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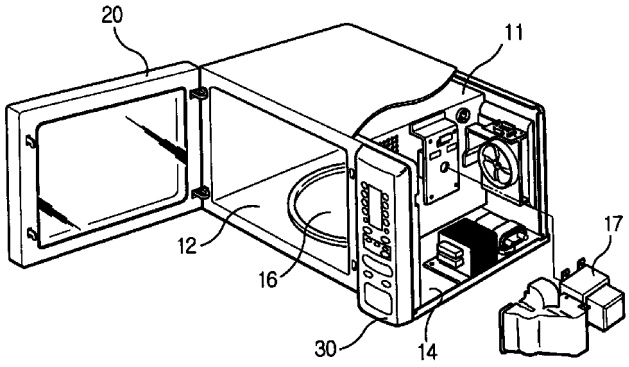
(54) Microwave oven with safety interlock

(57) The microswitches (131, 132, 133) of the safety interlock assembly of a microwave oven are mounted on a PCB (130) and connected to a main circuit board (104) by ribbon cables (136a, 136b) between the circuit boards.

FIG.1



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Description

[0001] The present invention relates to a microwave oven including a door position sensitive safety interlock assembly comprising a plurality of switches responsive to the position of a cooking chamber door.

[0002] Figure 1 shows a conventional microwave oven. Referring to Figure 1, the conventional microwave oven includes a cooking chamber 12 and an electrical component chamber 14 within a cabinet 11.

[0003] A turntable 16, on which food is placed for cooking, is located at the bottom of the cooking chamber 12. The turntable 16 is driven by a driving motor (not shown), which is installed under the cooking chamber 12.

[0004] A magnetron 17 and electrical components for driving the magnetron 17 are located in the device chamber 14. The microwaves generated by the magnetron 17 are guided to the cooking chamber 12 by a waveguide (not shown).

[0005] A door 20 is mounted at the front of the cooking chamber 12 and a control panel 30 is formed at the front of the electrical component chamber 14.

[0006] In the above-described conventional microwave oven, food is cooked by microwaves, generated by the magnetron 17 and guided to the cooking chamber, in accordance with instructions input by a user using the control panel 30.

[0007] A safety device is provided to prevent operation of the magnetron 17 oven with the cooking chamber door 20 open.

[0008] Referring to Figures 2 and 3, such a safety device comprises a door latch 42 mounted on the cabinet 11, a plurality of sensitive switches, e.g. microswitches, 45, 46, 47 mounted on the door latch 42, and a bolt element 48 mounted in the door 20 which actuates the sensitive switches 45, 46, 47 in dependence on whether the door 20 is open or closed.

[0009] The bolt element 48 includes a bar 49 movably disposed within the door 20, and a pair of arms 50a, 50b extended from the bar 49 through the back wall of the door 20. The bar 49 is downwardly biased by a spring 51 which is disposed below the bar 49.

[0010] The door latch 42 includes a pair of holes 43a, 43b though which the arms 50a, 50b can be inserted, and a pair of locking portions 44a, 44b for preventing unintended removal of the arms 50a, 50b from the latch 42.

[0011] The plurality of sensitive switches 45, 46, 47 include first and second sensitive switches 45, 46 and a monitor switch 47 mounted at appropriate places in the door latch 42.

[0012] A switch lever 52 is disposed between the second sensitive switch 46 and the monitor switch 47. A door lever 53 is provided at the bottom of the door latch 42.

[0013] The sensitive switches 45, 46, 47 are connected to a main circuit board 32, mounted to the back of the control panel 30 of the microwave oven by a connecting connector 54. The main circuit board 32 has various electric components for controlling the operation of the microwave oven.

[0014] When the door 20 is closed, the first and second arms 50a, 50b are inserted through the insertion holes 43a, 43b of the door latch 42 and move along the upper faces of the locking portions 44a, 44b which slope upwards extended from behind the insertion holes 43, 43b.

[0015] When the door 20 is completely closed, the first and second arms 50a, 50b are held by the locking portions 44a and 44b.

[0016] The first arm 50a is locked by the first locking portion 44a and presses the button of the first sensitive switch 45. The second arm 50b is locked by the second locking portion 44b and presses the button of the monitor switch 47. Simultaneously, the second arm 50b presses on the switch lever 53, pivoting it so that it presses the button of the second sensitive switch 46.

[0017] As described above, when the first and second arms 50a, 50b have been inserted through the insertion holes 43a, 43b of the door larch 42 and press the buttons of the sensitive switches 45, 46, 47, the operation of the magnetron is enabled and food can be cooked.

[0018] In the event that the door 20 is incompletely closed and the button of any of the first and second sensitive switches 45, 46 or the monitor switch 47 is not pressed, the microwave oven will not operate.

[0019] As shown in Figure 3, the conventional microwave oven employs separate leads 54 for connecting the sensitive switches 45, 46,47 to the main circuit board 32. Consequently, the wiring structure between the sensitive switches 45, 46,47 and the main circuit board 32 is complex and many steps, such as tying the leads 54 in a bundle, must be taken to prevent any interference with other components.

[0020] A microwave oven according to the present invention is characterised in that the switches are mounted to a printed circuit board and electrically connected to conductive tracks on the printed circuit board.

[0021] Preferably, the printed circuit board includes a multiway terminal block whose terminals are connected to said switches. More preferably, the printed circuit board includes a further multiway terminal block whose terminals are connected to said switches.

[0022] Preferably, the switches are connected to a control panel circuit board by a ribbon cable between said circuit boards.

[0023] An embodiment of the pesent invention will now be described, by way of example, with reference to Figures 4 and 5 of the accompanying drawings, in which:-

Figure 1 is a perspective view of a known microwave oven;

Figure 2 is an exploded perspective view of a safety

device of the microwave oven of Figure 1;

Figure 3 is a perspective view showing the wiring for the safety device shown in Figure 2;

Figure 4 is an exploded perspective view of the safety device for a microwave oven according to the present invention; and

Figure 5 is a perspective view showing the wiring of the safety device shown in Figure 4.

[0024] Referring to Figures 4 and 5, the safety device for the microwave oven includes a door latch 110 disposed within the cabinet 102 of a microwave oven, a printed circuit board 130 fixed to the door latch 110 and a plurality of sensitive switches 131, 132, 133 mounted on the printed circuit board 130 so as to be actuated by a bolt member 120.

[0025] The bolt member 120 includes a vertical bar 121 in the door 101 and a pair of arms 122a, 122b extending from the stick 121 out of the back of the door 101. The bar 121 is downwardly biased by a spring 123, which is located below the bar 121.

[0026] The door latch 110 includes a pair of insertion holes 112a, 112b, through which the arms 122a, 122b of the bolt member 120 can be inserted, and a pair of locking portions 114a, 114b for preventing unintended removal of the arms 122a, 122b from the insertion holes 112a, 112b.

[0027] The printed circuit board 130 is fixed to the rear of the locking portions 114a, 114b and the sensitive switches 131, 132, 133 are mounted at appropriate places on the printed circuit board 130. The first sensitive switch 131 is disposed to the rear of the first locking portion 114a, the monitor switch 133 is disposed to the rear side of the second locking portion 114b and the second sensitive switch 132 is disposed under the monitor switch 133.

[0028] An actuating member 117 is disposed between the monitor switch 133 and the second sensitive switch 132 for upwardly moving the second arm 122b to release the door 101. The actuating member 117 is pressed downwards by the second arm 122b and presses the button of the second sensitive switch 132. The actuating member 117 is integrally formed with a door release lever 116.

[0029] The first and second sensitive switches 131, 132 and the monitor switch 133 are connected with conductive tracks, formed on the printed circuit board 130, by connectors 134 mounted to the printed circuit board 130.

[0030] A main circuit board 104 is mounted at the back of the control panel 103 of the microwave oven and has various electric components of control part mounted thereon for controlling the operation of the microwave oven. The main circuit board 104 and the printed circuit board 130 are electrically connected to each other by ribbon cables 136a, 136b.

[0031] One ribbon cable 136a comprises a plurality of input lines and the other 136b comprises a plurality of output lines. It is not necessary to separate the input and output ribbon cables 136a, 136b from each other, since the wiring layout of the main circuit board 104 and the printed circuit board 130 can be modified in various ways.

[0032] When the door 101 is dosed, the first and second arms 122a, 122b are inserted through the insertion holes 112a, 112b of the door latch 110 and then move along the upper faces of the locking portions 114a, 114b. When the door 101 is completely closed, the first and second arms 122a, 122b are held by the locking portions 114a and 114b.

[0033] The first arm 122a is held by the first locking portion 112a and presses the button of the first sensitive switch 131 and the second arm 122b is held by the second locking portion 112b and presses the button of the monitor switch 133. Simultaneously, the actuating member 117 of the door lever 116 is pivoted downwardly by the second arm 122b, pressing the button of the second sensitive switch 132.

[0034] As described above, as the first and second arms 122a, 122b are inserted through the insertion holes 112a, 112b of the door latch 110, they press the buttons of the sensitive switches 131, 132, 133 and operation of the magnetron is enabled. Consequently, a user can cook food in the microwave oven in accordance with the instructions he inputs using the control panel 103.

[0035] In the event that the door 101 is incompletely closed, so that the button of any of the first and second sensitive switches 131, 132 or the monitor switch 133, is not pressed, the magnetron can not be operated.

[0036] When the user presses the door lever 116, the actuating member 117 of the door lever 116 is pivoted upwardly and the button of the second sensitive switch 132 is released. The actuating member 117 of the door lever 116 presses the second arm 122b upwards when the operational portion 117 is pivoted upwardly, so that the arms 122a, 122b are released from the locking portions 114a, 114b and the door 101 can be opened.

[0037] When the first and second arms 122a, 122b are released from the locking portions 114a, 114b, the arms 122a and 122b are moved downwardly along the slanted faces of the locking portions 114a, 114b by the restoring force of the spring 123, resulting in opening of the door.

[0038] As described above, as the arms 122a, 122b are released from the locking portions 114a, 114b, the buttons of the first and second sensitive switches 131 and 132 and the monitor switch 133 are released, so that the magnetron cannot be operated.

[0039] Although the printed circuit board 130 has been described fixed on the door latch 110, the printed circuit board 130 may be fixed directly to the cabinet 102, and the insertion holes 112a, 112b and the locking portions 114a, 114b of the door latch 110 may be directly formed in the cabinet 102. In the latter case,

since there is no need for the door latch 110, the number of parts may be reduced.

[0040] As described above, according to the safety device for the microwave oven according to the present invention, wiring between the plurality of sensitive switches and the main circuit board is electrically connected by the parallel connector.

[0041] Accordingly, the wiring structure between the sensitive switches and the main circuit board becomes very simple, and the wiring process can be completed by simply connecting the parallel connectors. As a result, the number of processes is reduced, increasing the assembly efficiency.

[0042] Meanwhile, in the case of directly fixing the printed circuit board on the cabinet without employing the door latch, further advantages can be obtained such as reduced number of parts, and manufacturing costs, or the like.

Claims

1. A microwave oven including a door position sensitive safety interlock assembly comprising a plurality of switches responsive to the position of a cooking chamber door, characterised in that the switches are mounted to a printed circuit board and electrically connected to conductive tracks on the printed circuit board.

2. A microwave oven according to claim 1, wherein the printed circuit board includes a multiway terminal block whose terminals are connected to said switches.

3. A microwave oven according to claim 2, wherein the printed circuit board includes a further multiway terminal block whose terminals are connected to said switches.

4. A microwave oven according to claim 1, 2 or 3, including a control panel circuit board, wherein the switches are connected to the control panel circuit board by a ribbon cable between said circuit boards.

5. A safety device for a microwave oven comprising:

   a door key movably mounted on a door of the microwave oven and having a key switch portion protruded toward the front side of the cabinet of the microwave oven;
   a door latch fixed within the cabinet and having an insertion hole through which the key switch portion of the door key is inserted;
   a plurality of sensitive switches for turning on/off an electricity supply which is electrically connected thereto by being turned on/off in accordance with an insertion of the key switch portion; and
   a printed circuit board on which a plurality of sensitive switches are fixed, and in which wiring is formed to electrically connect the sensitive switches to a main circuit board.

6. The safety device as claimed in claim 5, wherein the printed circuit board and the main circuit board are electrically connected by a parallel connector.

7. A safety device for a microwave oven comprising:

   a door key movably mounted on a door of the microwave oven and having a key switch portion protruded toward the front side of the cabinet of the microwave oven;
   a plurality of sensitive switches for turning on/off an electricity supply which is electrically connected thereto by being turned on/off in accordance with an insertion of the key switch portion; and
   a printed circuit board on which a plurality of sensitive switches are fixed, and in which wiring is formed to electrically connect the sensitive switches.

FIG. 1

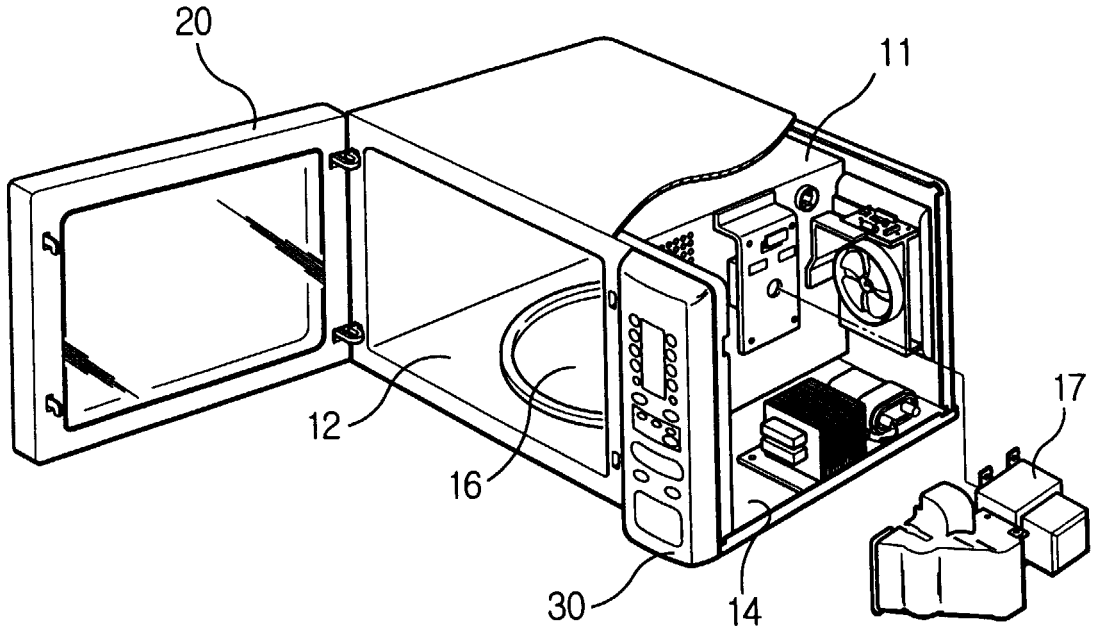


FIG.2

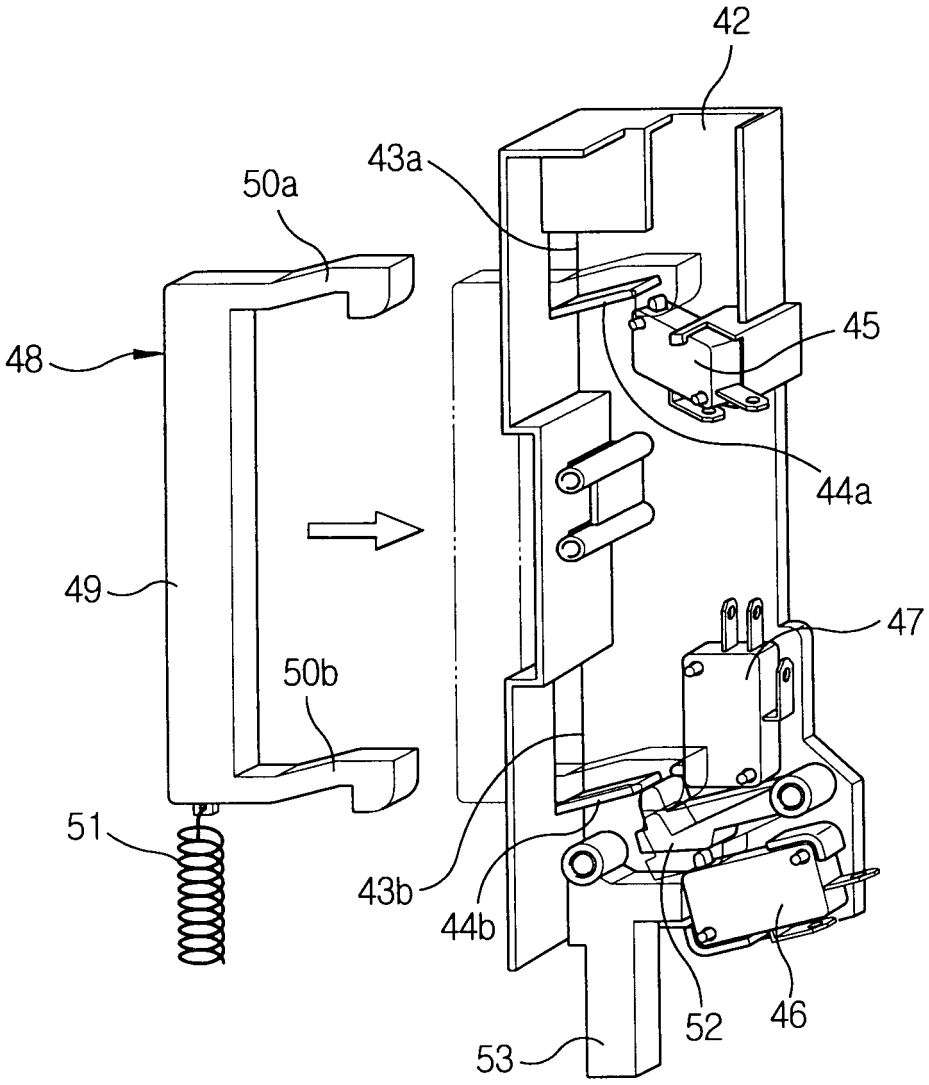


FIG.3

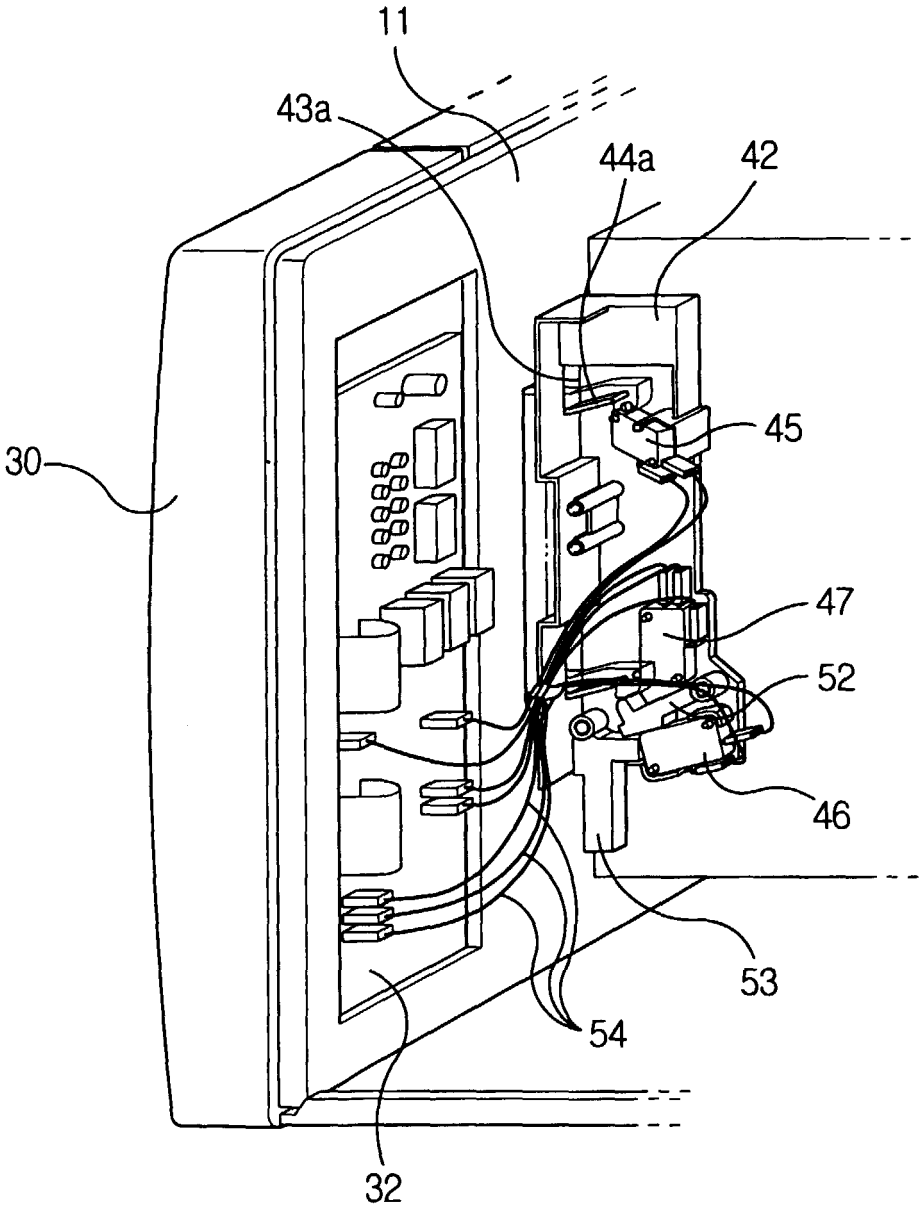


FIG.4

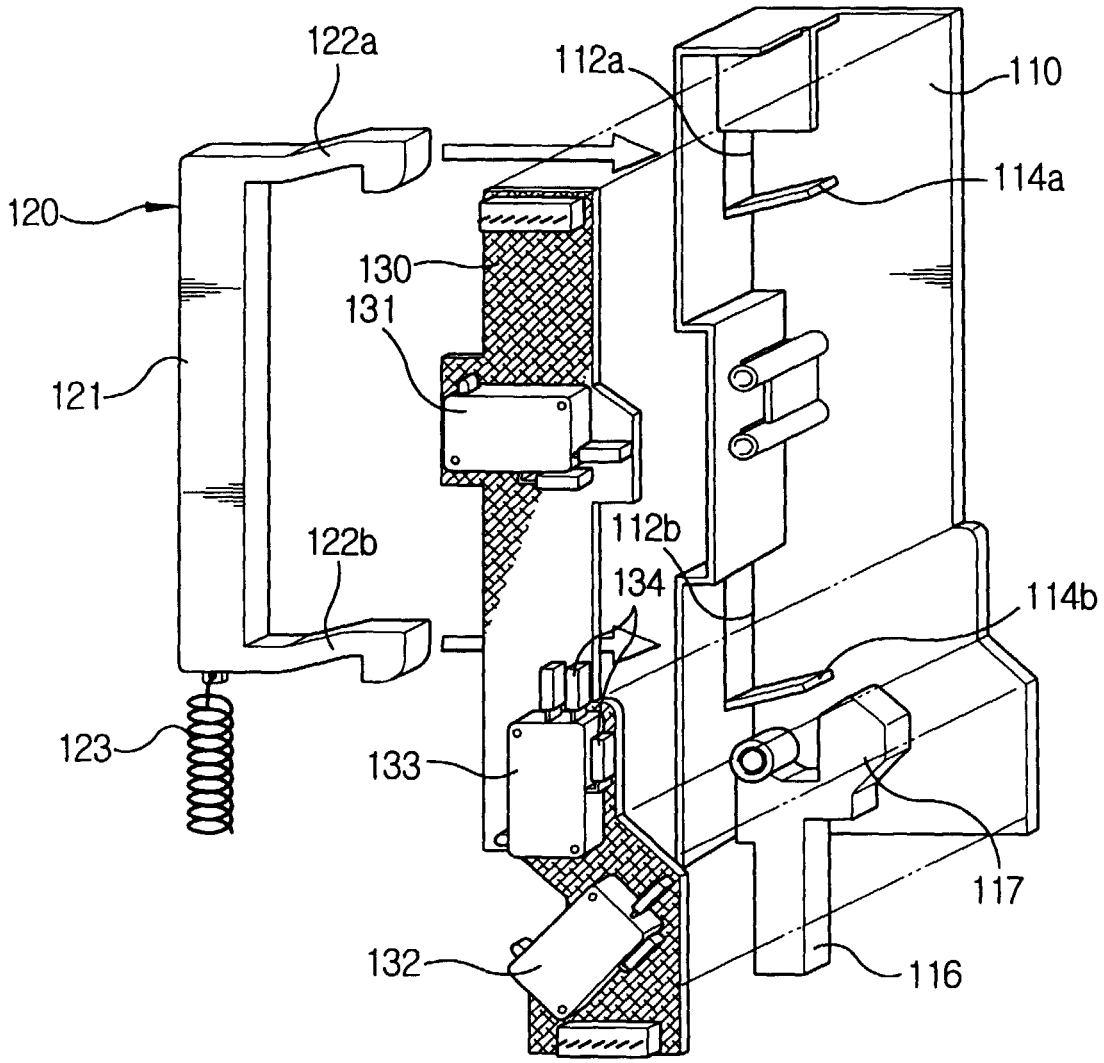
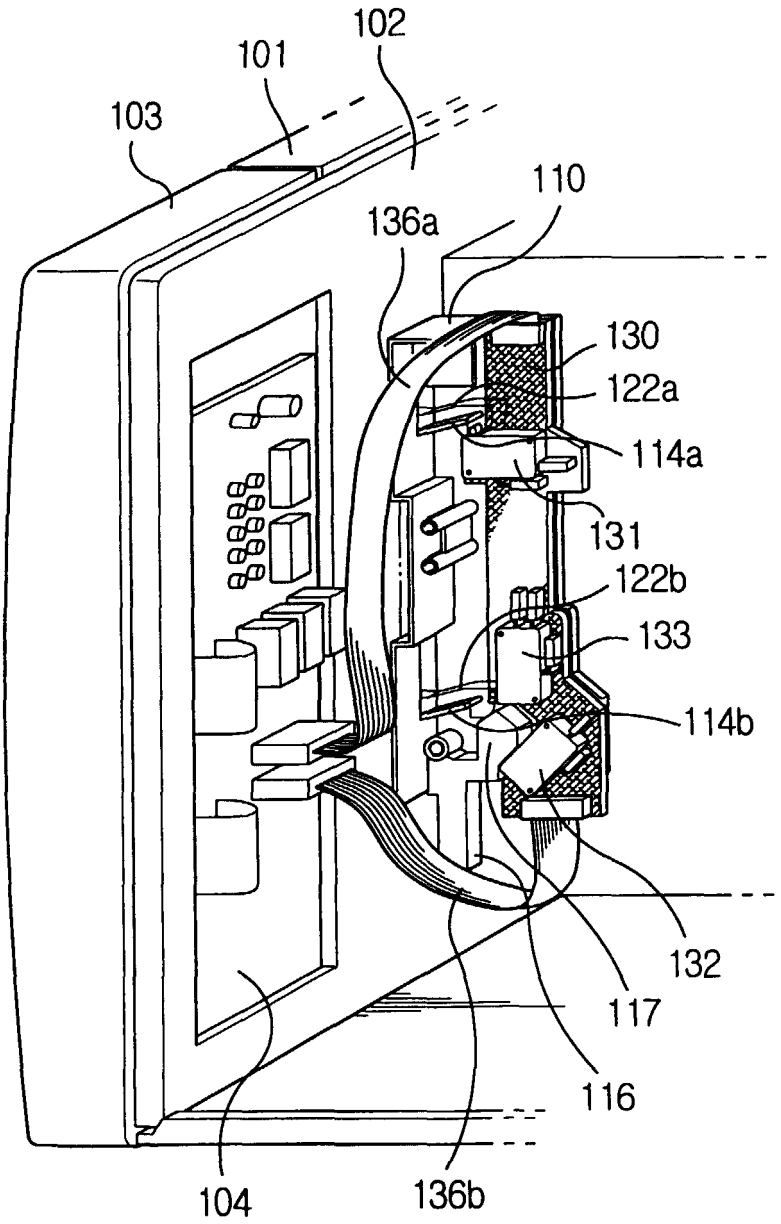

122a
112a
110
120
114a
130
131
121
122b
112b
134
114b
123
133
117
132
116

FIG.5


102
101
103
110
136a
130
122a
114a
131
122b
133
114b
132
117
116
104
136b