and 42b is performed. Thus, abnormal heat generation in the insertion plug P and/or abnormal heat generation between the plug blade S of the insertion plug P and the blade receiving spring blocks 42a and 42b of the electrical outlet 10A is detected and notification of abnormality and/or interruption of power supply is performed, thereby increasing safety of power supply performed indoors.

[0097] In the electrical outlet 10A according to this embodiment, at least part of the blade receiving spring blocks 42a and 42b may be in contact with the upper cover 12a made of a resin material and having the plug blade insertion ports 20a and 20b through which the plug blade S of the insertion plug P is inserted, such that the temperature of the protrusion 12c in contact with the blade receiving spring blocks 42a and 42b of the upper cover 12a may be derived from the temperature of the

location where the temperature sensor 54 is disposed and the predetermined threshold temperature may be set such that the temperature of the protrusion 12c is below the upper limit temperature of the upper cover 12a. This setting prevents thermal deformation, for example,

[0098] The present disclosure is not limited to the above embodiments and their modification examples; various modifications and improvements may be made within the scope of the claims of the present application.

REFERENCE SIGNS LIST

[0099] 2 decorative cover, 10 electrical outlet, 12 electrical outlet body cover (cover member), 12a upper cover, 12b lower cover, 12c protrusion, 13 attachment pin, 14 electrical outlet outer cover (cover member), 14a opening portion, 14b through hole, 14c power light portion, 14d abnormal light portion, 15 attachment hole, 16 casing, 18a, 18b plug blade insertion portion, 20a, 20b plug blade insertion portion (opening portion), 20c earthing terminal insertion port, 22 engaging portion, 24 bottom face, 25a, 25b casing inner face, 26 column portion, 27 partitioning wall portion, 28, 30, 32 space, 29 support protrusion, 40 blade receiving spring unit, 42a, 42b blade receiving spring block (blade receiving unit), 44 body member, 45 recess portion, 46 fixing member, 47a, 47b rib, 48 blade receiving spring, 49 bending spring portion, 49a bending portion, 49b extending portion, 50 coupling portion, 52 connection terminal portion, 54, 112a, 112b temperature sensor, 54a L-phase conductor, 54b N-phase conductor, 56 clip, 56a pinching piece, 56b coupling portion, 60a, 60b, 60c, 62a, 62b signal line, 70 open/close unit, 71 operation lever, 72 housing, 73 coil, 74 movable iron piece, 75 trigger lever, 75a, 76a, 79a shaft portion, 76 support lever, 77 operation plate, 78 press spring, 79 operation member, 80, 85 pressure contact spring 81 L-phase movable terminal plate, 82 L-phase movable terminal portion, 83 N-phase movable terminal plate, 84 N-phase movable terminal portion, 86 L-phase fixed terminal plate, 86a L-phase connection portion, 87 L-phase fixed terminal portion, 88 N-phase fixed terminal plate, 88a N-phase connection portion, 89 N-phase fixed terminal portion, 90 torsion spring, 92, 94 lock springs, 96 unlock member, 100 terminal portion, 102 earthing terminal portion, 104 earthing terminal plate, 105 screw, 106 earthing blade receiving spring 110 printed circuit board, 114a, 114b signal line, 120 substrate, 122 controller, 130 switch panel, 132 press switch, 134 power light emitting portion, 136 abnormal light emitting portion, P insertion plug, S plug blade.

Claims

1. An overheating countermeasure method for an electrical outlet comprising a blade receiving unit through which a plug blade of an insertion plug is inserted

and removed, the method comprising:

with a temperature sensor disposed on the blade receiving unit, detecting heat generation between the blade receiving unit and the plug blade, or detecting heat generation of the insertion plug inserted in the plug blade, via the plug blade of the insertion plug; and when the heat generation that is detected reaches a predetermined temperature or a higher temperature, performing notification of abnormality and/or interruption of power supply to the blade receiving unit.

2. The overheating countermeasure method for an electrical outlet according to claim 1, wherein at least part of the blade receiving unit is made in contact with a cover member made of a resin material and having an opening portion through which the plug blade of the insertion plug is inserted, a temperature of a portion of the cover member contacting the blade receiving unit is derived from a temperature of a location where the temperature sensor is disposed, and the predetermined temperature is set such that the temperature of the contacting portion is below an upper limit temperature of the cover member.
3. An electrical outlet including a blade receiving unit through which a plug blade of an insertion plug is inserted and removed, the electrical outlet comprising:

a temperature sensor in contact with the blade receiving unit, the temperature sensor configured to detect heat generation between the blade receiving unit and the plug blade or to detect heat generation of the insertion plug inserted in the plug blade, via the plug blade of the insertion plug; a notification unit configured to notify abnormality and/or an interruption unit configured to interrupt power supply to the blade receiving unit; and a controller configured to execute notification by the notification unit and/or interruption of power supply by the interruption unit, when the heat generation detected by the temperature sensor reaches a predetermined temperature or a higher temperature.

4. The electrical outlet according to claim 3, wherein at least part of the blade receiving unit is made in contact with a cover member made of a resin material and having an opening portion through which the plug blade of the insertion plug is inserted, the controller, based on a temperature of a location where the temperature sensor is disposed, derives

a temperature of a portion of the cover member that contacts the blade receiving unit, and the predetermined temperature is set such that the temperature of the contacting portion is below an upper limit temperature of the cover member.

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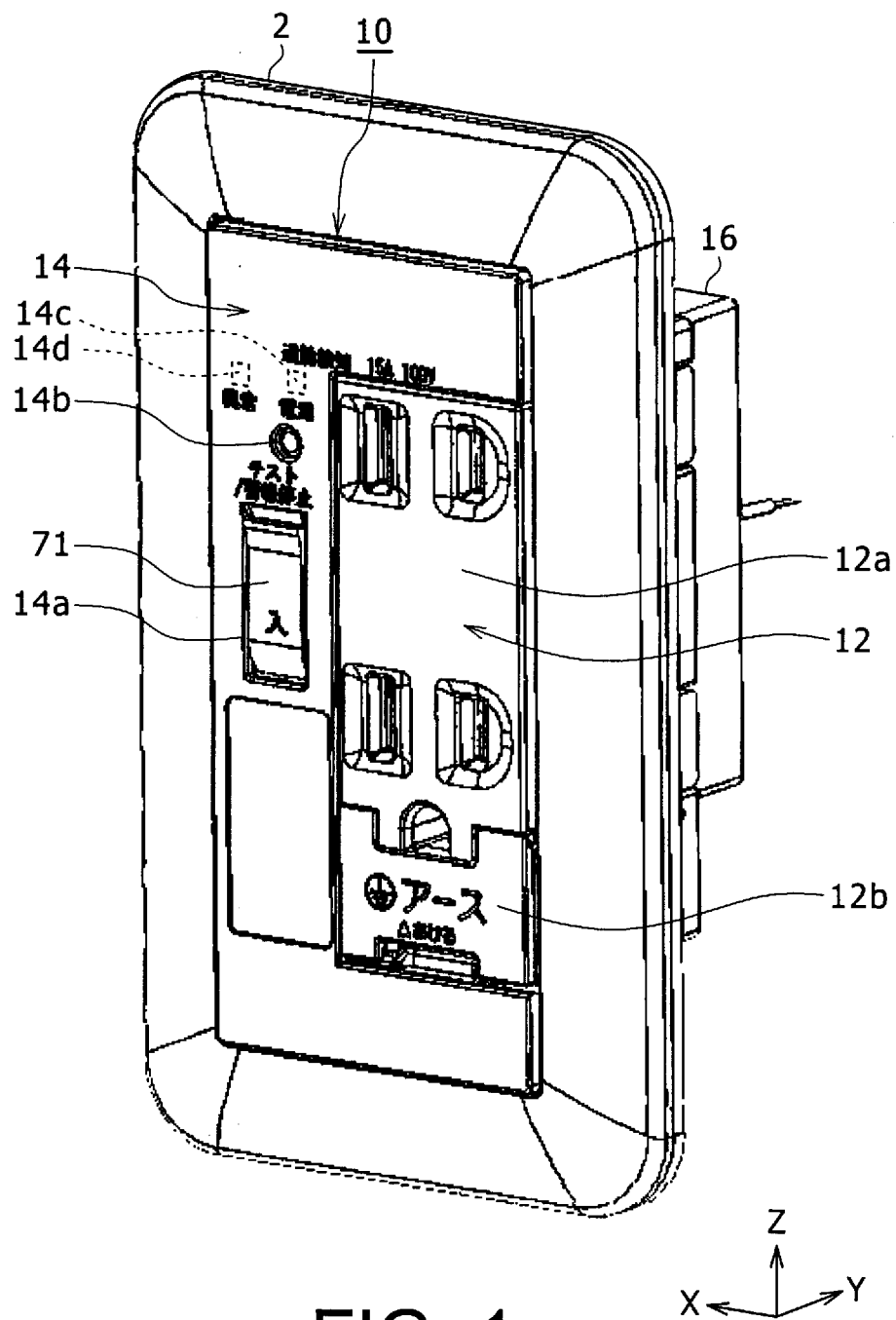


FIG. 1

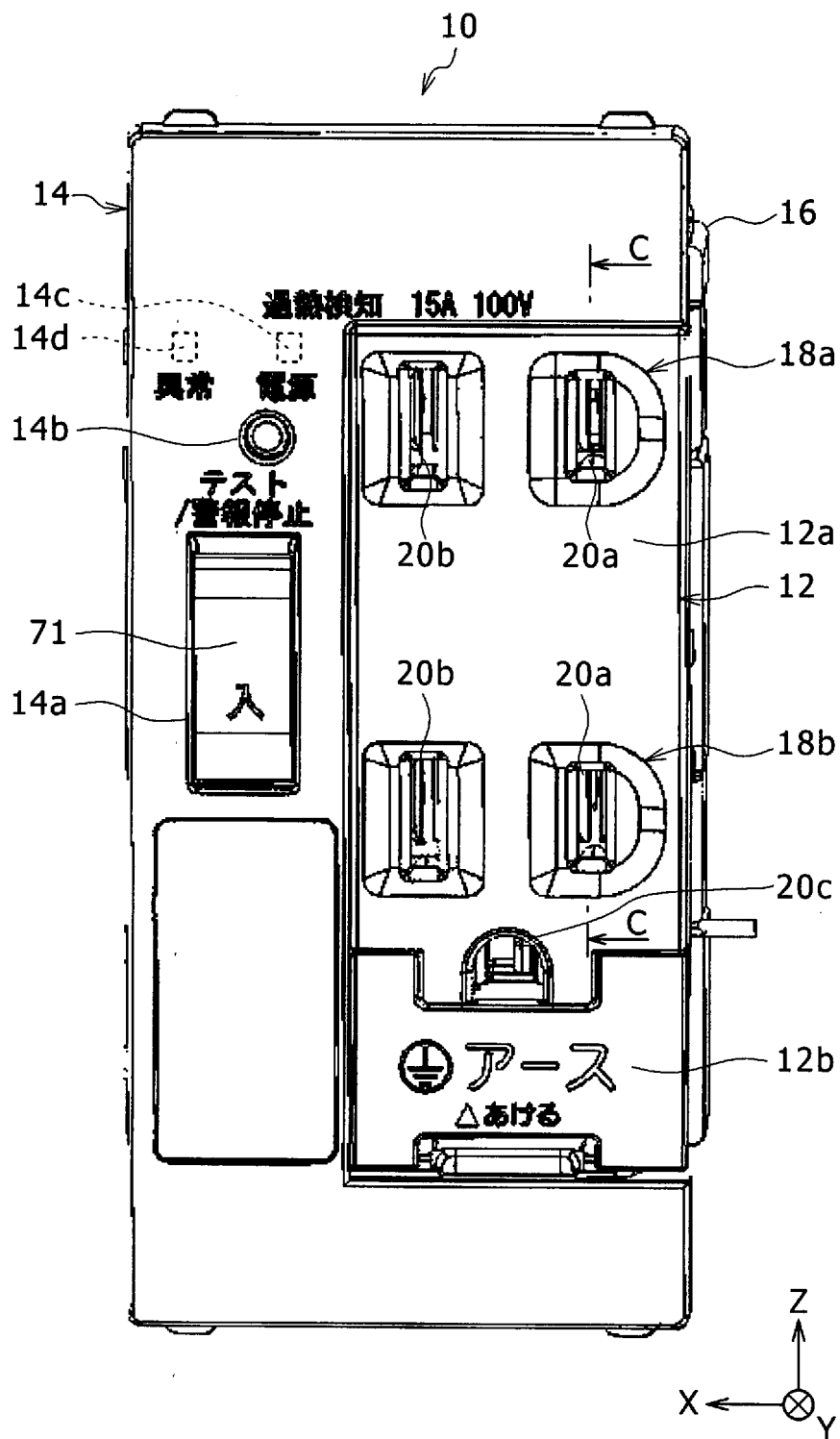


FIG. 2

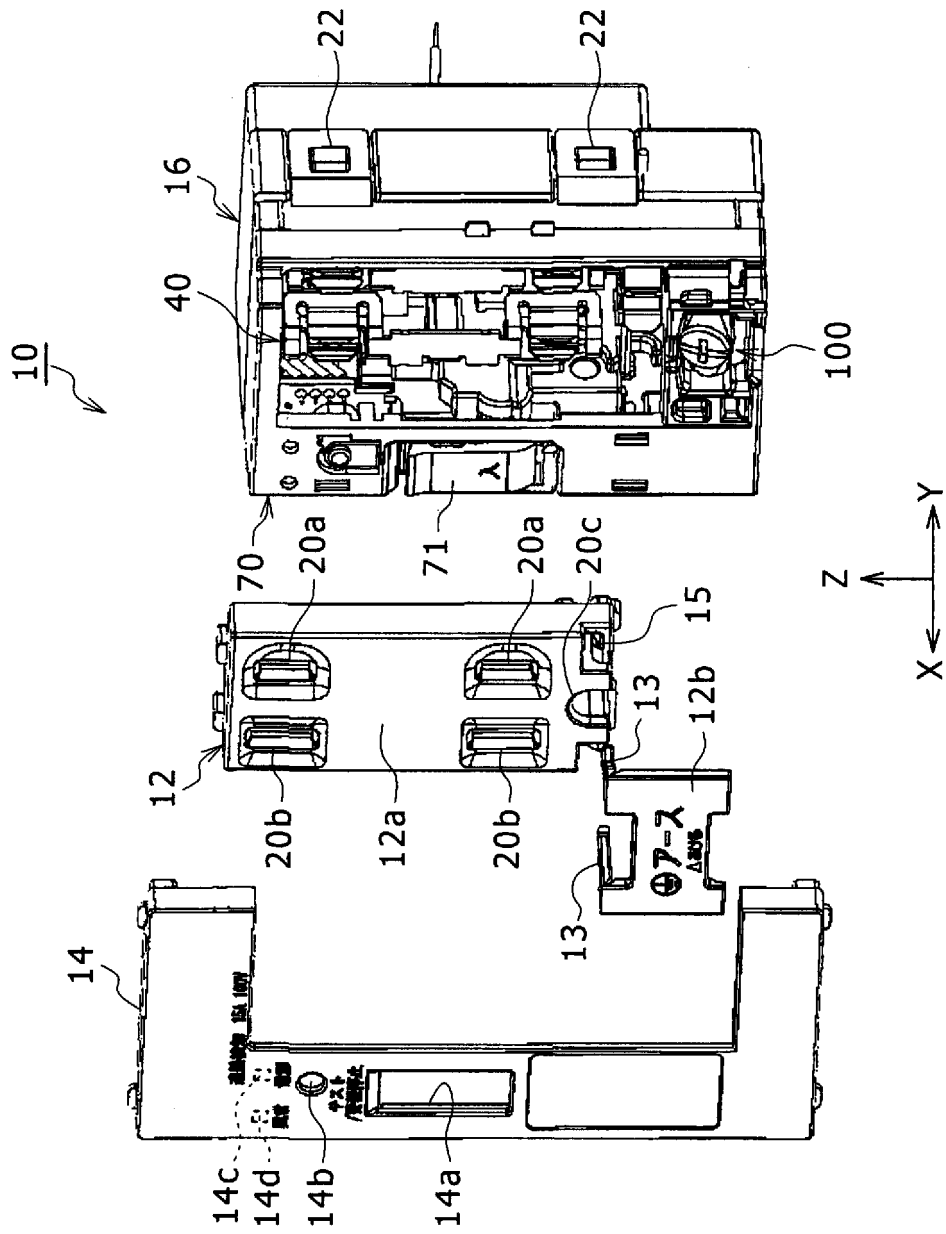


FIG. 3

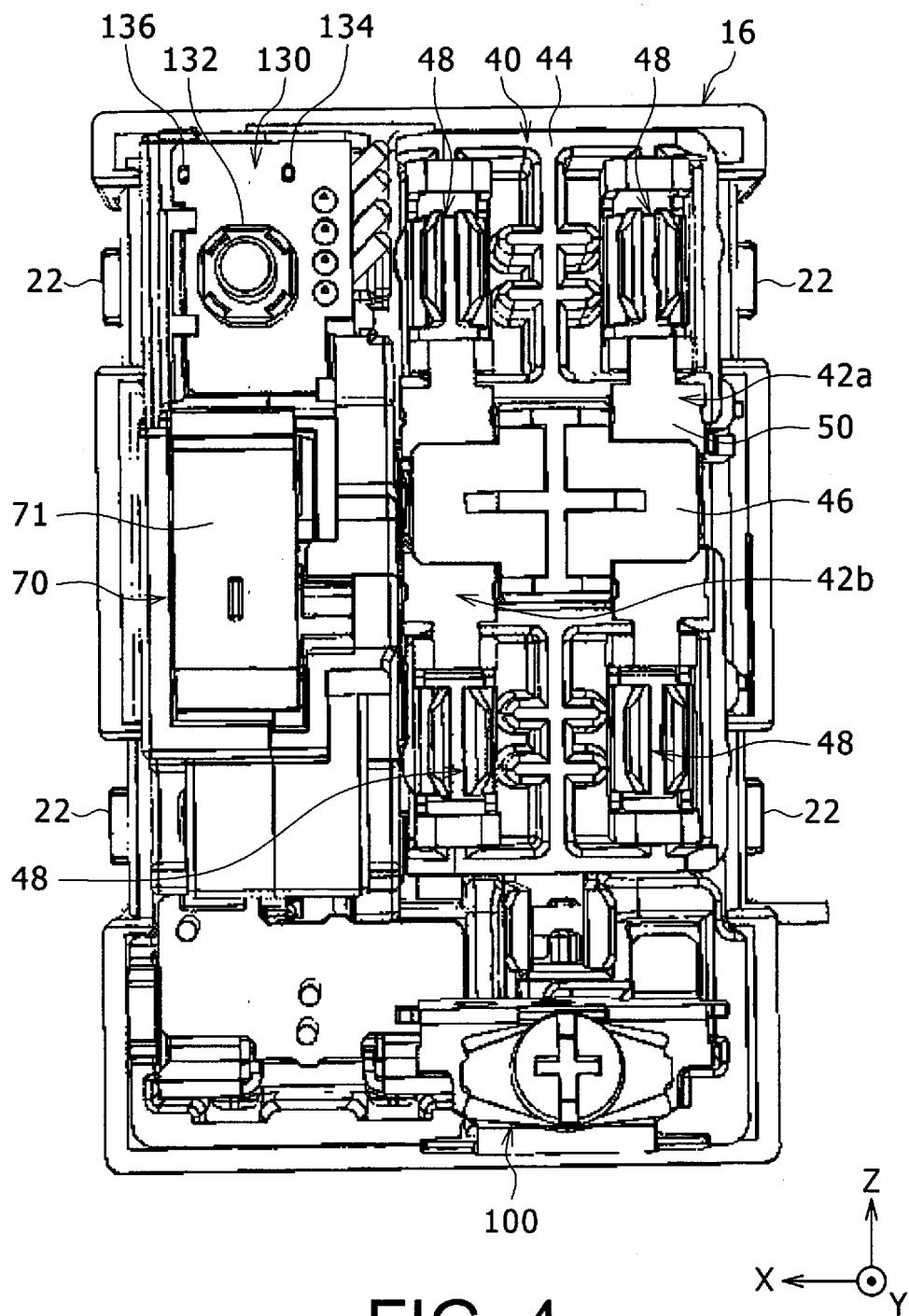


FIG. 4

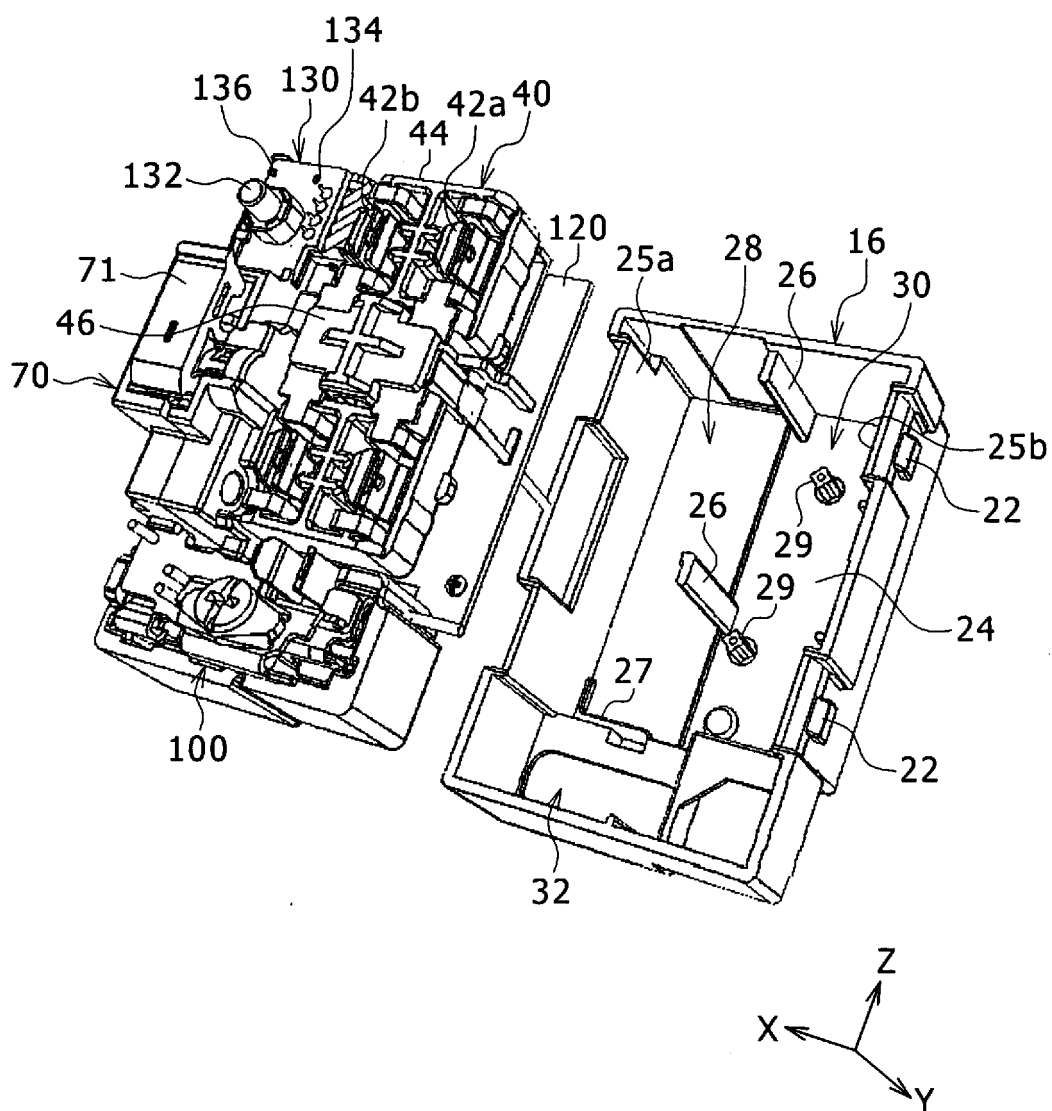


FIG. 5

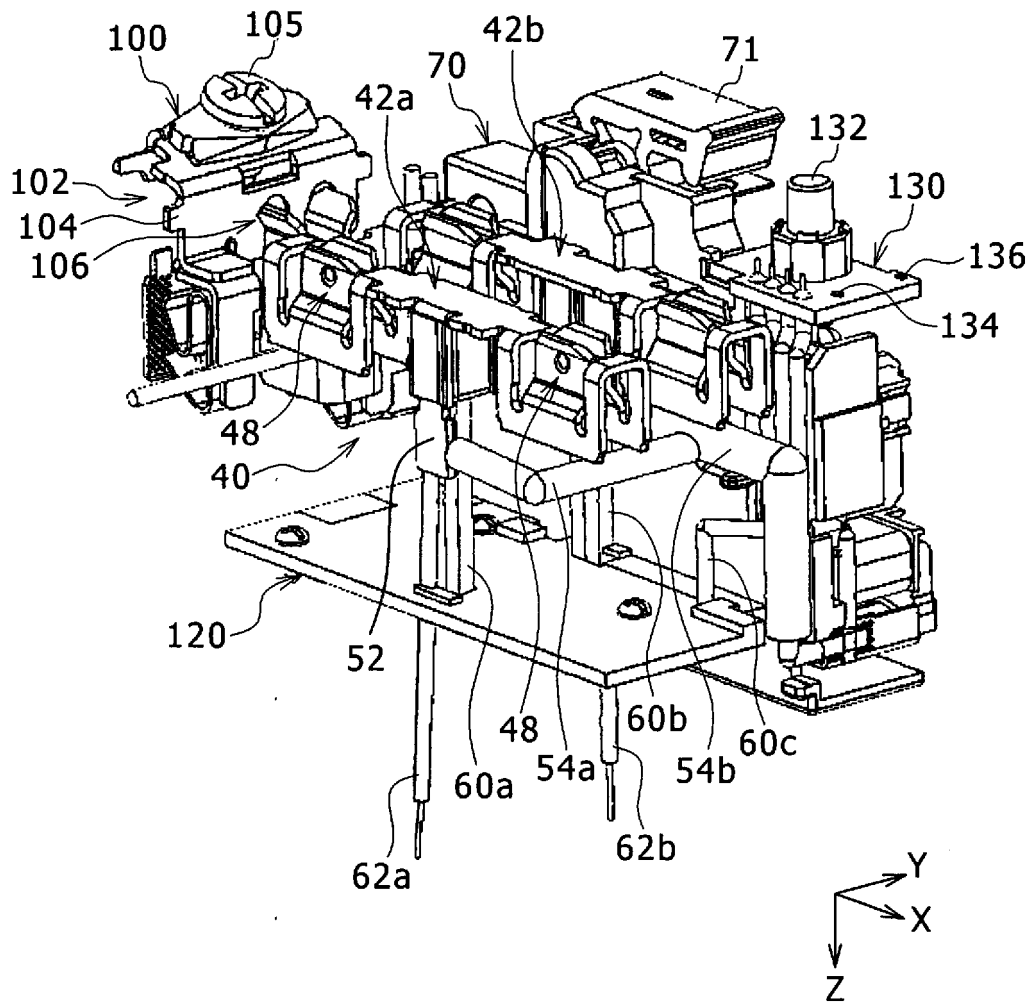


FIG. 6

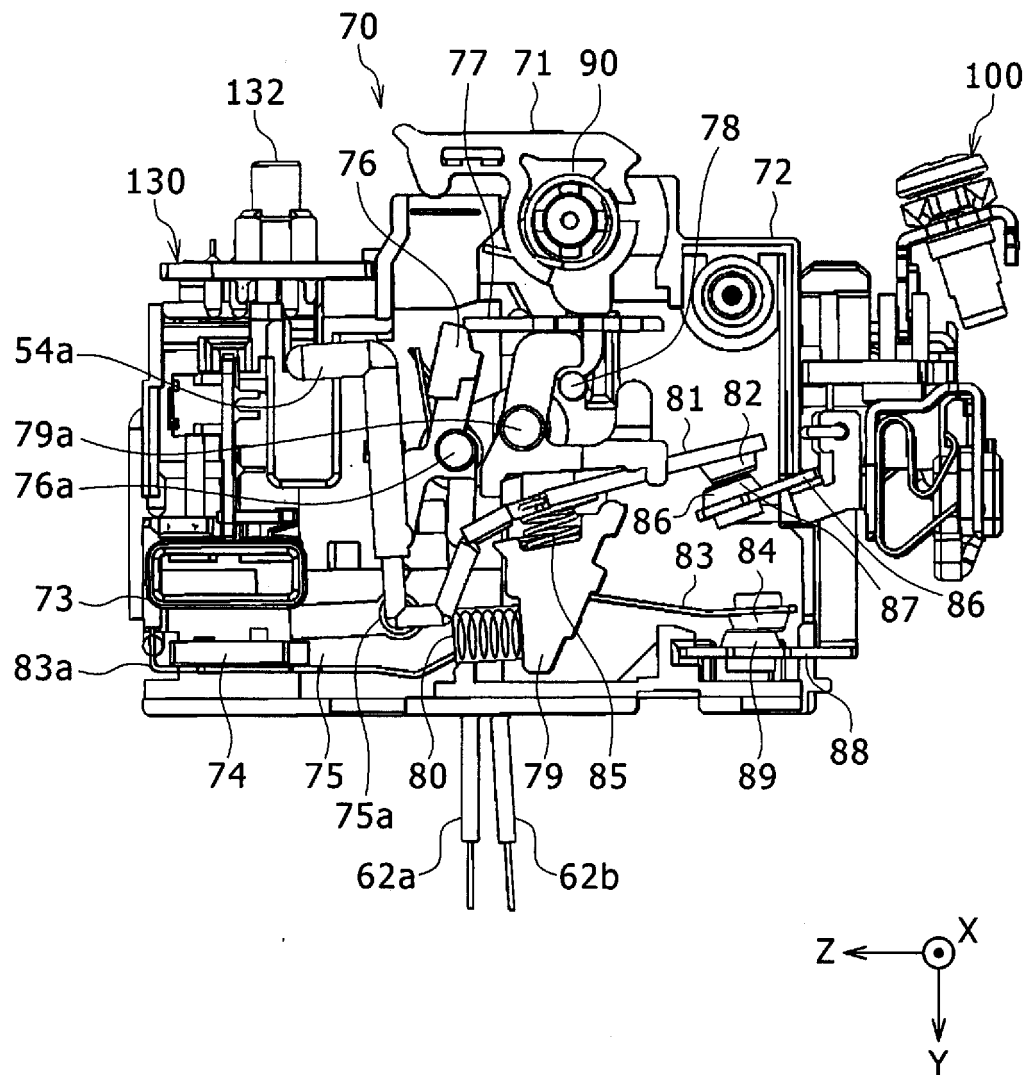


FIG. 7

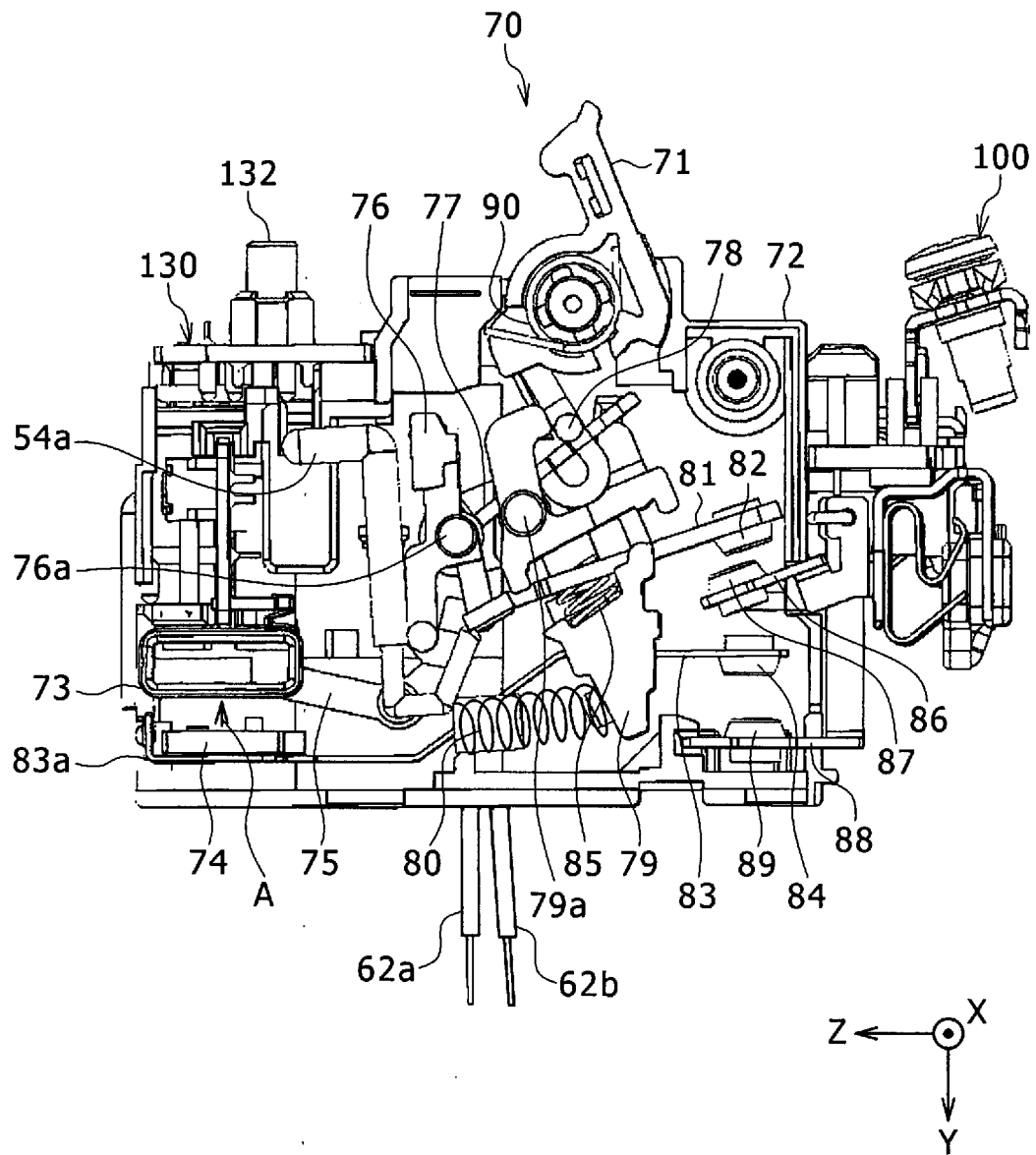


FIG. 8

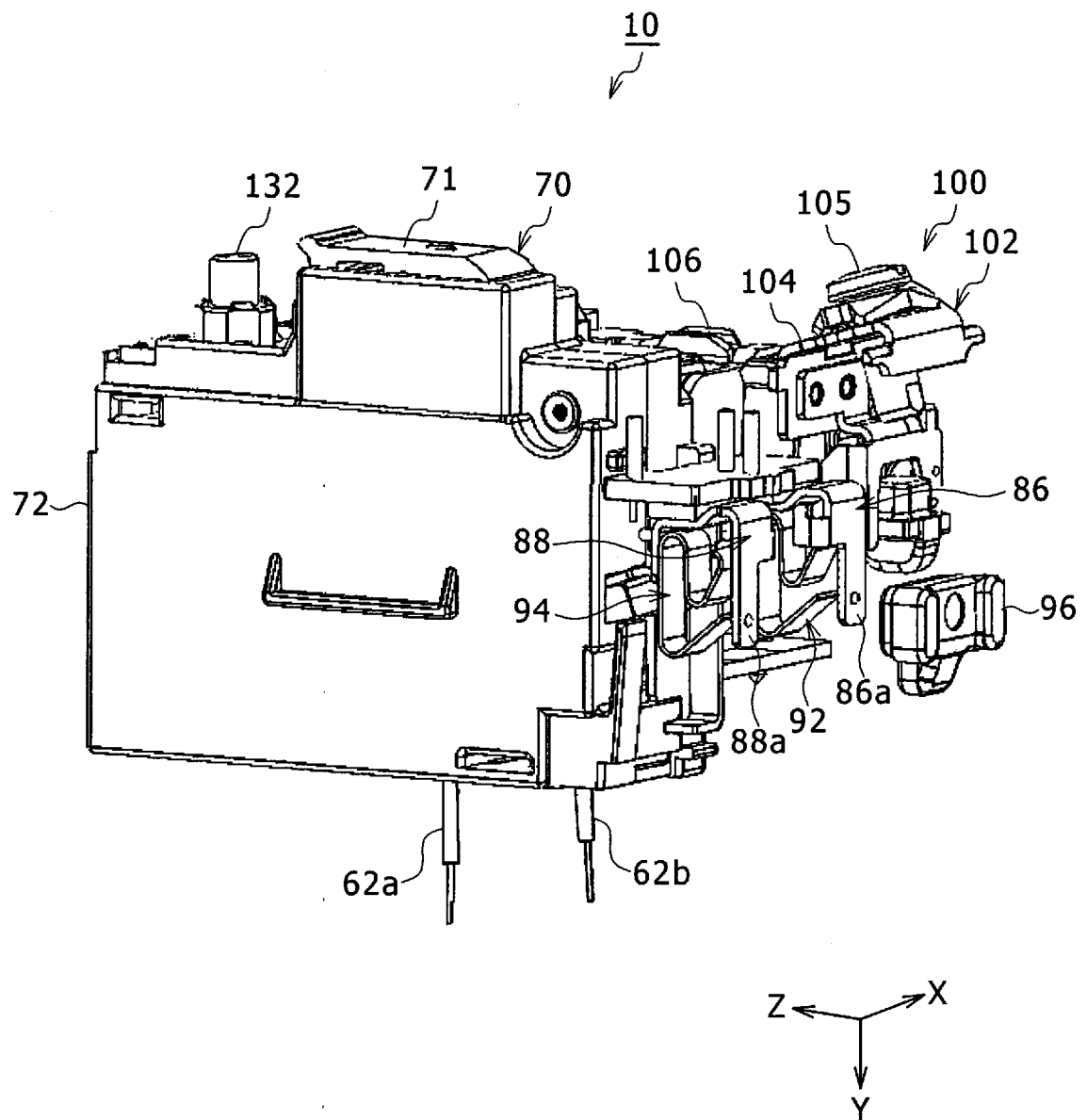


FIG. 9

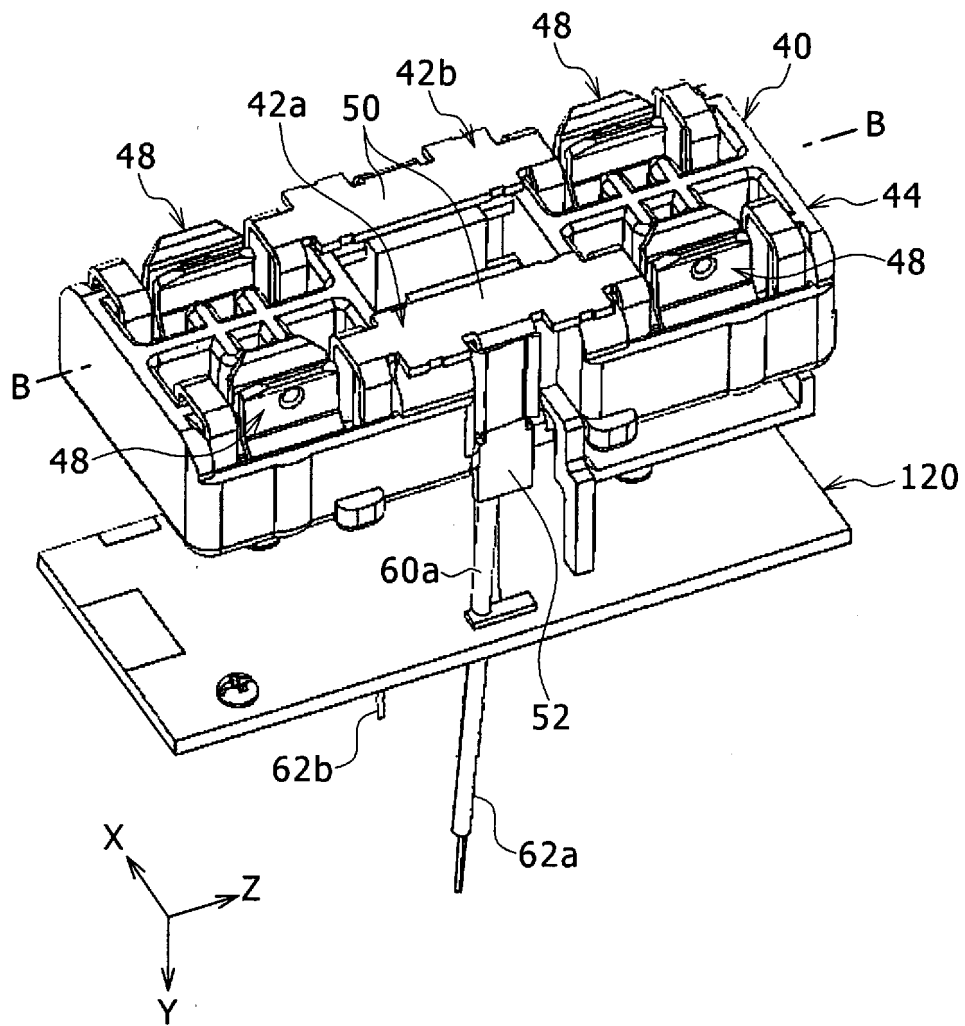


FIG. 10

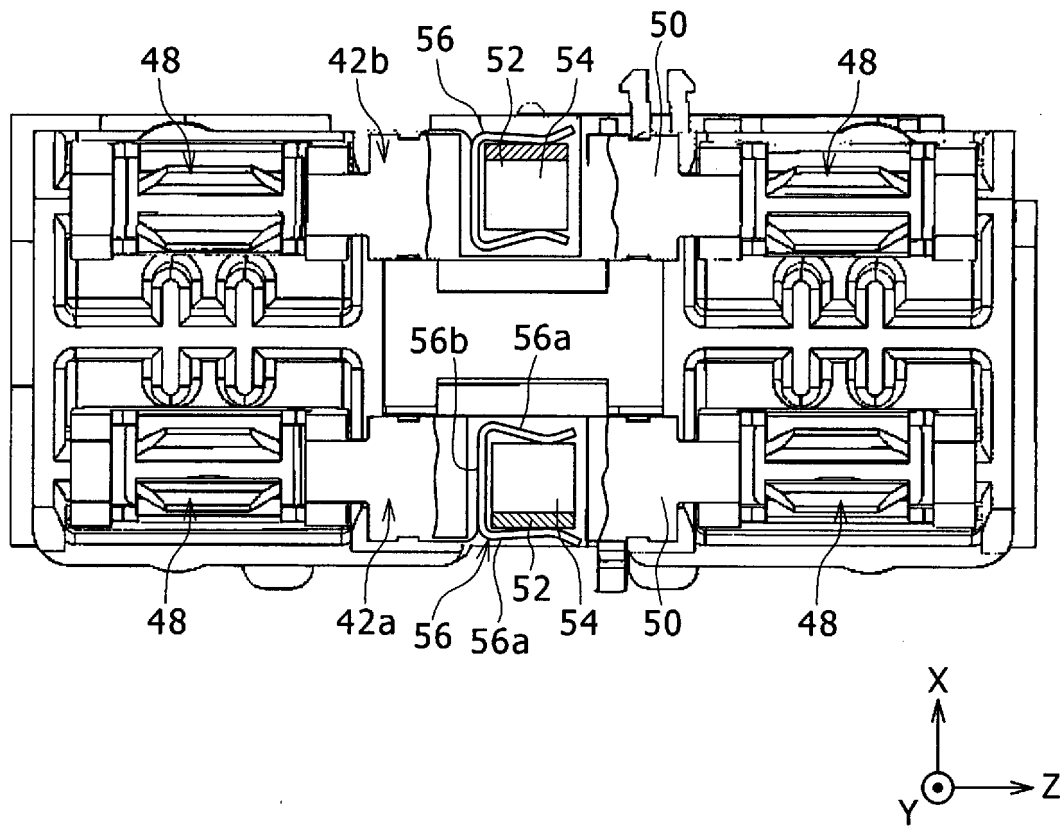


FIG. 11

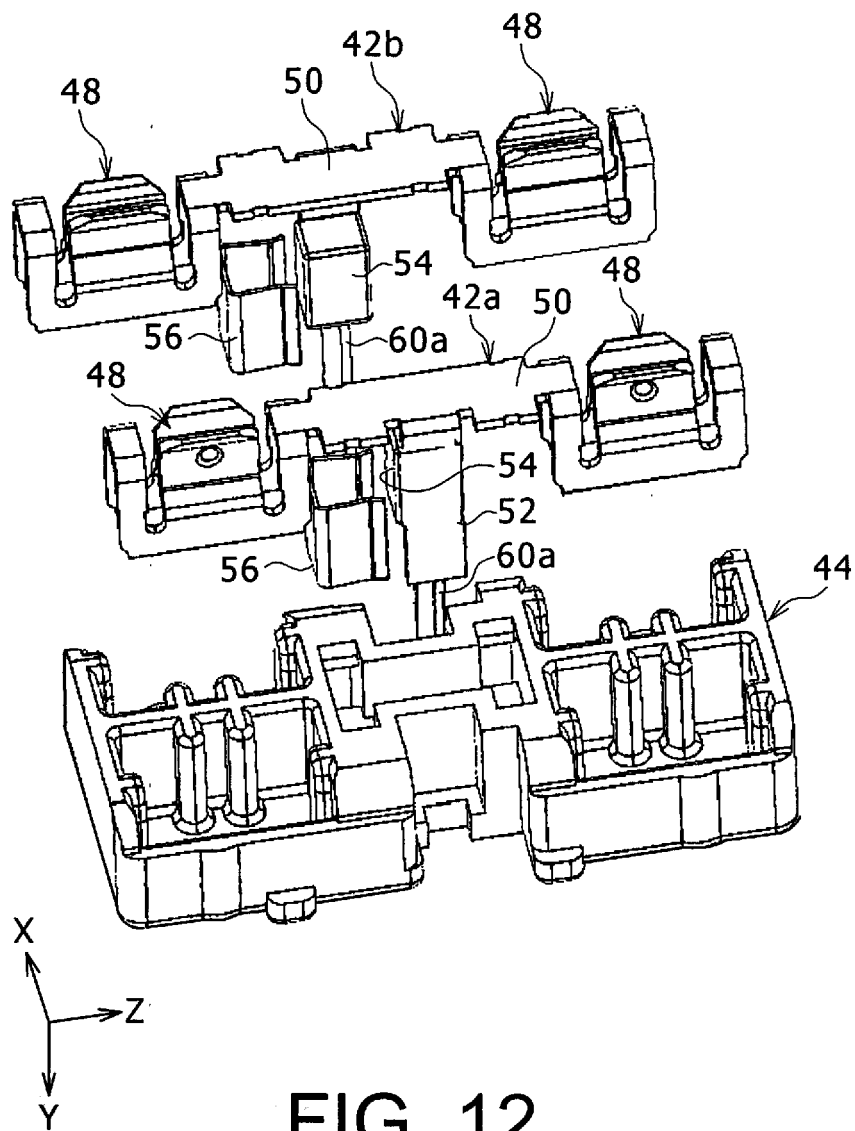


FIG. 12

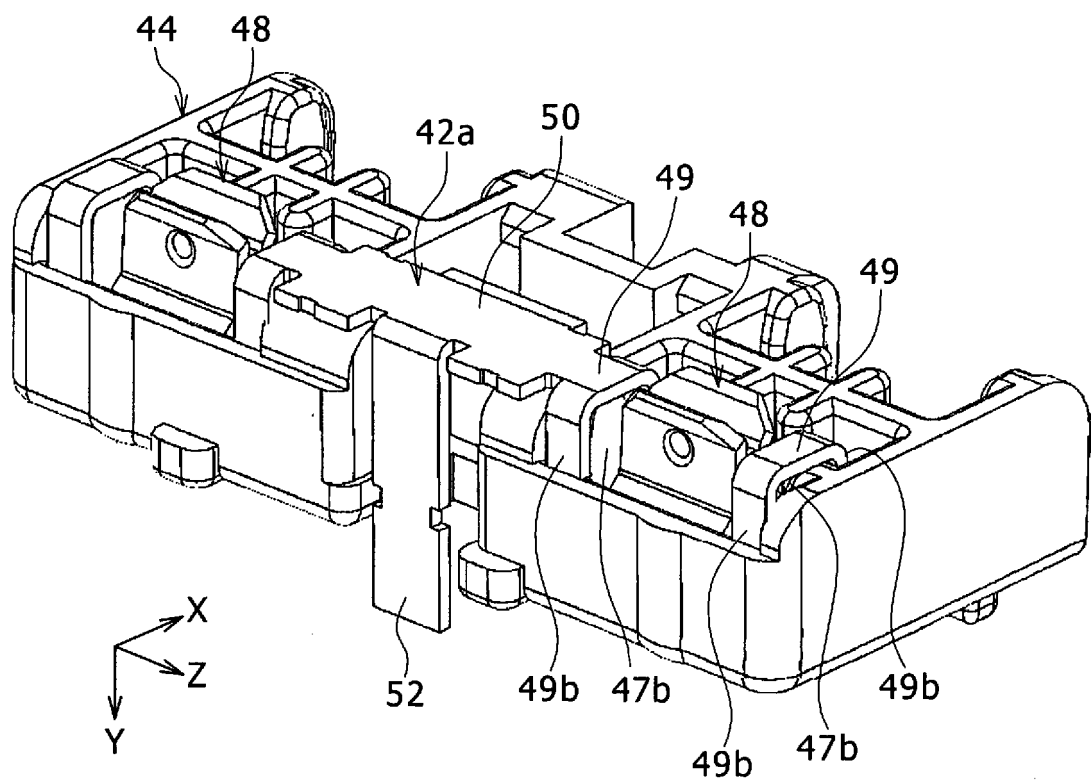


FIG. 13

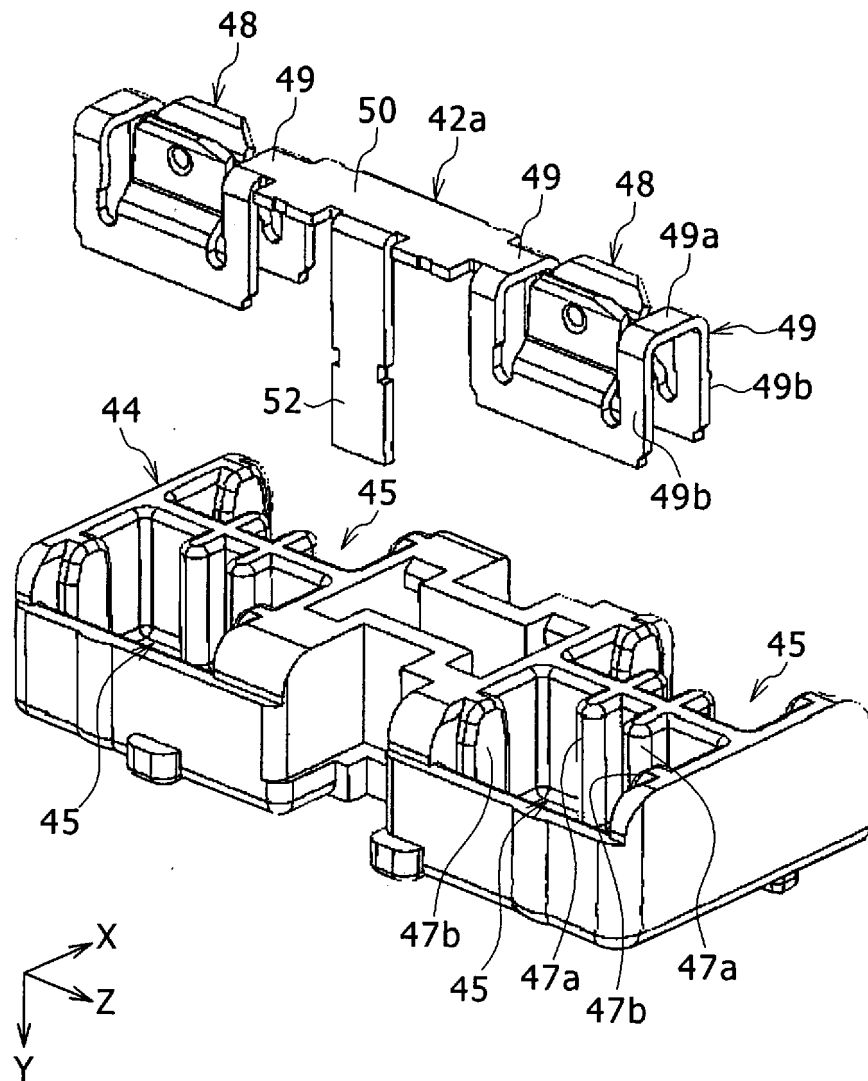


FIG. 14

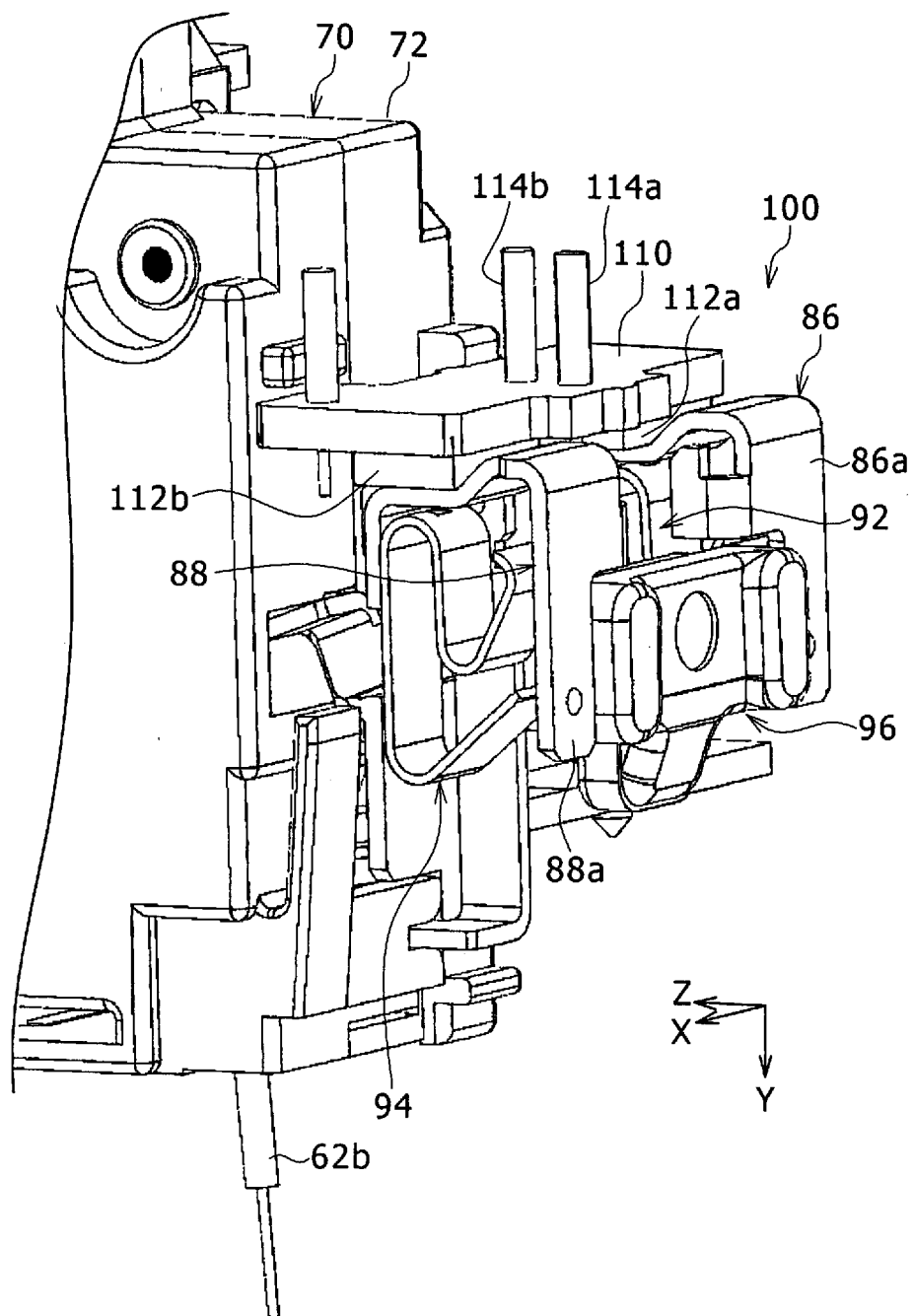


FIG. 15

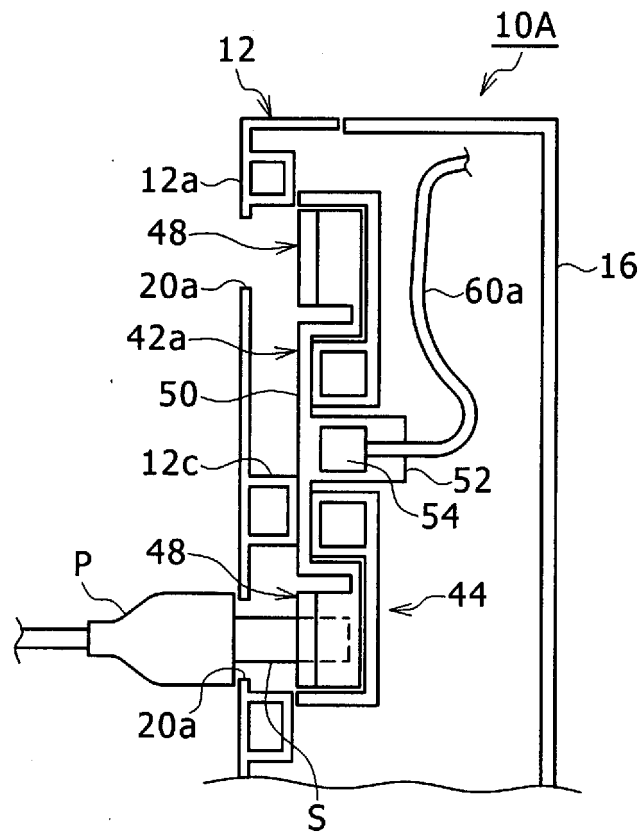


FIG. 16

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/041037

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. H01R13/713 (2006.01) i, H01R13/502 (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)

Int. Cl. H01R13/713, H01R13/502

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2019

Registered utility model specifications of Japan 1996-2019

Published registered utility model applications of Japan 1994-2019

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2012-43665 A (KOYO ELECTRONICS IND CO.) 01 March 2012, paragraphs [0017]-[0021], fig. 1, 2 (Family: none)	1-4
Y	JP 9-223286 A (MOGI, Toshio) 26 August 1997, paragraphs [0012]-[0022], [0031], [0089], fig. 1, 2 (Family: none)	1-4
A	JP 2000-348825 A (MITSUBISHI ELECTRIC CORP.) 15 December 2000, paragraphs [0013]-[0023], fig. 1, 2 (Family: none)	1-4



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
18.01.2019Date of mailing of the international search report
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Patent documents cited in the description

- JP 3190957 B [0003]