DESCRIPTION

TEMPERATURE CONTROL DEVICE FOR REFRIGERATORS

TECHNICAL FIELD

The present invention generally relates to refrigerators and, more particularly, to a temperature control unit used in the refrigerator to control the temperature inside the refrigerator.

BACKGROUND ART

The temperature control unit adapted for use in a refrigerator has been developed by way of example, the Japanese Patent Laid-open Publication No. 61-93375, published in 1986, discloses a temperature control unit installed in a rearmost wall of the refrigerating compartment such as shown in Figs. 12 and 13, and the Japanese Patent Laid-open Publication No. 4-161779, published in 1992, discloses a temperature control unit installed outside the refrigerating compartment at a location between a freezer door and a refrigerator door such as shown in Figs. 14 and 15.

The refrigerator generally comprises a rectangular box-like housing of a double-walled structure including outer and inner boxes with a heat insulating material 12 filled in a space between the outer and inner boxes. The refrigerator shown in Figs. 12 and 13 is of a type wherein the inner box is divided into a freezing compartment FC adapted to be opened or closed selectively by a freezer door FD and a refrigerating compartment RC defined beneath the freezing compartment FC and adapted to be opened or closed selectively by a refrigerator door RD. The refrigerating compartment RC is delimited by top, bottom, rear and side walls, which form parts of the inner box 1 of the refrigerator housing, the rear wall confronting the refrigerator door RD.

As shown in Figs. 12 and 13, the prior art temperature control unit is accommodated, together with two temperature control knobs 23, in a control box 22 which is in turn mounted at a portion of the rear wall of the inner box 1 adjacent the top well as best shown in Fig. 12. The temperature control knobs 23 are for the freezing compartment FC and for the refrigerating compartment RC, respectively, and each knob 23 has a radially extending finger-piece 23a formed integrally therewith. The temperature inside the freezing compartment FC or inside the refrigerating compartment RC can be adjusted by turning a corresponding one of the temperature control knobs 23 in either direction with the user nipping the associated finger-piece 23a.

The refrigerator shown in Fig. 14 is similar in structure to that shown in Fig. 12, but has a transverse trim box 7 fixed to a lower portion of the freezer door FD for movement together therewith. As best shown in Fig. 15, a generally elongated circuit carrier board 3 and a generally elongated control panel 9 are connected together by means of a plurality of set screws 4 and the resultant assembly is in turn accommodated within the trim box 7 together with a display panel 5. The trim box 7, accommodating the circuit carrier board 3, the control panel 9 and the display panel 5, is encased within and secured from below to the lower portion of the freezer door FD by means of set screws 25. In the assembled condition, the control panel 9 is covered by two slide door segments 27 each having a display window 26 defined therein.

Adjustment of the temperatures inside the freezing compartment and the refrigerating compartment can be accomplished by opening the associated slide door segments 27 so that the user can press adjustment buttons mounted on the control panel 9, respectively.

It has been found that the prior art temperature control units discussed above have the following problems.

Specifically in the case of the temperature control unit disclosed in the first-mentioned Japanese publication, the user is forced to take an awkward posture in such a way as to stoop down and then to extend his or her arm deep into the refrigerating compartment RC to reach the temperature control unit when he or she wishes to turn one or both of the temperature control knobs 23.

Also, where a region of the refrigerating compartment RC between the refrigerator door RD and the rear wall where the temperature control unit is installed is filled with foodstuffs to be refrigerated, access to the temperature control unit is difficult to accomplish unless the foodstuffs are removed. Moreover, considering that the temperature control box 22 is installed in a fashion protruding from the rear wall into the refrigerating compartment RC, the maximum space available for storing the foodstuffs tends to be limited.

On the other hand, in the case of the temperature control unit disclosed in the second-mentioned Japanese publication, due to installation of the temperature control unit at that lower portion of the freezer door FD immediately above the refrigerator door RD, not only required is the use of a relatively long electric wiring 11 made up of a bundle of electric lines, which tends to bring about an increase in cost, but also render information displayed through the display windows 26 to be difficult to read. Also, considering that adjustment of the temperatures inside the freezing compartment and the refrigerating compartment requires the associated slide door segments 27 to be opened and then closed before and after the user presses the adjustment buttons mounted on the control panel 9, respectively, the repeated opening and closure of the slide doors over a long period of use would eventually result in damage to one or both of the slide door segments 27 to such an extent as to bring about reduction in aesthetic appearance of the refrigerator.

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In addition, the temperature control unit may be damaged or malfunction when that lower portion of the freezer door FD then being opened collides inadvertently against, for example, a cupboard or cabinet positioned next to the refrigerator.

DISCLOSURE OF INVENTION

Accordingly, the present invention has been devised with a view to substantially eliminating the above discussed problems inherent in the prior art temperature control devices used in the refrigerators and is intended to provide an improved temperature control unit which is effective to accomplish a maximized utilization of the space available in the refrigerator, which can easily and comfortably be handled without forcing the user to take an awkward posture and which is simple in structure and easy to install at a location where the temperature control unit is less susceptible to damage.

To this end, the present invention, briefly speaking, is featured in that the temperature control unit is embedded in a side portion of the inner box forming a part of the refrigerator housing. With the temperature control unit so embedded, not only the maximized utilization of the space available in the refrigerator can be possible, but the user can have an easy visual confirmation and comfortable access to the temperature control unit with no need to take an awkward position and the temperature control unit itself can be mounted in a safe position at a reduced cost.

According to the present invention, there is provided a temperature control device in a refrigerator having at least one compartment defined by top, bottom and opposite side walls, and a heat insulating material exteriorly encircling the compartment. One of the side walls has a mounting hole defined therein and having a front surface thereof confronting the compartment. The device includes a box-like console, a circuit carrier board fixedly connected to a rear surface of the console and having an electric

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wiring extending outwardly therefrom, a display panel disposed on a front surface of the console, at least one manipulatable temperature control element mounted on the console, a hat-like console casing having a peripheral flange and fixedly secured to the side wall in alignment with the mounting hole with the peripheral flange held in abutment with a rear surface of the side wall so as to define a console pocket, and a plurality of mounting elements engageable with one side edge of the side wall around the mounting hole for securement of the console to the side wall. The console is received in the console pocket with the electric wiring accommodated within the console pocket and with the display panel and the temperature control element confronting the compartment.

Preferably, the temperature control element may be a temperature control knob having a finger recess defined therein for the access by a user's finger. Alternatively, the temperature control element may comprise a temperature control push-button and a plurality of light emitting elements for the display of a temperature selected.

Preferably, the console includes a peripheral flange protruding transversely from the rear surface of the console and encircling the circuit carrier board and at least one rib formed on an upper wall portion of the peripheral flange and positioned behind the mounting element.

Preferably, the console casing has a bottom wall lying parallel to the side wall and spaced in opposition to the mounting hole and two parallel upright ribs are formed on the bottom wall of the console casing for snugly accommodating the electric wiring. Instead of the two parallel upright ribs, a plurality of wire catches may be employed.

Also preferably, a front side wall portion of the side wall adjacent the opening leading to the compartment is inclined relative to the remaining side wall portion of the side wall and in that the mounting hole is defined in the front side wall portion.

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The console may be pivotally mounted in the mounting hole and has a top wall formed with a guide slot, in which case a slidable anchor member is slidably fitted to the rear surface of the side wall for engagement in the guide slot to define the stroke of pivotal movement of the console.

BRIEF DESCRIPTION OF DRAWINGS

The present invention will become readily understood from the following description of preferred embodiments thereof made with reference to the accompanying drawings, in which like parts are designated by like reference numeral and in which:

Fig. 1 is a schematic perspective view of a top portion of a refrigerator in which a temperature control unit according to a first preferred embodiment of the present invention is installed;

Fig. 2 is a fragmentary longitudinal sectional view, on an enlarged scale, showing the temperature control unit shown in Fig. 1;

Fig. 3 is a view similar to Fig. 2, showing the temperature control unit according to a second preferred embodiment of the present invention;

Fig. 4 is a fragmentary perspective view of a portion of the temperature control unit shown in Fig. 3;

Fig. 5 is a schematic exploded view showing the temperature control unit according to a third preferred embodiment of the present invention;

Fig. 6 is a schematic exploded view showing the temperature control unit according to a fourth preferred embodiment of the present invention;

Fig. 7 is a view similar to Fig. 1, showing the temperature control unit according to a seventh preferred embodiment of the present invention;

Fig. 8 is a fragmentary sectional view, on an enlarged scale, showing a portion of the temperature control unit of Fig. 7 as viewed from top;

Fig. 9 is a schematic exploded view showing the temperature control unit according to a sixth preferred embodiment of the present invention;

Fig. 10 is a view similar to Fig. 1, showing the temperature control unit of Fig. 9;

Fig. 11 is a schematic diagram showing a push-button type temperature control which can be employed in place of a knob-type temperature control employed in the temperature control unit according to any one of the preferred embodiment of the present invention;

Fig. 12 is a longitudinal sectional view of a refrigerator showing the position of the conventional temperature control unit;

Fig. 13 is a schematic front elevational view of the conventional temperature control unit shown in Fig. 12;

Fig. 14 is a schematic view showing another conventional temperature control unit; and

Fig. 15 is an exploded view, on an enlarged scale, showing the conventional temperature control unit of Fig 14.

BEST MODE FOR CARRYING OUT THE INVENTION

The refrigerator to which the present invention is applicable may be of any known structure such as shown in Fig. 12 or may have at least one compartment for refrigerating foodstuffs accommodated therein. However, for the purpose of description of the present invention, reference is made to the refrigerator of a type having a freezing compartment, a refrigerating compartment, and a chilling compartment in the form of a sliding drawer box

for storing foodstuffs at a low temperature adjustable within the range of, for example, -5°C to 8°C, preferably 5°C to 7°C for storing vegetables.

(First Embodiment)

Referring now to Figs. 1 and 2, the refrigerator comprises a rectangular box-like housing of a double-walled structure including outer and inner boxes with a heat insulating material 12 filled in a space between the outer and inner boxes. The refrigerator shown therein is of a type wherein the inner box is divided into a freezing compartment FC adapted to be opened or closed selectively by a freezer door FD and a refrigerating compartment RC located, for example, above the freezing compartment FC and adapted to be opened or closed selectively by a refrigerator door RD. The refrigerating compartment RC is delimited by a top wall TW, a bottom wall BW, a rear wall RW and opposite side walls SW, which form respective parts of the inner box 1 of the refrigerator housing, the rear wall RW confronting the refrigerator door RD.

One of the opposite side walls SW of the inner box 1 is formed with a generally rectangular mounting hole 2 at a location adjacent the opening of the refrigerating compartment RC or adjacent the refrigerator door RD when the latter is in position to close the opening of the refrigerating compartment RC. A generally rectangular hat-like console casing 13 having a peripheral flange 10 is embedded in the insulating material 12 with its opening aligned with the mounting hole 2 and with its peripheral flange 10 fixedly held in abutment with a rear surface of the peripheral lip region of the side wall SW around the mounting hole 2, to thereby complete a console pocket CP. It is to be noted that, for the reason which will become clear from the subsequent description, the opening of the hat-like console casing 13 is so oversized relative to the opening of the mounting hole 2 that at least upper and lower, opposite portions of the peripheral lip region of the side wall SW

around the mounting hole 2 can protrude a distance inwardly of the mounting hole 2 to thereby define respective engagement pawls 1a and 1b.

A generally box-like console C includes a generally rectangular front panel 50 having a generally rectangular peripheral flange 50a (or 50b) formed integrally therewith. The peripheral flange 50a (or 50b) protrudes from a rear surface thereof in a direction transverse thereto and are positioned at respective locations set a distance backwardly from upper and lower ends of the front panel 50. This peripheral flange 50a (or 50b) has upper and lower wall portions opposite to each other which are integrally formed with respective upper and lower tongues 6a and 6b. The upper and lower tongues 6a and 6b extend slantwise and outwardly from the upper and lower wall portions of the peripheral flange 50a (or 50b) so as to terminate at a position spaced from the adjacent upper and lower ends of the front panel 50 a distance substantially equal to or slightly smaller than the thickness of the upper engagement pawls 1a and 1b, respectively.

The console C also includes a circuit carrier board 3 spacedly fixed to the rear surface of the front panel 50 by means of a plurality of set screws 4, a display panel 30 disposed on a front surface of the front panel 50 for providing a visual indication of the status of operation of the refrigerator, for example, occurrence of a trouble in the refrigerator, and three temperature control knobs 31a, 31b and 31c disposed on the front surface of the front panel 50 and used to adjust the temperature inside the chilling chamber (not shown), the temperature inside the refrigerating compartment and the temperature inside the freezing compartment, respectively. Each of the temperature control knobs 31a, 31b and 31c has a finger recess 8 defined therein for the access of a user's finger thereto when the respective knob 31a, 31b or 31c is desired to be turned for adjustment of the temperature inside the corresponding compartment.

The console C of the structure described above is accommodated within the console pocket CP in the following manner. When the console C carrying the circuit carrier board 3 is, after having been aligned with the mounting hole 2, pushed into the console pocket CP with the upper and lower engagement pawls 1a and 1b sliding over the upper and lower tongues 6a and 6b while causing the latter to be substantially yielded against their own resiliency in sliding contact with the upper and lower engagement pawls 1a and 1b. Simultaneously with complete insertion of the console C into the console pocket CP with the upper and lower ends of the front panel 50 held in contact with the upper and lower engagement pawls 1a and 1b from outside, the upper and lower tongues 6a and 6b are erected by their own resiliency to thereby clamp the upper and lower engagement pawls 1a and 1b in cooperation with the upper and lower ends of the front panel 50, respectively, as shown in Fig. 2.

With the console C received securely within the console pocket CP in the manner as hereinabove described, an electric wiring 11 made up of a bundle of electric lines extending outwardly from the circuit carrier board 3 extends in a space delimited between the console casing 13 and the console C and then to an electric power source circuit A through a perforation 13a defined in an upper wall portion of the console casing 13 having been embedded in the insulating material 12.

Considering that the console C including the temperature control knobs 31a to 31c is installed at a portion of one of the side walls SW adjacent the opening leading into the refrigerating compartment RC which occupies a top region of the refrigerator as a whole, it is clear that not only the utilization of the space within the refrigerating compartment RC can be maximized, but also the user can gain an easy and comfortable access to the console C with no need to take an awkward posture. Also, the console C is substantially free from damage which would be brought about when it is installed in the door

such as discussed in connection with the prior art shown in Figs. 14 and 15, and the length of the electric wiring 11 can also be reduced as compared with that employed in the prior art temperature control unit shown in Figs. 14 and 15. The user can also easily visually confirm information displayed on the display panel 30 disposed on the front panel 50 of the console C and used to provide an visual indication of the status of operation of the refrigerator.

(Second Embodiment)

In the embodiment shown in Figs. 3 and 4, the upper wall portion of the peripheral flange 50a is integrally formed with at least one transverse rib 14 positioned thereon in the same side of the upper tongues 6a in parallel to the front panel 50. This rib 14 protrudes upwardly therefrom a distance smaller then the height of each upper tongue 6a as measured upwardly from the upper wall portion of the peripheral flange 50a and extends in a direction widthwise of the console C and parallel to the plane of the front panel 50.

The transverse rib 14 serves as a means for avoiding any possible ingress of condensed droplets of condensed water into the space inside the peripheral flange 50a where the circuit carrier board 3 is disposed. More specifically, without the transverse rib 14, droplets of water formed by condensation of a vapor component and sticking to the side wall SW will enter in between the side wall SW and the upper end of the front panel 50 and then flow backwardly along the upper wall portion of the peripheral flange 50a and into the space inside the peripheral flange 50a. The presence of the transverse rib 14 is effective to guide the droplets of water laterally therealong so as to flow downwards along opposite side wall portions of the peripheral flange 50a to thereby avoid the ingress of the water droplets into the space inside the peripheral flange 50a.

In the embodiment shown in Figs. 3 and 4, although the lower tongues 6b may be functionally identical with those shown in and described in connection with the foregoing embodiment, but are rather used to serve as

leaf springs for biasing the console C as a whole upwardly after the console C has been completely received in the console pocket CP. More specifically, the console C employed in the second embodiment of the present invention shown in Figs. 3 and 4 is mounted in the console pocket CP by first allowing the upper engagement pawl 1a to be received between the upper tongues 6a and the upper end of the front panel 50 and then pushing a lower portion of the console C towards the console pocket CP with the lower tongues 6b sliding over the lower engagement pawl 6b while being yielded against their own resiliency. Upon completion of insertion of the console C into the console pocket CP, the lower tongues 6b restore to the original shape by the effect of their own resiliency, biasing the console C as a whole upwardly.

The use of the lower tongues 6b which rather serve as leaf springs is effective to accommodate a variation in dimension or completeness of the console C relative to the size of the console pocket CP and also to facilitate a cursory mounting of the console C in the console pocket PC.

(Third Embodiment)

In this third embodiment of the present invention, an upright bottom wall of the console casing 13 defining the bottom of the console pocket CP is formed with a pair of vertically extending, juxtaposed upright ribs 15 spaced from each other a distance sufficient to accommodate the bundled electric lines forming the electric wiring 11 and protruding towards the console C a distance sufficient to avoid the bundled electric lines from being bitten between the bottom wall of the console casing 13 and the console C when the latter is mounted in the console pocket CP. With the juxtaposed ribs 15, one or some of the bundled electric lines of the electric wiring 11 can be advantageously avoided from being broken during servicing or replacement of the console C.

(Fourth Embodiment)

In this embodiment of the present invention, in place of the juxtaposed upright ribs 15 shown in Fig. 5, the upright bottom wall of the console casing 13 is formed with a plurality of, for example, two, generally L-shaped cable catches 16 to avoid a loosening of the electric wiring 11.

Since these cable catches 16 are effective to avoid an arbitrary meandering of the electric wiring 11 as is the case with the upright ribs 15 shown in Fig. 5 during servicing or replacement of the console C, an inadvertent breakage of one or some of the bundled electric lines of the electric wiring 11 can effectively avoided.

(Fifth Embodiment)

In this embodiment, at least one of the opposite side walls SW of the inner box 1 defining the refrigerating compartment RC has a front side wall portion 17 most inclined relative to the remaining side wall portion of such one side wall SW such that as viewed from the top as shown in Fig. 8, the associated side wall of the refrigerating compartment RC has a wall thickness progressively decreasing towards a front side rim flush with the opening leading into the refrigerating compartment RC. The mounting hole 2 referred to above is defined in the inclined front side wall portion 17 of the side wall SW. The console C is mounted in the console pocket CP in a manner similar to that described in connection with any one of the first and second embodiments of the present invention.

Since that inclined front side wall portion 17 diverges from the remaining side wall portion so as to face towards the opening leading into the refrigerating compartment RC rather than towards the opposite side wall SW, therefore the user can easily and conveniently view the display panel 30 in the console C, and also can make an easy access to any one of the temperature control knobs 31a to 31c.

(Sixth Embodiment)

The console C as shown in Figs. 9 and 10, is of a configuration having a generally triangular cross-section including, in addition to the front panel 50, generally sector-shaped top and bottom panels 51 and 52, a substantially arcuately sectioned side wall 53 and a rear panel 54. The top panel 51 is formed with a curved guide slot 19 defined therein so as to follow the curvature of the arcuate side wall 53. The console C also includes a pair of anchor arms 55 protruding laterally and outwardly from around a joint between the front panel 50 and the rear panel 54 and is pivotally mounted in the console pocket CP with the anchor arms 55 non-detachably anchored to behind a left side edge of the mounting hole 2 in any suitable manner. The side wall SW has a slidable pin 18 supported for movement up and down as shown by the arrow, said slidable pin 18 being engaged in the curved guide slot 19 once the console C has been mounted in the console pocket CP.

Thus, it will readily be seen that the console C can be pivoted about the hinge defined by points of connection between the anchor arms 55 and the side edge of the mounting hole 2 between a folded position, in which the front panel 50 lies substantially parallel to the adjacent side wall SW, and a drawn position as shown in Fig. 10. The stroke of movement of the console C is limited by the size of the curved guide slot 19 in cooperation with the slidable pin 18 that is loosely engaged therein.

The mounting of the console C in the manner shown in Figs. 10 and 11 is particularly advantageous where the inclined front side wall portion 17 is not available for the console C because a door switch 20a and a label 20b setting forth instructions of how to use the refrigerator are disposed on the inclined front side wall portion 17 as shown in Fig. 10. In such situation, there will be no way other than to dispose the console C in the side wall SW at a location somewhat a distance inwardly from the opening leading to the refrigerating compartment RC and, accordingly, to provide a ready access to

the temperature control knobs 31a to 31c and also to the display panel 30, the console C is pivotally mounted as discussed hereinabove.

(Modification)

In describing any one of the foregoing preferred embodiments of the present invention, the temperature control unit has been shown and described as having the temperature control knobs 31a to 31c. However, in place of the temperature control knobs 31a to 31c, push-button controls may be employed. Each push-button control includes, as shown in Fig. 11, a push-button PB and a row of light emitting elements LED, each of which provides a visual indication of a varying temperature selected when lit.

As a matter of course, only one or two of the temperature control knobs may be replaced with the push-button control or controls to allow the console C to have a combination of the temperature control knob or knobs and the push-button type temperature controls or control.

The use of the light emitting elements to provide a visual indication of the selected temperature inside the refrigerating compartment highlights the visibility as compared with calibrations used in connection with any of the temperature control knobs 31a to 31c.

As described above, in the improved temperature control unit of the present invention, there can be accomplished a maximized utilization of the space available in the refrigerator, which can easily and comfortably be handled without forcing the user to take an awkward posture and which is simple in structure and easy to install at a location where the temperature control unit is less susceptible to damage. That is, since the temperature control unit is embedded in a side portion of the inner box forming a part of the refrigerator housing, not only the maximized utilization of the space available in the refrigerator can be possible, but the user can have an easy visual confirmation and comfortable access to the temperature control unit with no

need to take an awkward position and the temperature control unit itself can be mounted in a safe position at a reduced cost.

Although the present invention has been described in connection with the preferred embodiments thereof, it should be noted that various changes and modifications are apparent to those skilled in the art. For example, although in any one of the foregoing embodiments the refrigerator has been described having three compartments, the present invention is equally applicable where the refrigerator has only one refrigerating or freezing compartment and, in such case, the three temperature control knobs or push-buttons need not be employed, but the only temperature control knob or push-bottom suffices.

Accordingly, such changes and modifications so far as encompassed by the appended claims are to be understood as included within the scope of the present invention.

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CLAIMS

1. A temperature control device for use in a refrigerator having an inner and outer boxes forming a refrigerator housing comprising at least one compartment (RC, FC) adapted to be selectively opened and closed by a refrigerator door (RD, FD), said compartment being defined by top, bottom and opposite side walls (TW; BW; and SW) and including a heat insulating material (12) exteriorly encircling the compartment, characterized in that:

one of the side walls (SW) has a mounting hole (2) defined therein and having front and rear surfaces opposite to each other with the front surface thereof confronting the compartment (RC, FC), so that the temperature control device is embedded in said mounting hole (2) defined in one of the side walls of the inner box.

2. The temperature control device as defined in Claim 1, wherein the temperature control device comprises a console (C) having front and rear surfaces opposite to each other, a circuit carrier board (3) fixedly connected to the rear surface of the console (C) and including an electric wiring (11) extending outwardly therefrom, a display panel (30) disposed on the front surface of the console (C), at least one manipulatable temperature control element mounted on the console (C), a console casing (13) having a peripheral flange (10) and fixedly secured to the side wall (SW) in alignment with the mounting hole (2) with the peripheral flange (10) held in abutment with the rear surface of the side wall (SW) so as to define a console pocket (CP), and a plurality of mounting elements (6a, 6b; 55) engageable with one side edge of the side wall (SW) around the mounting hole (2) for securement of the console (C) to the side wall (SW), so that the console (C) is received in the console pocket (CP) with the electric wiring (11) accommodated within the console pocket (CP) and with the display panel (30) and the temperature control element (31a or 31b or 31c: PB, LED) confronting the compartment.

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3. The temperature control device as defined in Claim 2, characterized in that the temperature control element is a temperature control knob having a finger recess (8) defined therein for the access by a user's finger.

4. The temperature control device as defined in Claim 2, characterized in that the temperature control element comprises a temperature control push-button (PB) and a plurality of light emitting elements (LED) for the display of a temperature selected.

5. The temperature control device as defined in Claim 2, characterized in that the console (C) includes a peripheral flange (50a) protruding transversely from the rear surface of the console (C) and encircling the circuit carrier board (3) and at least one rib formed on an upper wall portion of the peripheral flange (50a) and positioned behind the mounting element (6a).

6. The temperature control device as defined in Claim 2, characterized in that the console casing (13) has a bottom wall lying parallel to the side wall (SW) and spaced in opposition to the mounting hole (2) and two parallel upright ribs are formed on the bottom wall of the console casing (13) for snugly accommodating the electric wiring (11).

7. The temperature control device as defined in Claim 2, characterized in that the console casing (13) has a bottom wall lying parallel to the side wall (SW) and spaced in opposition to the mounting hole (2), and a plurality of catch members are formed on the bottom wall of the console casing (13) for trapping the electric wiring (11).

8. The temperature control device as defined in Claim 2, characterized in that a front side wall portion (17) of the side wall (SW) adjacent the opening leading to the compartment is inclined relative to the remaining side wall portion of the side wall (SW) and in that the mounting hole (2) is defined in the front side wall portion (17).

9. The temperature control device as defined in Claim 2, characterized in that the console is pivotally mounted in the mounting hole (2) and has a top wall formed with a guide slot (19) and in that there is provided a slidable anchor member slidably fitted to the rear surface of the side wall (SW) for engagement in the guide slot (19) to define the stroke of pivotal movement of the console.

REPLACEMENT SHEET
03 SEP 1999

In addition, the temperature control unit may be damaged or malfunction when that lower portion of the freezer door FD then being opened collides inadvertently against, for example, a cupboard or cabinet positioned next to the refrigerator.

DISCLOSURE OF THE INVENTION

Accordingly, the present invention has been devised with a view to substantially eliminating the above discussed problems inherent in the prior art temperature control devices used in the refrigerators and is intended to provide an improved temperature control unit which is effective to accomplish a maximized utilization of the space available in the refrigerator, which can easily and comfortably be handled without forcing the user to take an awkward posture and which is simple in structure and easy to install at a location where the temperature control unit is less susceptible to damage.

To this end, the present invention, briefly speaking, is featured in that the temperature control unit is embedded in a side portion of the inner box forming a part of the refrigerator housing. With the temperature control unit so embedded, not only the maximized utilization of the space available in the refrigerator can be possible, but the user can have an easy visual confirmation and comfortable access to the temperature control unit with no need to take an awkward position and the temperature control unit itself can be mounted in a safe position at a reduced cost.

According to the present invention, there is provided a temperature control device for use in a refrigerator having an inner and outer boxes forming a refrigerator housing comprising at least one compartment (RC, FC) adapted to be selectively opened and closed by a refrigerator door (RD, FD), said compartment being defined by top, bottom and opposite side walls (TW; BW; and SW) and including a heat insulating material (12) exteriorly encircling the compartment, wherein one of the side walls (SW) has a mounting hole (2) defined therein and having front and rear surfaces opposite to each other with the front surface thereof confronting the compartment (RC, FC), so that the temperature control device is embedded in said mounting hole (2) defined in one of the side walls of the inner box, characterised in that:

a display (30) is disposed on a front surface of the temperature control device and a circuit carrier board (3) is fixed to a rear surface of the temperature control device.

Preferably the device includes a box-like console defining the front and rear surfaces, the circuit carrier board being fixedly connected to the rear surface of the console with electric

REPLACEMENT SHEET
03 SEP 1999

wiring extending outwardly therefrom, at least one manipulatable temperature control element

surface of the console, at least one manipulatable temperature control element mounted on the console, a hat-like console casing having a peripheral flange and fixedly secured to the side wall in alignment with the mounting hole with the peripheral flange held in abutment with a rear surface of the side wall so as to define a console pocket, and a plurality of mounting elements engageable with one side edge of the side wall around the mounting hole for securement of the console to the side wall. The console is received in the console pocket with the electric wiring accommodated within the console pocket and with the display panel and the temperature control element confronting the compartment.

Preferably, the temperature control element may be a temperature control knob having a finger recess defined therein for the access by a user's finger. Alternatively, the temperature control element may comprise a temperature control push-button and a plurality of light emitting elements for the display of a temperature selected.

Preferably, the console includes a peripheral flange protruding transversely from the rear surface of the console and encircling the circuit carrier board and at least one rib formed on an upper wall portion of the peripheral flange and positioned behind the mounting element.

Preferably, the console casing has a bottom wall lying parallel to the side wall and spaced in opposition to the mounting hole and two parallel upright ribs are formed on the bottom wall of the console casing for snugly accommodating the electric wiring. Instead of the two parallel upright ribs, a plurality of wire catches may be employed.

Also preferably, a front side wall portion of the side wall adjacent the opening leading to the compartment is inclined relative to the remaining side wall portion of the side wall and in that the mounting hole is defined in the front side wall portion.

CLAIMS

1. A temperature control device for use in a refrigerator having an inner and outer boxes forming a refrigerator housing comprising at least one compartment (RC, FC) adapted to be selectively opened and closed by a refrigerator door (RD, FD), said compartment being defined by top, bottom and opposite side walls (TW; BW; and SW) and including a heat insulating material (12) exteriorly encircling the compartment, wherein one of the side walls (SW) has a mounting hole (2) defined therein and having front and rear surfaces opposite to each other with the front surface thereof confronting the compartment (RC, FC), so that the temperature control device is embedded in said mounting hole (2) defined in one of the side walls of the inner box, characterised in that:

a display (30) is disposed on a front surface of the temperature control device and a circuit carrier board (3) is fixed to a rear surface of the temperature control device.

2. The temperature control device as defined in Claim 1, wherein the temperature control device comprises a console (C) defining the front and rear surfaces opposite to each other, with the circuit carrier board (3) being fixedly connected to the rear surface of the console (C) with electric wiring (11) extending outwardly therefrom, at least one manipulatable temperature control element mounted on the console (C), a console casing (13) having a peripheral flange (10) and fixedly secured to the side wall (SW) in alignment with the mounting hole (2) with the peripheral flange (10) held in abutment with the rear surface of the side wall (SW) so as to define a console pocket (CP), and a plurality of mounting elements (6a,6b,55) engageable with one side edge of the side wall (SW) around the mounting hold (2) for securement of the console (C) to the side wall (SW), so that the console (C) is received in the console pocket (CP) with the electric wiring (11) accommodated within the console pocket (CP) and with the display panel (30) and the temperature control element (31a or 31b or 31c: PB, LED) confronting the compartment.

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(54) Title: TEMPERATURE CONTROL DEVICE FOR REFRIGERATORS

(57) Abstract

A temperature control device in a refrigerator having at least one compartment (RC or FC) defined by top, bottom and opposite side walls (TW; BW; and SW), and a heat insulating material (12) exteriorly encircling the compartment. One of the side walls (SW) has a mounting hole (2) defined therein and having a front surface thereof confronting the compartment (RC or FC). The device includes a box-like console (C), a circuit carrier board (3) fixedly connected to a rear surface of the console (C) and having an electric wiring (11) extending outwardly therefrom, a display panel (30) disposed on a front surface of the console (C), at least one manipulatable temperature control element (31a, 31b, 31c: PB, LED) mounted on the console (C), a hat-like console casing (13) having a peripheral flange (10) and fixedly secured to the side wall (SW) in alignment with the mounting hole (2) with the peripheral flange (10) held in abutment with a rear surface of the side wall (SW) so as to define a console pocket (CP), and a plurality of mounting elements (6a, 6b; 55) engageable with one side edge of the side wall (SW) around the mounting hole (2) for securement of the console (C) to the side wall (SW). The console (C) is received in the console pocket (CP) with the electric wiring (11) accommodated within the console pocket (CP) and with the display panel (30) and the temperature control element confronting the compartment.

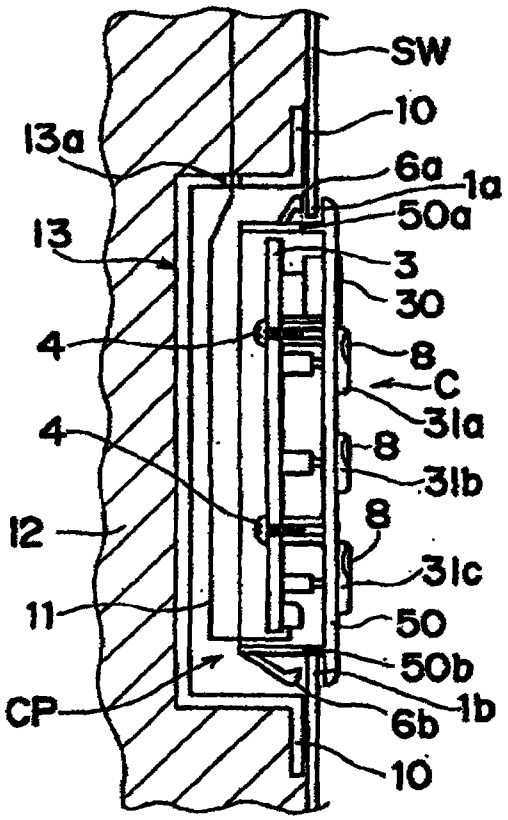


Fig.1

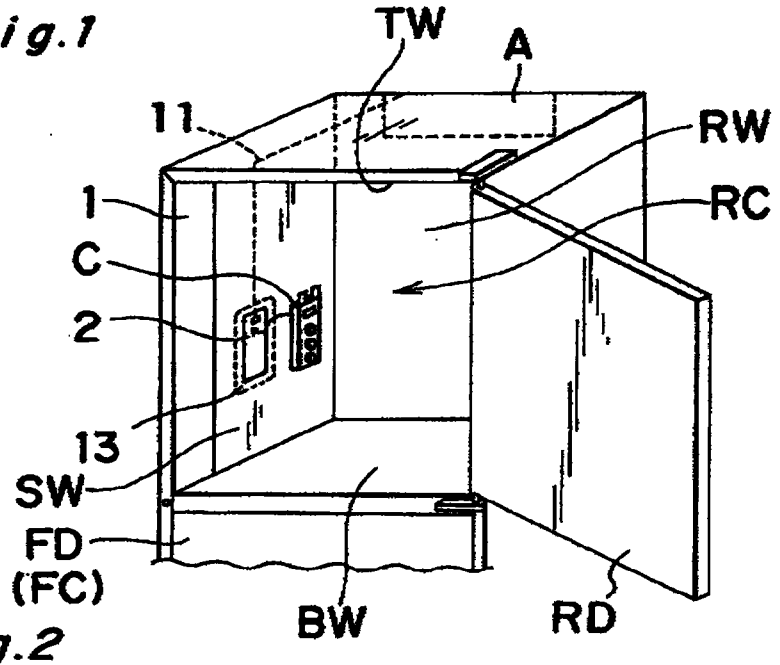


Fig.2

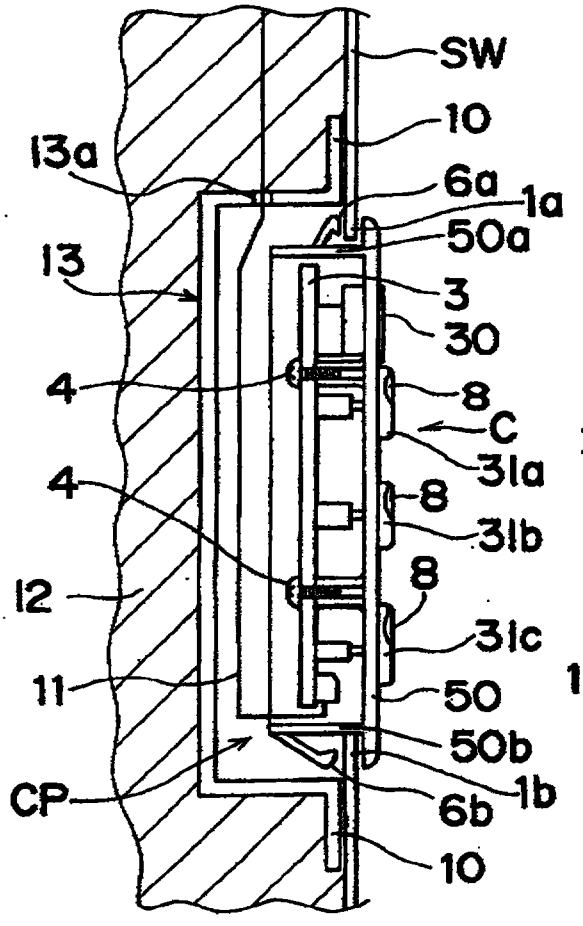


Fig.3

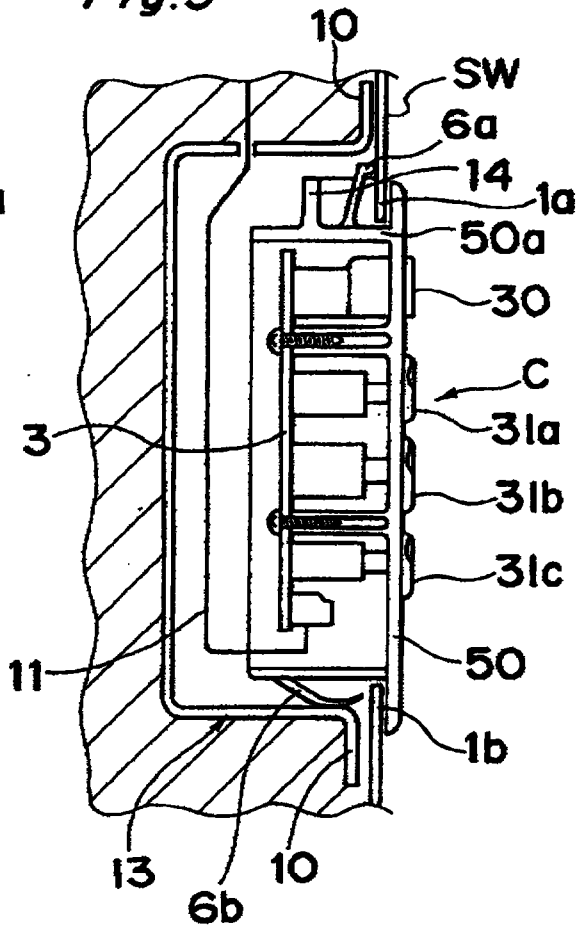


Fig.4

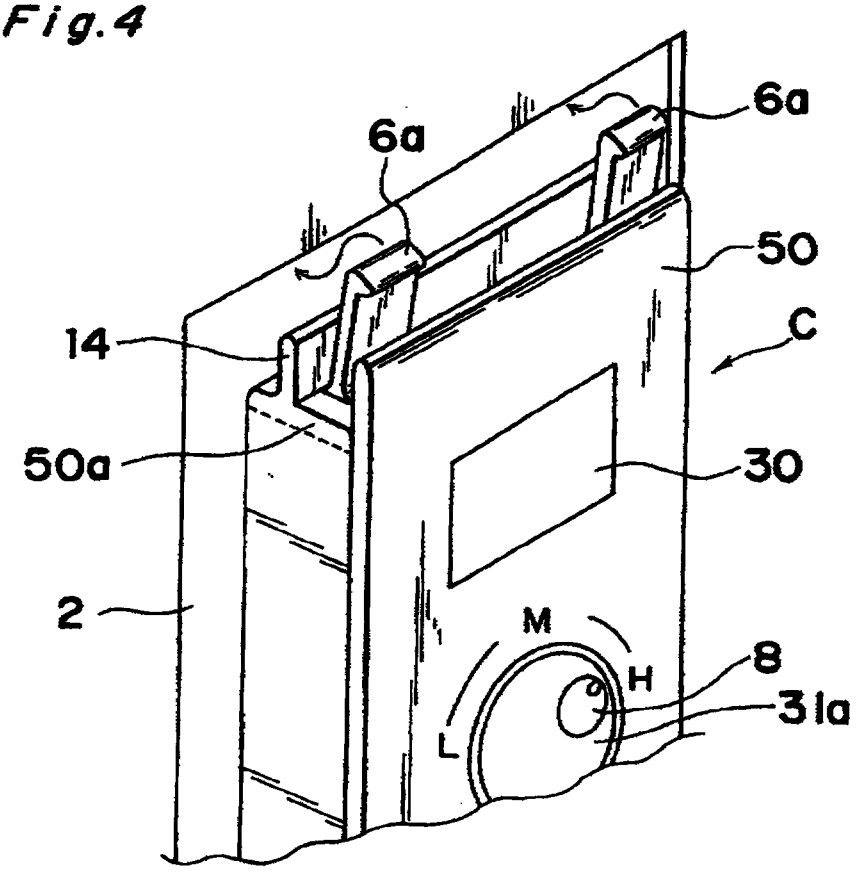

6a
6a
50
C
14
50a
30
2
M
H
L
8
31a

Fig.5

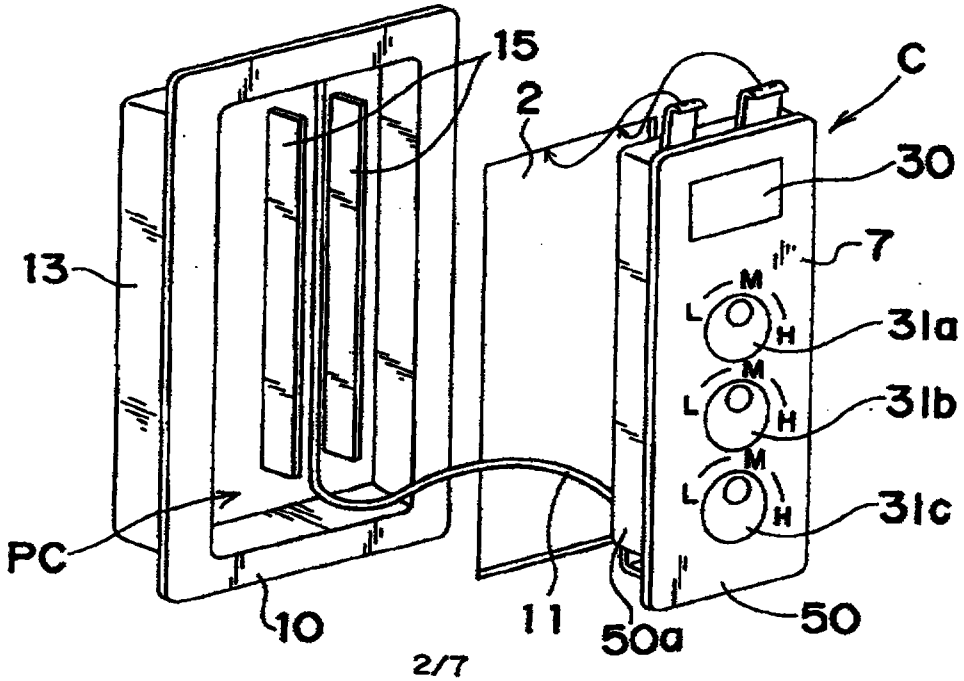

15
2
C
30
13
7
M
L
H
31a
31b
31c
PC
10
11
50a
50

Fig.6

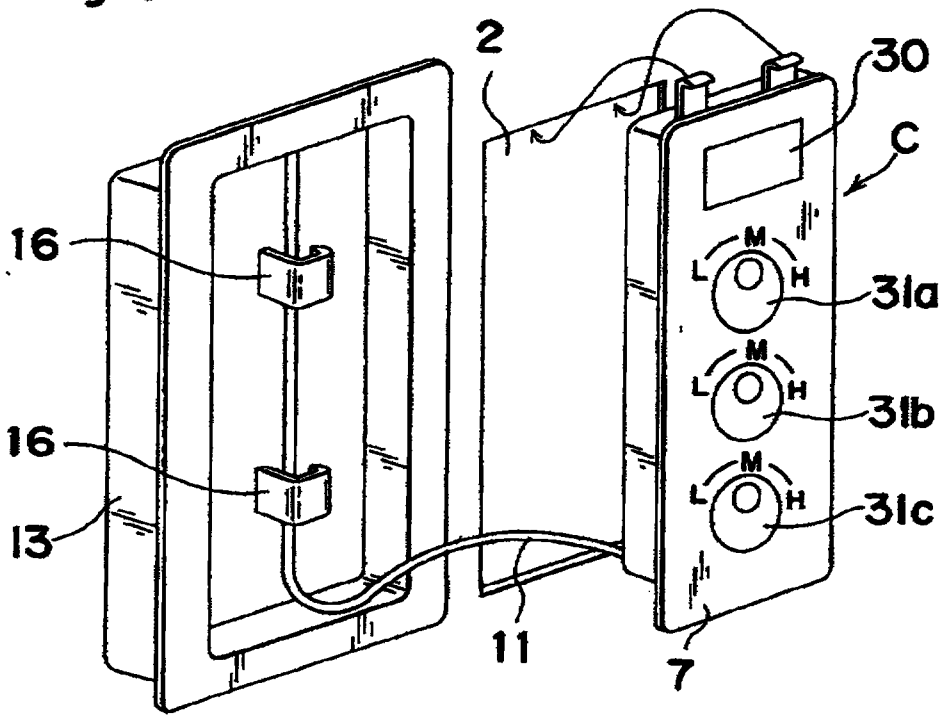


Fig.7

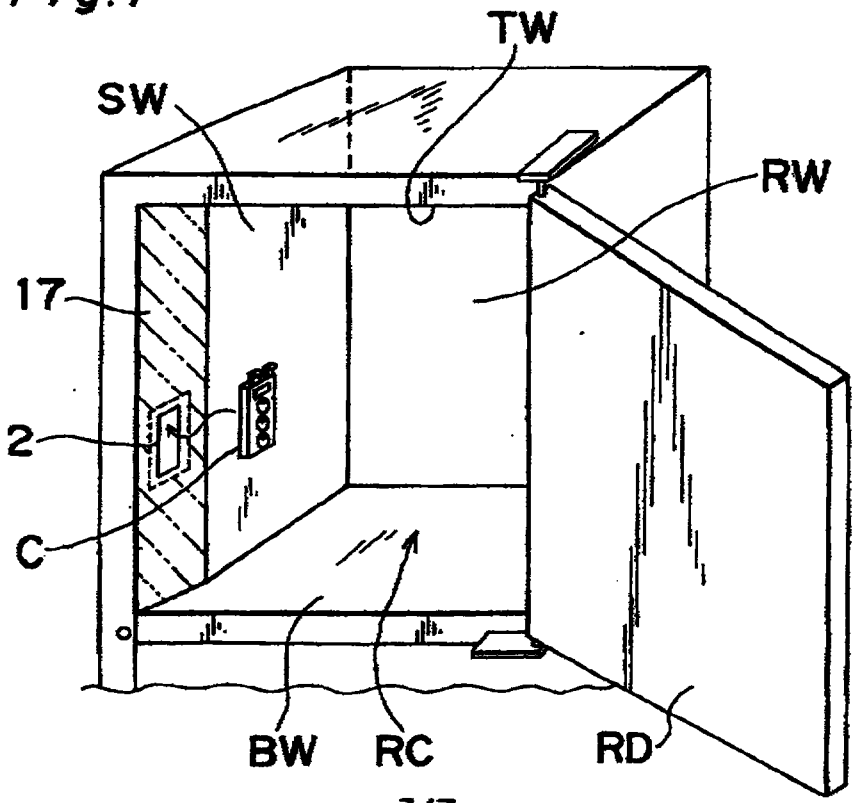


Fig.8

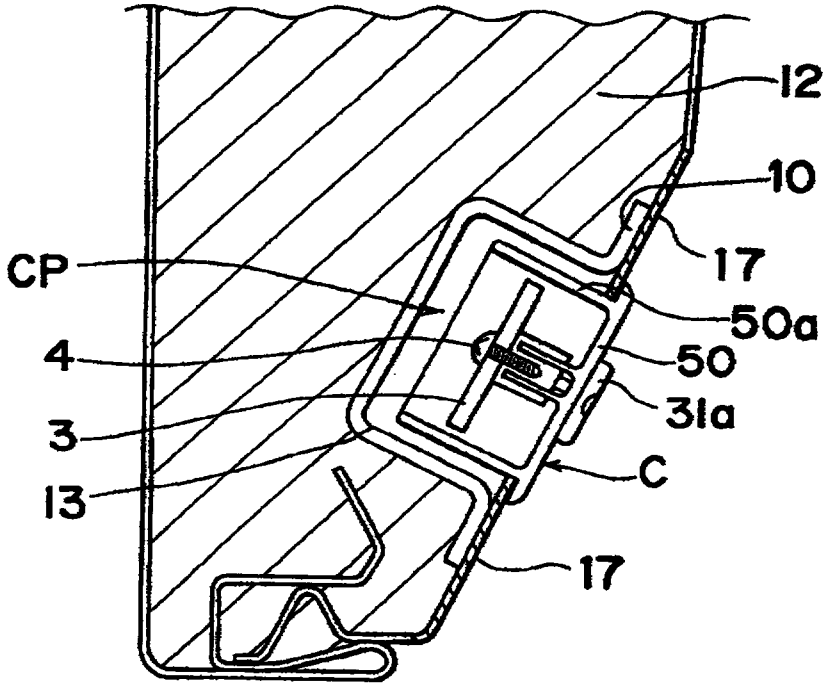

12
10
17
CP
50a
4
50
3
31a
13
C
17

Fig.9

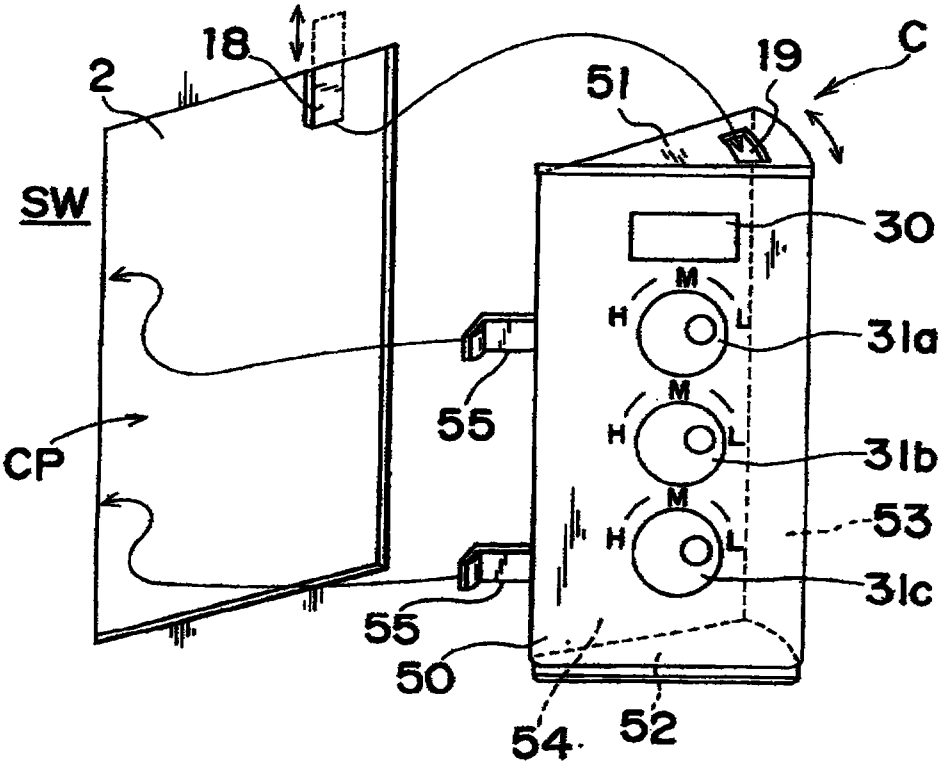

18
2
19
C
51
SW
30
M
H
L
31a
55
CP
31b
53
31c
55
50
54
52

Fig.10

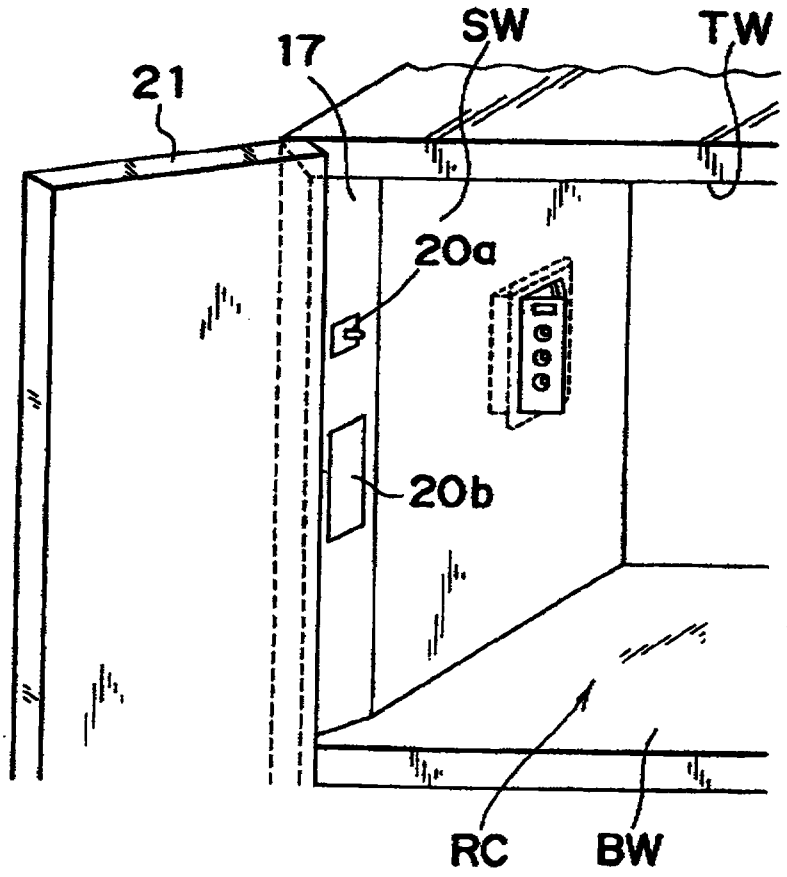


Fig.11

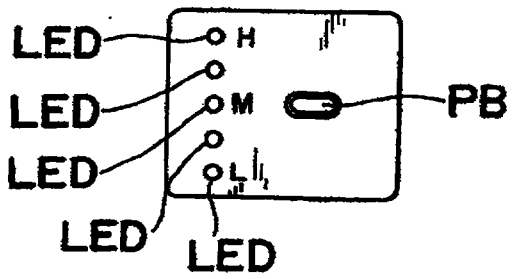


Fig.12

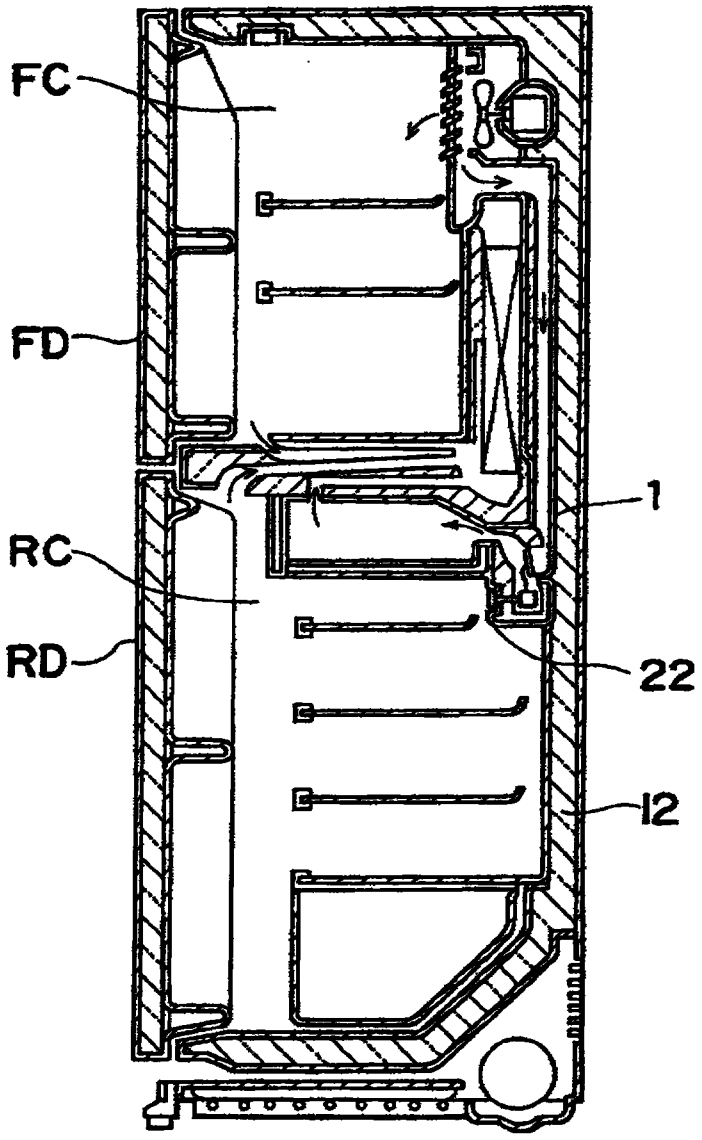


Fig.13

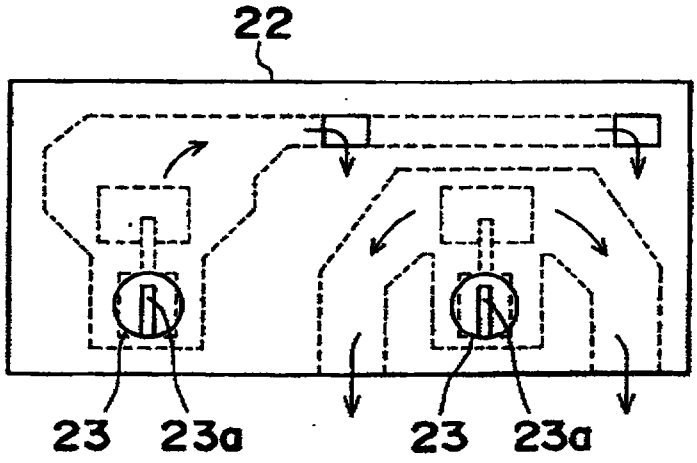


Fig.14

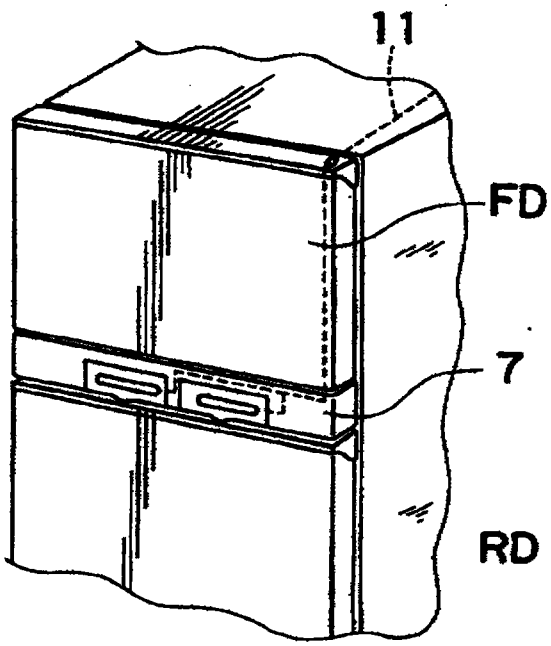


Fig.15

