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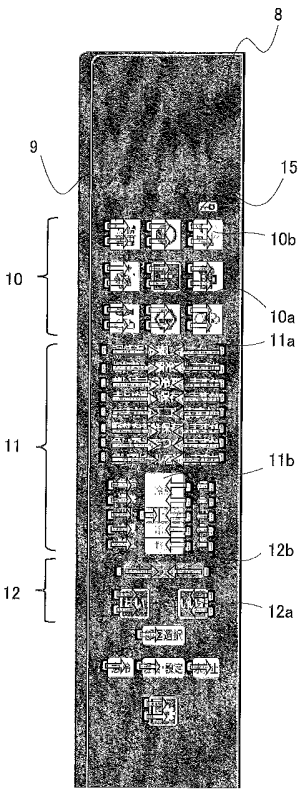
(54) **Title**: OPERATION DEVICE AND REFRIGERATOR/FREEZER

(54) 発明の名称 : 操作装置及び冷蔵冷凍庫



(57) **Abstract**: In this operation device at least some of multiple display elements (9) are formed in a row of at least three sections (10, 11, 12), and light sources (15), which are provided in correspondence with at least one of the display elements (9) forming the section (11) located in the center of the three sections (10, 11, 12), are arranged such that the light axis of the light source is approximately perpendicular to the direction in which the row is aligned. Thus, when the direction of the user's line of sight changes, the frequency with which the light-emitting element of the light sources (15) enters the user's field of vision is reduced, thereby making the display element (9) easier to read.

(57) 要約: 本発明に係る操作装置は、複数の表示要素９の少なくとも一部は、少なくとも３つの区画１０、１１、１２を一列に形成し、３つの区画１０、１１、１２のうち中央に位置する区画１１を形成する少なくとも一つの表示要素９に対応して設けられた光源１５は、光軸が列の列方向と略垂直になるように配置されることで、使用者の目線の向きが変化した際に、光源１５の発光部が使用者の視界に入る頻度が低減されるため、表示要素９の読みづらさが改善される。

WO 2014/024631 A1

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DESCRIPTION

Title of Invention

OPERATION DEVICE AND REFRIGERATOR-FREEZER

Technical Field

[0001]

The present invention relates to an operation device and a refrigerator-freezer including the operation device.

Background Art

[0002]

Mainstream refrigerator-freezers of the related art include a plurality of compartments having different temperature zones to respond to diversification of diet.

In such refrigerator-freezers, the user can freely set functions, for example, functions of changing the temperature and performance of each compartment. For example, the user can set a function of decreasing or increasing the temperature in each compartment by a predetermined temperature, a function of changing performance to a fast cooling mode in which the cooling capacity temporarily increases, or a function of changing performance to a power saving mode in which power consumption is reduced. For example, in a refrigerator-freezer having a temperature switch compartment, the user can freely set a function of changing performance to a refrigerating mode in which the temperature in the compartment becomes higher than or equal to the freezing point or a freezing mode in which the temperature in the compartment becomes lower than the freezing point.

In such a refrigerator-freezer, an operation device is provided on a surface of a door. By operating the operation device, the user can select and set a function and set the selected function in more detail.

[0003]

The operation device includes a surface component provided with a layer having marked portions on which display elements, such as markings and text, are written, for example, by printing, a display means disposed on the rear side of the surface component to display the display elements on the surface component by

20133008208 08 Jan 2015

illuminating a light source such as a light emitting diode (LED), and an input means, such as buttons, with which the user selects and sets the function, sets the compartment where the selected function is to work, and sets the temperature to be changed by the selected function (see, for example, Patent Literature 1).

Citation List

Patent Literature

[0004]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2011-47550 (paragraphs [0021]-[0023], Fig. 3)

Summary of Invention

Technical Problem

[0005]

In the operation device of the refrigerator-freezer of the related art, the light source is disposed such that the optical axis thereof meets the user's gaze. Hence, a light emitting portion of the light source gets within sight of the user, and the user has difficulty in reading the display elements such as markings and text.

Even if the light source is disposed such that the optical axis thereof does not meet the user's gaze, that is, such that the optical axis is parallel to the surface of the surface component, since light emitted from the light source has a spread angle centered on the optical axis, the light emitting portion of the light source is still within sight of the user, and the user also has difficulty in reading the display elements such as markings and text.

[0006]

The present invention has been made to address the above problems, and obtains an operation device that aims to relieve difficulty in reading display elements and a refrigerator-freezer including the operation device.

2013300820 08 Jan 2015

Reference to any prior art in the specification is not, and should not be taken as, an acknowledgment or any form of suggestion that this prior art forms part of the common general knowledge in Australia or any other jurisdiction or that this prior art could reasonably be expected to be ascertained, understood and regarded as relevant by a person skilled in the art.

[0007]

An operation device according to the present invention includes at least a layer having a plurality of marked portions on which information used for operation is written in accordance with a shape of at least one of a transmitting portion and a non-transmitting portion, a light emitting member provided on a rear side of the layer and having a surface opposed to the marked portions, the light emitting member emitting incident light from the surface, and a plurality of light sources at least one of which is provided for each of the marked portions to cause the light to enter the light emitting member, the light sources being disposed such that optical axes thereof are substantially parallel to the layer. At least some of the plurality of marked portions form at least three blocks. The three blocks are arranged in a line. The three blocks are formed such that, when a figure including the three blocks and having a minimum total peripheral length is drawn, a width dimension of the figure in a direction perpendicular to a line direction of the line is smaller than a width dimension in a direction parallel to the line direction of the line. The light source provided in correspondence with at least one of the marked portions that forms a center block of the three blocks is disposed such that an optical axis thereof is substantially perpendicular to the line direction of the line.

In accordance with one aspect of the invention there is provided an operation device comprising at least: a layer having a plurality of marked portions having at least any of an icon, text and a marking, a light emitting member provided on a rear side of the layer and having a surface opposed to the marked portions, the light emitting member emitting incident light from the surface; and a

plurality of light sources at least one of which is provided for each of the marked portions to cause the light to enter the light emitting member, the light sources being disposed such that optical axes thereof are substantially parallel to the layer, wherein at least some of the plurality of marked portions form at least three blocks, wherein the three blocks are arranged in a line, wherein the three blocks are formed such that, when a figure including the three blocks and having a minimum total peripheral length is drawn, a width dimension of the figure in a direction perpendicular to a line direction of the line is smaller than a width dimension in a direction parallel to the line direction of the line, and wherein the light source provided in correspondence with at least one of the marked portions that forms the center block of the three blocks is disposed such that an optical axis thereof is substantially perpendicular to the line direction of the line.

In accordance with another aspect of the invention there is provided an operation device comprising at least: a layer having a plurality of marked portions having at least any of an icon, text and a marking, a light emitting member provided on a rear side of the layer and having a surface opposed to the marked portions, the light emitting member emitting incident light from the surface; and a plurality of light sources at least one of which is provided for each of the marked portions to cause the light to enter the light emitting member, the light sources being disposed such that optical axes thereof are substantially parallel to the layer, wherein at least some of the plurality of marked portions form at least three blocks, wherein the three blocks are arranged in a line, wherein the three blocks are formed such that, when a figure including the three blocks and having a minimum total peripheral length is drawn, a width dimension of the figure in a direction perpendicular to a line direction of the line is smaller than a width dimension in a direction parallel to the line direction of the line, and wherein the light source provided in correspondence with at least one of the marked portions that forms the block located on an outer side of the center block of the three blocks is disposed such that an optical axis thereof is substantially parallel to the

2013300820 08 Jan 2015

line direction of the line and such that the light enters the light emitting member from a side close to the center block.

As used herein, except where the context requires otherwise, the term "comprise" and variations of the term, such as "comprising", "comprises" and "comprised", are not intended to exclude further additives, components, integers or steps.

Advantageous Effects of Invention

[0008]

In the operation device according to the present invention, at least some of the plurality of marked portions form at least three blocks arranged in a line. The light source provided in correspondence with at least one of the marked portions that form the center block of the three blocks is disposed such that the optical axis thereof is substantially perpendicular to the line direction of the line. This aims to reduce the frequency at which a light emitting portion of the light source comes into sight of the user when the user's gaze shifts.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a front view of a refrigerator-freezer in which an operation device according to Embodiment 1 of the present invention is mounted.

[Fig. 2] Fig. 2 illustrates a state in which all display elements in the operation device according to Embodiment 1 of the present invention are displayed.

[Fig. 3] Fig. 3 illustrates the cross-sectional structures of a surface component and display means of displaying display elements that do not function as input means in the operation device according to Embodiment 1 of the present invention.

[Fig. 4] Fig. 4 illustrates the cross-sectional structures of the surface component and display means of displaying display elements functioning as input means in the operation device according to Embodiment 1 of the present invention.

[Fig. 5] Fig. 5 illustrates the cross-sectional structure of display means of displaying an icon to be touched by the user to select a function to be set in the operation device according to Embodiment 1 of the present invention.

[Fig. 6] Fig. 6 is a front view of the display means of displaying the icon to be touched by the user to select the function to be set in the operation device according to Embodiment 1 of the present invention, from which a first layer is removed.

[Fig. 7] Fig. 7 is a front view of the display means of displaying the icon to be touched by the user to select the function to be set in the operation device according to Embodiment 1 of the present invention, in which the first layer is provided.

[Fig. 8] Fig. 8 illustrates a state in which all of the display elements in the operation device according to Embodiment 1 of the present invention are displayed, on which first light sources are superposed.

[Fig. 9] Fig. 9 illustrates exemplary changes of the display states of the display elements when selecting and setting the function in the operation device according to Embodiment 1 of the present invention.

[Fig. 10] Fig. 10 illustrates exemplary changes of the display states of the display elements when selecting and cancelling the function in the operation device according to Embodiment 1 of the present invention.

[Fig. 11] Fig. 11 illustrates exemplary changes of the display states of the display elements when stopping setting or cancelling the function on the way in the operation device according to Embodiment 1 of the present invention.

[Fig. 12] Fig. 12 illustrates a state in which the user of an operation device according to Comparative Example 1 views a display element from the front side.

[Fig. 13] Fig. 13 illustrates a display state of the display element when a first light source is illuminated in the operation device according to Comparative Example 1.

[Fig. 14] Fig. 14 illustrates a state in which the user of an operation device according to Comparative Example 2 views a display element displayed above from below.

[Fig. 15] Fig. 15 illustrates a state in which the user of the operation device according to Comparative Example 2 views a display element displayed below from above.

[Fig. 16] Fig. 16 illustrates the viewing order of the user of the operation device according to Embodiment 1 of the present invention.

[Fig. 17] Fig. 17 illustrates a modification of a display state of a function selection block in the operation device according to Embodiment 1 of the present invention.

[Fig. 18] Fig. 18 illustrates a modification of the display state of the function selection block in the operation device according to Embodiment 1 of the present invention.

[Fig. 19] Fig. 19 illustrates a modification of a display state of a function setting block in the operation device according to Embodiment 1 of the present invention.

[Fig. 20] Fig. 20 illustrates modifications of icons used to stop setting or cancelling the function in the operation device according to Embodiment 1 of the present invention.

[Fig. 21] Fig. 21 illustrates an example in which a light guide plate is integrated in the operation device according to Embodiment 1 of the present invention.

[Fig. 22] Fig. 22 illustrates a state in which all display elements in an operation device according to Embodiment 2 of the present invention are displayed, on which first light sources are superposed.

[Fig. 23] Fig. 23 illustrates a state in which the user of the operation device according to Embodiment 2 of the present invention views a display element displayed above from below.

[Fig. 24] Fig. 24 illustrates a state in which the user of the operation device according to Embodiment 2 of the present invention views a display element displayed below from above.

[Fig. 25] Fig. 25 illustrates a state in which all display elements in an operation device according to Embodiment 3 of the present invention are displayed, on which first light sources are superposed.

[Fig. 26] Fig. 26 illustrates a state in which all of the display elements in the operation device according to Embodiment 3 of the present invention are displayed, on which the first light sources are superposed.

[Fig. 27] Fig. 27 illustrates cross-sectional structures of a surface component and display means of displaying display elements that do not function as input means in an operation device according to Embodiment 4 of the present invention.

[Fig. 28] Fig. 28 illustrates cross-sectional structures of the surface component and display means of displaying display elements functioning as input means in the operation device according to Embodiment 4 of the present invention.

[Fig. 29] Fig. 29 illustrates an example of a surface component in the operation device according to Embodiment 4 of the present invention.

Description of Embodiments

[0010]

An operation device according to the present invention will be described below with reference to the drawings.

While the operation device is mounted in a refrigerator-freezer in the description of Embodiments, the operation device of the present invention includes operation devices to be mounted in refrigerator-freezers having structures different from the described structures and other apparatuses. In the description of Embodiments, terms representing directions (for example, "front", "rear", "up", "down", "right" and "left") are appropriately used. However, these terms do not limit

the present invention. In the drawings, the same members and the same portions are denoted by the same reference numerals. Illustrations of fine structures are appropriately simplified or omitted. Redundant descriptions are appropriately simplified or omitted.

[0011]

Embodiment 1

An operation device according to Embodiment 1 will be described below.

(Configuration of Refrigerator-Freezer)

First, a description will be given of the configuration of a refrigerator-freezer in which the operation device of Embodiment 1 is mounted.

Fig. 1 is a front view of the refrigerator-freezer in which the operation device of Embodiment 1 is mounted. As illustrated in Fig. 1, a refrigerator-freezer 1 includes a refrigerating compartment 2, an ice-making compartment 3, a temperature switch compartment 4, a freezing compartment 5, and a crisper compartment 6. The refrigerating compartment 2 is provided with doors 2a and 2b. The doors 2a and 2b can be opened and closed by being pivoted around hinges. The ice-making compartment 3 has a water storage case therein, where water supplied to a tank provided in the refrigerating compartment 2 is automatically frozen into ice and is stored. In the temperature switch compartment 4, a refrigerating mode and a freezing mode can be switched, and the temperature can be set arbitrarily. An operation device 7 is provided on a surface of the door 2a of the refrigerating compartment 2. In the description of Embodiments, the front surface direction and the rear surface direction of the refrigerator-freezer 1 are referred to as "front side" and "rear side", respectively.

[0012]

(Structure of Operation Device)

Next, the structure of the operation device according to Embodiment 1 will be described.

Fig. 2 illustrates a state in which all display elements in the operation device of Embodiment 1 are displayed. As illustrated in Fig. 2, a surface component 8 is

provided on a surface of the operation device 7. On the surface component 8, a plurality of display elements 9 are to be displayed. The display elements 9 are displayed when light sources of display means provided on the rear side of the surface component 8 are illuminated by a control means (not illustrated). On each of the display elements 9, information necessary for operation is written. The display means is provided in each of the display elements 9.

[0013]

At least some of the display elements 9 are arranged in accordance with the application uses of written information, and constitute a function selection block 10 (the function selection block 10 corresponds to the "block" formed by "marked portions" including at least "the marked portion having information used to select the function" in the present invention), a function explanation block 11 (the function explanation block 11 corresponds to the "block" formed by "marked portions" including at least "the marked portion having information explaining a function" in the present invention), and a function setting block 12 (the function setting block 12 corresponds to the "block" formed by the "marked portions" including at least the "marked portion having information used to set the function" in the present invention). The function selection block 10, the function explanation block 11, and the function setting block 12 are arranged in a line. While the blocks are arranged in a vertical line in this example, they may be arranged in a horizontal line, or may be arranged in a line in other directions.

[0014]

The function selection block 10 displays, for example, an icon 10a to be touched by the user to start an operation of setting a function, and icons 10b provided in correspondence with functions to be set such as to be touched by the user to select a function to be set.

The function explanation block 11 displays, for example, text 11a explaining the function corresponding to the icon 10b selected by the user and asking whether to set the function, and a marking 11b explaining the compartment where the function corresponding to the icon 10b selected by the user is to work.

The function setting block 12 displays, for example, icons 12a to be touched by the user to used to set or cancel the selected function, and text 12b that informs the user that the function is set or cancelled.

[0015]

The display elements 9 may be displayed at different positions in the blocks. For example, while the text 11a is displayed on the upper side of the marking 11b in the function explanation block 11 in Fig. 2, alternatively, the marking 11b may be displayed on the upper side of the text 11a. When the text 11a is displayed on the upper side of the marking 11b, the relations between the icons 10b and the text 11a are emphasized. When the marking 11b is displayed on the upper side of the text 11a, the relations between the icons 10b and the marking 11b are emphasized.

[0016]

On the surface component 8, display elements 9 other than the display elements 9, which constitute the function selection block 10, the function explanation block 11, and the function setting block 12, may be displayed or do not have to be displayed. In this example, display means and input means used to set the functions other than the functions corresponding to the icons 10b or to set the selected function in more detail are provided on the lower side of the function setting block 12. The display means and the input means may be provided on the upper side of the function selection block 10 or between the blocks, or may be provided at positions apart from the line of the blocks.

[0017]

The icon 10a is provided at the center of the function selection block 10, and is always displayed to be always visually identified. The icon 10a functions as an input means to be first touched by the user when setting the function.

The icons 10b similarly function as input means. The user selects a function to be set by touching any of the icons 10b. Each of the icons 10b has a marking that is associated with the function itself to be set by selection of the icon 10b or a situation where the function is to be used.

[0018]

The text 11a is prepared for each icon 10b. When the user selects an icon 10b, text corresponding to the selected icon 10b is displayed.

The marking 11b displays the compartment where the function corresponding to the icon 10b selected by the user is to work such the user identifies the compartment.

Since the function corresponding to the selected icon 10b is explained by the text 11a or the marking 11b in this way, the user can identify the operation when the function is set without reading a user's manual or the like. The text 11a and the marking 11b may function as input means as necessary.

[0019]

The icons 12a have signs (characters) such as "YES" and "NO". The icons 12a function as input means. When the user selects and touches any of the signs (characters), such as "YES" and "NO", to answer the text 11a, the function corresponding to the selected icon 10b is set or cancelled.

The text 12b has text that informs the user that the function is set or cancelled when the icon 12a is selected. Display of the text 12b allows the user to identify completion of the operation. Fig. 2 illustrates a case in which text informing that the function is set is displayed. Text informing that the function is cancelled may be displayed, and both the text informing that the function is set and the text informing that the function is cancelled may be displayed. The text 12b does not have to be displayed, if needed. The operation device of the present invention includes an operation device in which text 12b is not displayed. The text 12b may also function as an input means as necessary.

[0020]

(Structures of Surface Component and Display Means)

Next, a description will be given of the structures of the surface component and the display means in the operation device according to Embodiment 1.

First, with reference to Fig. 3, a description will be given of the structures of the surface component and the display means of displaying display elements that do not function as input means.

Fig. 3 illustrates the cross-sectional structures of the surface component and the display means of displaying the display elements that do not function as input means in the operation device of Embodiment 1. As illustrated in Fig. 3, display means 13 are provided between the surface component 8 and a printed board 14.

[0021]

The surface component 8 includes a first layer 8a having a basic color or pattern of the operation device 7, and a second layer 8b having the display elements 9. The first layer 8a is provided on the forefront side of the surface component 8, and the second layer 8b is provided on the rear side of the first layer 8a. The second layer 8b has transmitting portions, and the display elements 9 are written in accordance with the shapes of the transmitting portions (the second layer 8b corresponds to "layer" in the present invention, and areas of the second layer 8b having the display elements 9 correspond to the "marked portions" in the present invention). The first layer 8a and the second layer 8b are molded integrally with a transmissive member 8c formed of, for example, resin. It is only necessary that the transmissive member 8c has the light transmitting property, and the transmissive member 8c may be formed of, for example, glass. Only one surface component 8 may be provided for all the display elements 9, or for example, the surface component 8 may be provided for each block or each form of the display elements 9. The second layer 8b may have display elements 9 written in accordance with the shape of non-transmitting portions, or the display elements 9 may be displayed while appropriately using the shapes of the transmitting portions and the non-transmitting portions. Alternatively, transmitting portions having high transmittance and transmitting portions having low transmittance may be provided, and the display elements 9 may be displayed in accordance with the shapes of the transmitting portions having high transmittance and the transmitting portions having low transmittance.

[0022]

Each display means 13 includes a first light source 15, a light guide plate 16, and a shielding wall 17 (the light guide plate 16 corresponds to "light emitting

member" in the present invention). One display means 13 is provided for each of the display elements 9 in the second layer 8b of the surface component 8. One or a plurality of first light sources 15 are provided for each display means 13 such that the optical axis thereof is parallel to the surface of the surface component 8. The light guide plate 16 bends light from the first light source 15 provided beside 90 degrees by the reflecting action and emits planar light toward the surface component 8. The surface component 8 has a certain thickness of, for example, 2 mm or more under molding restrictions. The surface component 8 may be combined with the light guide plate 16 provided on the rear side thereof. The surface component 8 functions as a light guide layer together with the light guide plate 16. The first light source 15 can be illuminated while changing the luminance.

[0023]

While the first light source 15 is not illuminated, the display elements 9 written in the second layer 8b are hidden by the first layer 8a, and the user cannot visually identify the display elements 9. In contrast, while the first light source 15 is illuminated, light passes through the transmitting portion of the second layer 8b, so that the display element 9 provided in the second layer 8b appears on the front surface of the first layer 8a. Since shielding walls 17 are provided between the display means 13, the display elements 9 can be displayed individually. Part of light passing through the transmissive member 8c reaches the area between the display elements 9 in the second layer 8b. However, when the display elements 9 are written in accordance with the shape of the transmitting portions, the non-transmitting portions are provided in the areas between the display elements 9 in the second layer 8b. Hence, it is possible to more clearly display only the display elements 9 including the illuminated first light sources 15.

[0024]

Next, with reference to Fig. 4, a description will be given of the structure of the display means that displays the display elements 9 functioning as input means. The structure of the display means of displaying the icons 10b, that is, the icons to be touched by the user to set the function will be described later.

Fig. 4 illustrates the cross-sectional structures of the surface component and the display means that displays the display elements functioning as input means in the operation device of Embodiment 1. As illustrated in Fig. 4, each display means 13 includes a first light source 15, a light guide plate 16, a shielding wall 17, and an input means 18.

[0025]

The input means 18 is an electrode of a capacitive touch sensor. The input means 18 is attached to a surface of the printed board 14. The input means 18 is provided on the rear side of the light guide plate 16 provided for each display element 9. When the user touches the area of the surface component 8 where the display element 9 is displayed, the input means 18 detects the change in capacitance value via the surface component 8 and the light guide plate 16, and transmits a signal to the control means (not illustrated).

[0026]

Next, with reference to Figs. 5 to 7, a description will be given of the structure of the display means that displays each icon 10b, that is, an icon to be touched by the user to select a function to be set.

Fig. 5 illustrates the cross-sectional structure of the display means that displays the icon to be touched by the user of the operation of Embodiment 1 to select the function to be set. Fig. 6 is a front view of the display means that displays the icon to be touched by the user of the operation device of Embodiment 1 to select the function to be set, from which the first layer is removed. As illustrated in Figs. 5 and 6, display means 13 of displaying the icons 10b each further include a second light source 19 in addition to a first light source 15, a light guide plate 16, a shielding wall 17, and an input means 18. The second light source 19 is illuminated when the function corresponding to the icon 10b provided with the second light source 19 is in a set state. The second light source 19 emits light of a color different from the color of light emitted from the first light source 15. The second light source 19 is provided on the upper left side of the light guide plate 16 such that the optical axis thereof is perpendicular to the surface of the surface component 8.

[0027]

Fig. 7 is a front view of the display means that displays the icon to be touched by the user of the operation device of Embodiment 1 to select the function to be set, in which the first layer is provided. As illustrated in Fig. 7, when light emitted from the second light source 19 passes through the transmitting portion of the second layer 8b, a mark 20 appears on the first layer 8a. When the first light source 15 is turned on to display the icon 10b and the function corresponding to the icon 10b is set, the control means (not illustrated) turns on the second light source 19. When the function is cancelled, the control means (not illustrated) does not turn on the second light source 19.

[0028]

(Arrangement of First Light Source)

Next, a description will be given of the arrangement of the first light sources in the operation device of Embodiment 1.

Fig. 8 illustrates a state in which all of the display elements in the operation device of Embodiment 1 are displayed, on which the first light sources are superposed. As illustrated in Fig. 8, the function selection block 10, the function explanation block 11, and the function setting block 12 are arranged in a vertical line on the surface component 8. Each of the first light sources 15 emits light to the light guide plate 16 from the direction perpendicular to the line direction, that is, from the right-left direction in this example. When the blocks are arranged in a horizontal line, the first light source 15 emits light to the light guide plate 16 from the up-down direction.

[0029]

(Operation of Operation Device)

The operation of the operation device of Embodiment 1 will be described below.

First, a description will be given of the procedure for selecting and setting a function in the operation device of Embodiment 1. Fig. 9 illustrates exemplary

changes of the display state of the display elements when the function is selected and set in the operation device of Embodiment 1.

Step 901 is a state before the procedure. The control means (not illustrated) always illuminates the first light source 15 provided at the icon 10a such that the icon 10a can always be visually identified. The control means (not illustrated) turns off the first light sources 15 provided in the display elements 9 different from the icon 10a such that the display elements 9 cannot be visually identified. This operation can reduce power consumption during standby. When the user touches the icon 10a, the procedure proceeds to Step 902.

[0030]

In Step 902, the control means (not illustrated) turns on all of the first light sources 15 provided at the icons 10b other than the icon 10a in the function selection block 10 such that all of the icons 10b can be visually identified. When the user touches any of the icons 10b, the procedure proceeds to Step 903.

[0031]

In Step 903, the control means (not illustrated) turns on the first light source 15 provided at text 11a corresponding to the selected icon 10b such that the text 11a can be visually identified. At the same time, when there is a need to display the compartment where the function corresponding to the selected icon 10b is to work, the control means (not illustrated) turns on all of the first light sources 15 provided at the marking 11b. At this time, the control means (not illustrated) controls the luminances of the first light sources 15 such that an area of the marking 11b corresponding to the compartment, where the function corresponding to the selected icon 10b is to work, is brightly displayed and areas of the marking 11b corresponding to the other compartments are darkly displayed. At the same time, the control means turns on the first light sources 15 provided at the icons 12a such that the icons 12a can be visually identified. When the user touches an icon 12a with "YES", the procedure proceeds to Step 904. By thus providing the step of confirming whether or not to set the selected icon 10b, the user can determine whether or not to set the function while performing the operation.

[0032]

While Fig. 9 illustrates the case in which the control means (not illustrated) turns off the first light sources 15 provided at the icons 10b other than the selected icon 10b, the present invention is not limited to such a case. For example, the first light sources 15 provided at the icons 10b other than the selected icon 10b may remain illuminated. Further, while the control means (not illustrated) controls the luminances of the first light sources 15 such that the areas of the marking 11b corresponding to the compartments other than the compartment where the function corresponding to the selected icon 10b is to work are darkly displayed, the present invention is not limited to such a case. For example, the first light sources 15 may be controlled such that the areas of the marking 11b corresponding to the compartments other than the compartment, where the function corresponding to the selected icon 10b is to work, are not displayed.

[0033]

In Step 904, the control means (not illustrated) turns on the first light source 15 provided at the text 12b such that the text 12b can be visually identified. The control means (not illustrated) maintains that state for a predetermined time (for example, 5 seconds), and the procedure proceeds to Step 905. While the control means (not illustrated) controls the luminances of the first light sources 15 such that all of the areas of the marking 11b are brightly displayed in Fig. 9, the present invention is not limited to such a case. For example, the luminances of the first light sources 15 may be controlled such that the marking 11b is kept in the state of Step 903. Alternatively, the luminances of the first light sources 15 may be controlled such that the marking 11b is not displayed.

[0034]

In Step 905, the control means (not illustrated) turns on the first light source 15 and the second light source 19 provided at the icon 10b corresponding to the set function such that the icon 10b and the mark 20 can be visually identified. When a predetermined time (for example, 30 seconds) elapses while the user does not touch any of the display elements 9 after that, the procedure returns to Step 901. While

Fig. 9 illustrates the case in which the control means (not illustrated) turns on the first light sources 15 provided at all of the icons 10b, the present invention is not limited to such a case. For example, the first light sources 15 provided at the icons 10b other than the icon 10b corresponding to the set function may be turned off.

[0035]

The order in which the function selection block 10, the function explanation block 11, and the function setting block 12 are arranged may be changed appropriately. Further, the function selection block 10, the function explanation block 11, and the function setting block 12 do not have to be arranged in series. When the function selection block 10, the function explanation block 11, and the function setting block 12 are thus arranged in series in this order, the blocks are arranged in the order in which the user visually identifies the blocks during operation. This allows the user to perform operation while checking the contents of the functions in a natural manner. Further, the user does not wonder which display element 9 is to be touched next, and therefore, does not feel stress.

[0036]

Next, the procedure for selecting and cancelling the function in the operation device of Embodiment 1 will be described. Fig. 10 illustrates exemplary changes of the display state of the display elements when selecting and cancelling the function in the operation device of Embodiment 1. Descriptions overlapping with those of the procedure for selecting and setting the function are appropriately simplified or omitted.

In Step 1001, when the user touches the icon 10a, the procedure proceeds to Step 1002.

[0037]

In Step 1002, the control means (not illustrated) turns on the second light source 19 provided at the icon 10b corresponding to the set function, in addition to the first light sources 15 provided at all of the icons 10b. When the user touches the icon 10b corresponding to the set function, the procedure proceeds to Step 1003.

[0038]

In Step 1003, the control means (not illustrated) turns on the first light source 15 provided at the text 11a corresponding to the selected icon 10b such that the text 11a can be visually identified, similarly to Step 903. At the same time, when there is a need to display the compartment where the function corresponding to the selected icon 10b is to work, all of the first light sources 15 provided at the marking 11b are turned on. Further, at the same time, the first light sources 15 provided at the icons 12a are turned on such that the icons 12a can be visually identified. When the user touches the icon 12a with "NO", the procedure proceeds to Step 1004. When the user touches the icon 12a with "YES", the procedure proceeds to Step 904.

[0039]

In Step 1004, the control means (not illustrated) turns off the second light source 19 provided at the icon 10b whose function is cancelled. The control means (not illustrated) maintains that state for a predetermined time (for example, 5 seconds), and the procedure proceeds to Step 1005. While Fig. 10 illustrates the case in which the control means (not illustrated) does not turn on the first light source 15 at the text 12b, the present invention is not limited to such a case. For example, when words "CANCELLED" are written as the text 12b, the first light source 15 provided at the text 12b may be turned on such that the words "CANCELLED" can be visually identified.

[0040]

In Step 1005, the control means (not illustrated) turns on the first light sources 15 provided at all of the icons 10b such that all of the icons 10b can be visually identified. When a predetermined time (for example, 30 seconds) elapses in a state in which the user does not touch any of the display elements 9 after that, the procedure returns to Step 1001.

[0041]

Next, the operation of stopping setting or cancelling the function in the middle of the operation in the operation device of Embodiment 1 will be described. Fig. 11 illustrates exemplary changes of the display states of the display elements when setting or canceling the function is stopped in the middle of the operation in the

operation device of Embodiment 1. Descriptions overlapping with those of the operation of selecting and setting the function and the operation of selecting and cancelling the function are appropriately simplified or omitted.

In Step 1101, when the user touches the icon 10a, the procedure proceeds to Step 1102.

[0042]

In Step 1102, when the user touches the icon 10b whose function is to be set or cancelled, the procedure proceeds to Step 1103. Fig. 11 illustrates the case in which the user touches the icon 10b whose function is to be cancelled.

[0043]

In Step 1103, the control means (not illustrated) controls the first light sources 15 and the second light sources 19, similarly to Step 930 or Step 1003. When visually identifying the text 11a and the marking 11b and wanting to stop setting or canceling the function, for example, when noticing wrong selection of the function, the user touches the icon 10a. When recognizing the touch with the icon 10a, the control means (not illustrated) proceeds to Step 1104. Such an icon prepared for stopping setting or cancelling allows the user to determine whether or not to set or cancel the function during operation.

[0044]

In Step 1104, the control means (not illustrated) returns the display state of the display elements 9 to the display state of Step 1102. When a predetermined time (for example, 30 seconds) elapses in a state in which the user does not touch any of the display elements 9 after that, the procedure returns to Step 1101.

[0045]

(Effects of Operation Device)

First, Comparative Example 1 and Comparative Example 2 are given as examples of conventional operation devices, and effects of Comparative Examples will be described.

First, Comparative Example 1 will be described with reference to Figs. 12 and 13. Fig. 12 illustrates a state in which the user of an operation device according to

Comparative Example 1 views a display element from the front side. Fig. 13 illustrates a display state of the display element when a first light source in the operation device of Comparative Example 1 is turned on. As illustrated in Fig. 12, in the operation device of Comparative Example 1, a first light source 15 is provided such that the optical axis thereof is perpendicular to the surface of a surface component 8. For this reason, when the user views the display element 9 from the front side, the user's gaze meets the optical axis of the first light source 15, and a bulb shape appearing phenomenon of a light emitting portion of the first light source 15 occurs as illustrated in Fig. 13. Thus, the user has difficulty in reading the display element 9.

[0046]

Next, Comparative Example 2 will be described with reference to Figs. 14 and 15. Fig. 14 illustrates a state in which the user of an operation device according to Comparative Example 2 views a display element displayed above from below. Fig. 15 illustrates a state in which the user of the operation device of Comparative Example 2 views a display element displayed below from above. In the operation device of Comparative Example 2, a first light source 15 is provided such that the optical axis thereof is parallel to the surface of a surface component 8, unlike the operation device of Comparative Example 1. For this reason, when the user views the display element 9 from the front side, the user's gaze does not meet the optical axis of the first light source 15, and a bulb shape appearing phenomenon illustrated in Fig. 13 does not occur. However, as illustrated in Figs. 14 and 15, when the first light source 15 of the display element 9 provided above is located on the upper side of a light guide plate 16 and when the first light source 15 of the display element 9 provided below is located on the lower side of the light guide plate 16, since light emitted from the first light source 15 has a spread angle centered on the optical axis, the user's gaze meets a part of the spread light. In this case, the bulb shape appearing phenomenon illustrated in Fig. 13 is relaxed, but the light emitting portion of the first light source 15 is still within sight of the user. Hence, the user has difficulty in reading the display element 9.

[0047]

The effects of the operation device of Embodiment 1 will be described below.

Fig. 16 illustrates the viewing order of the user of the operation device according to Embodiment 1. Fig. 16 illustrates both a case in which the text 11a is displayed on the upper side of the marking 11b and a case in which the marking 11b is displayed on the upper side of the text 11a. As illustrated in Fig. 16, in the operation device of Embodiment 1, the function selection block 10, the function explanation block 11, and the function setting block 12 are arranged in a line according to the viewing order of the user. That is, when setting the function, the user shifts the gaze in the order of the function selection block 10, the function explanation block 11, and the function setting block 12.

[0048]

The function explanation block 11 is provided at a height that is substantially equal to the height of the user's gaze when the user of standard height views the function explanation block 11 from the front side while standing upright. For this reason, the user's gaze points upward when viewing at the function selection block 10 and the user's gaze points downward when viewing the function setting block 12. According to this structure, the user can view the text 11a and the marking 11b displayed in the function explanation block 11 from almost the front side, and can confirm the explanation of the functions in a comfortable position. Further, almost the center of the three blocks in the height direction nearly coincides with the height of the user's gaze when the user views from the front side while standing upright, and the user can substantially equally shift the gaze up and down. Here, standard height refers to the average height of women (the average value of heights of women in twenties to sixties except for upper and lower 5%). For example, the standard height is about 160 cm in Japan. For this reason, for example, the height of the function explanation block 11 from the installation surface is preferably about 130 to 150 cm in Japan such as to nearly coincide with the height of the user's gaze when the user of standard height views from the front side while standing upright.

[0049]

Unlike the operation device of Comparative Example 1 and the operation device of Comparative Example 2, in the operation device of Embodiment 1, each first light source 15 is disposed such that the optical axis thereof extends in the direction parallel to the surface of the surface component 8 and perpendicular to the line direction of the blocks, that is, in the right-left direction in this example, as illustrated in Fig. 8.

According to this structure, the user's gaze does not meet the optical axis of the first light source 15, and the bulb shape appearing phenomenon illustrated in Figs. 12 and 13 can be prevented. Hence, the difficulty in reading the display elements 9 is relieved.

The three blocks are formed such that, when a figure including the three blocks and having a minimum peripheral length is drawn, the width dimension of the figure in the right-left direction is smaller than the width dimension in the up-down direction, that is, such that the figure is vertically long in this example. Thus, the user's gaze more widely shifts in the up-down direction than in the right-left direction. That is, the light emitting portion of the first light source 15 is more likely to come within sight of the user when the user's gaze shifts in the up-down direction than when it shifts in the right-left direction. For this reason, when the optical axis of the first light source 15 is thus provided in the direction substantially perpendicular to the up-down direction, the bulb shape appearing phenomenon illustrated in Figs. 14 and 15 can be prevented during the shift in the up-down direction in which the light emitting portion of the first light source 15 is likely to come within sight of the user. As a result, the frequency at which the light emitting portion of the first light source 15 comes within sight of the user is decreased, and the difficulty in reading the display element 9 is relieved.

[0050]

For example, when the operation device of Embodiment 1 is mounted in an apparatus that allows the user to freely change the relative relation between the position of the function explanation block 11 and the position of the user's gaze when the user views from the front side, such as a short apparatus or a portable apparatus, the user changes the standing position and posture such as to view the block

disposed at the center, that is, the function explanation block 11 in this example from the front side in order to equally view the function selection block 10, the function explanation block 11, and the function setting block 12. For this reason, even if the function explanation block 11 is not located at the height substantially equal to the height of the user's gaze when the user of standard height views from the front side while standing upright, the user changes the direction of the gaze to point upward when viewing the function selection block 10 and to point downward when viewing the function setting block 12. By providing the optical axis of the first light source 15 in the direction substantially perpendicular to the up-down direction, the bulb shape appearing phenomenon illustrated in Figs. 14 and 15 can be prevented during the shift in the up-down direction, similarly to the above.

[0051]

When the blocks are arranged in a horizontal line, the user similarly changes the standing position and posture so as to view the block disposed at the center from the front side. For this reason, the user changes the direction of the gaze to point rightward when viewing the right block and to point leftward when viewing the left block. By providing the optical axis of the first light source 15 in the direction substantially perpendicular to the right-left direction, the bulb shape appearing phenomenon illustrated in Figs. 14 and 15 can be prevented during the shift in the right-left direction, similarly to the above. When the blocks are located at the height substantially equal to the height of the user's gaze when the user of standard height views from the front side while standing upright, the user can view the blocks in a comfortable position.

[0052]

While the first light sources 15 of all of the display elements 9 are arranged in the right-left direction in the operation device of Embodiment 1, only the first light sources 15 of some of the display elements 9 may be arranged in the right-left direction. When the first light sources 15 of all of the display elements 9 are arranged in the right-left direction, the frequency of the bulb shape appearing phenomenon can be decreased further.

[0053]

(Modifications)

While the control means (not illustrated) turns on the first light sources 15 provided at all of the icons 10b in the function selection block 10, for example, in Step 902 of Fig. 9, Step 1002 of Fig. 10, and Step 1102 of Fig. 11 in the operation device of Embodiment 1, the present invention is not limited to such a case.

Figs. 17 and 18 illustrate modifications of display states of the function selection block in the operation device of Embodiment 1. For example, as illustrated in Fig. 17, when there are functions that cannot be set according to the operation state of the refrigerator-freezer, the first light sources 15 provided at the icons 10b corresponding to the functions that cannot be set may be turned off. This structure allows the user to recognize which functions cannot be set.

When the first light sources 15 provided at the icons 10b corresponding to the functions that cannot be set are turned off, as illustrated in Fig. 17, the user may misrecognize that the first light sources 15 are out of order. Hence, as illustrated in Fig. 18, the first light sources 15 provided at the icons 10b corresponding to the functions, which cannot be set, may be illuminated with dark light. This structure allows the user to visually distinguish the icons 10b corresponding to the functions that can be set and the icons 10b corresponding to the functions that cannot be set.

[0054]

While the icons 12a are displayed on the lower side of the text 12b in the function setting block 12 in the operation device of Embodiment 1, as illustrated in Fig. 2, the present invention is not limited to such a case.

Fig. 19 illustrates a modification of a function setting block in the operation device of Embodiment 1. For example, as illustrated in Fig. 19, the icons 12a may be displayed on the upper side of the text 12b. In such a case, even if the text 12b is displayed when the user touches any of the icons 12a, the text 12b is hidden by the hand touching the icon 12a, and the user cannot recognize that the function is set. In contrast, as illustrated in Fig. 2, when the icons 12a are displayed on the lower side

of the text 12b, the text 12b is not hidden by the hand, and the user can more reliably recognize that the function is set.

[0055]

While the icon 10a is used as the icon for stopping setting or canceling the function in the operation device of Embodiment 1, as illustrated in Fig. 11, the present invention is not limited to such a case.

Fig. 20 illustrates a modification of an icon for stopping setting or canceling the function in the operation device of Embodiment 1. For example, as illustrated in Fig. 20, an icon 12c intended therefor may be added. The icon 12c is provided with a display means 13 having an input means 18. The icon 12c has signs (characters) such as "RETURN" or "CANCEL." According to this structure, the user easily identifies the icon for stopping setting or cancelling the function, and operability of the operation device 7 is enhanced further. Alternatively, an icon other than the icon 10a may be used as the icon for stopping setting or canceling the function.

[0056]

While the first layer 8a and the second layer 8b are provided on the front surface of the transmissive member 8c in the operation device of Embodiment 1, as illustrated in Figs. 3 to 5, the present invention is not limited to such a case. For example, the layers may be provided at a position other than the front surface of the transmissive member 8c. Other layers and other members may be provided on the front side of the first layer 8a. The first layer 8a and the second layer 8b may be provided in a member different from the transmissive member 8c, and the different member may be provided on the front side or the rear side of the surface component 8. In this case, the surface component 8 and the different member may be combined into one.

[0057]

While the light guide plates 16 are provided for the corresponding display elements 9 in the operation device of Embodiment 1, they may be combined into one. According to this structure, it is unnecessary to individually attach the light guide plates 16, and this further simplifies assembly operation. For example, all of the light

guide plates 16 may be combined into one component, or may be combined in each of the blocks or according to the form of the display elements 9. Fig. 21 illustrates an example in which the light guide plates in the operation device of Embodiment 1 are combined. For example, an integrated light guide plate 16 is provided at the text 11a, it can be formed in a shape illustrated in Fig. 21. In this example, the first light sources 15 are disposed in areas A provided on the outer sides of the light guide plate 16 in the right-left direction. In this example, the shielding walls 17 are disposed in groove portions or holes B extending parallel to the right-left direction of the light guide plate 16.

[0058]

While the input means 18 is formed by the electrode of the capacitive touch sensor assembled in the display means 13 in the operation device of Embodiment 1, as illustrated in Figs. 4 and 5, the present invention is not limited to such a case. For example, the input means 18 may be formed by a switch, such as a button, and the switch may be disposed, for example, near the display means 13 in the up, down, right, or left direction or disposed in a different housing communicable with the operation device 7. When the input means 18 is formed by the electrode of the capacitive touch sensor assembled in the display means 13, as in the operation device of Embodiment 1, since no movable part is provided, unlike the switch, durability can be enhanced. Further, since there is no groove for entry of moisture or the like, unlike the switch, the water resistance can be enhanced. Still further, static electricity does not accumulate in the groove for entry of the moisture or the like, and the user does not feel stress during operation.

[0059]

Embodiment 2

An operation device according to Embodiment 2 is different from the operation device of Embodiment 1 in the arrangement of first light sources.

The operation device of Embodiment 2 will be described below.

First, the structure of the operation device of Embodiment 2 will be described. Descriptions overlapping with those of the operation device of Embodiment 1 are appropriately simplified or omitted.

Fig. 22 illustrates a state in which all display elements in the operation device of Embodiment 2 are displayed, on which first light sources are superposed. As illustrated in Fig. 22, a function selection block 10, a function explanation block 11, and a function setting block 12 are arranged in a vertical line on a surface component 8. First light sources 15 emit light toward corresponding light guide plates 16 from the direction parallel to the line direction, that is, from the up-down direction in this example.

[0060]

The first light sources 15 provided at display elements 9 on the upper side of almost the center of the function explanation block 11 in the height direction, that is, at an icon 10a, icons 10b, and text 11a in this example, are disposed on the lower sides of the corresponding light guide plates 16. The first light sources 15 provided at display elements 9 on the lower side of almost the center of the function explanation block 11 in the height direction, that is, at a marking 11b, icons 12a, and text 12b in this example, are disposed on the upper sides of the corresponding light guide plates 16. When the blocks are arranged in a horizontal line, the first light sources 15 provided at the display elements 9 on the right side of almost the center of the function explanation block 11 in the horizontal direction are disposed on the left sides of the corresponding light guide plates 16. The first light sources 15 provided at the display elements 9 on the left side of almost the center of the function explanation block 11 in the horizontal direction are disposed on the right sides of the corresponding light guide plates 16.

[0061]

Next, the effects of the operation device according to Embodiment 2 will be described.

The function explanation block 11 is provided such that the height of almost the center in the height direction is substantially equal to the height of the gaze of the

user of standard height when the user views from the front side while standing upright. For this reason, in this example, the user's gaze points upward when viewing the icon 10a, the icons 10b, and the text 11a, and the user's gaze points downward when viewing the marking 11b, the icons 12a, and the text 12b.

[0062]

Fig. 23 illustrates a state in which the user of the operation device of Embodiment 2 views a display element displayed above from below. Fig. 24 illustrates a state in which the user of the operation device of Embodiment 2 views a display element displayed below from above. Unlike the operation device of Comparative Example 1 and the operation device of Comparative Example 2, in the operation device of Embodiment 2, as illustrated in Fig. 22, the first light sources 15 are disposed on the lower sides of the corresponding light guide plates 16 at the display elements 9 displayed above, and are disposed on the upper sides of the corresponding light guide plates 16 at the display elements 9 displayed below. Hence, even when the user's gaze shifts between the blocks, as illustrated in Figs. 23 and 24, that is, even when the direction of the gaze changes to the upward direction or the downward direction, a bulb shape appearing phenomenon illustrated in Figs. 14 and 15 is not caused by entry of the light emitting portions of the first light sources 15 in sight of the user. This relieves the difficulty in reading the display elements 9.

[0063]

In the operation device of Embodiment 2, the function explanation block 11 is provided such that the height of almost the center thereof in the height direction, that is, the height of an area between the display area of the text 11a and the display area of the marking 11b is substantially equal to the height of the user's gaze when the user of standard height views from the front side while standing upright. However, there are variations in the height of the user. When the user who does not have the standard height views from the front side while standing upright, the height of the user's gaze is equal to the height of a portion other than the area between the display area of the text 11a and the display area of the marking 11b. For this reason, it is necessary to make consideration, for example, to provide a space for absorbing

variations in the height of the user between the display area of the text 11a and the display area of the markings 11b.

When the operation device of Embodiment 2 is mounted in, for example, an apparatus, such as a short apparatus or a portable apparatus, in which the user can freely change the relative relation between the position of the function explanation block 11 and the position of the user's gaze when the user views from the front side, it is unnecessary to consider the variations in the height of the user.

Even if the variations in the height of the user are not considered, a bulb shape appearing phenomenon illustrated in Figs. 14 and 15 is prevented at the display elements 9 other than the display elements 9 displayed between almost the center of the function explanation block 11 in the height direction and the portion having the height substantially equal to the height of the user's gaze when the user views from the front side while standing upright. Hence, the difficulty in reading the display elements 9 is relieved greatly.

[0064]

While the height of almost the center of the function explanation block 11 in the height direction is substantially equal to the height of the gaze of the user of standard height when the user views from the front side while standing upright in the operation device of Embodiment 2, the height of a different portion on the surface component 8 may be substantially equal to the height of the gaze of the user of standard height when the user views from the front side while standing upright. That is, it is only necessary that the first light sources 15, which are provided at the display elements 9 on the upper side of the portion at the height substantially equal to the height of the gaze of the user of standard height when the user views from the front side while standing upright, should be disposed on the lower sides of the corresponding light guide plates 16 and that the first light sources 15, which are provided in the display elements 9 on the lower side of the portion at the height substantially equal to the height of the gaze of the user of standard height when the user views from the front side while standing upright, should be disposed on the upper sides of the corresponding light guide plates 16. When the height of almost the center of the

function explanation block 11 in the height direction is substantially equal to the height of the gaze of the user of standard height when the user views from the front side while standing upright, as in the operation device of Embodiment 2, the gaze can be substantially equally shifted up and down.

[0065]

While the first light sources 15 in all of the display elements 9 displayed on above are disposed on the lower sides of the corresponding light guide plates 16 and the first light sources 15 in all of the display elements 9 displayed below are disposed on the upper sides of the corresponding light guide plates 16 in the operation device of Embodiment 2, only the first light source 15 in some of the display elements 9 may be disposed in that manner. When the first light sources 15 in all of the display elements 9 are disposed in that manner, the frequency of the occurrence of the bulb shape appearing phenomenon can be reduced further.

[0066]

Embodiment 3

An operation device according to Embodiment 3 is different from the operation devices of Embodiment 1 and Embodiment 2 in the arrangement of first light sources.

The operation device of Embodiment 3 will be described below.

First, the structure of the operation device of Embodiment 3 will be described. Descriptions overlapping with those of the operation devices of Embodiment 1 and Embodiment 2 are appropriately simplified or omitted.

Fig. 25 illustrates a state in which all display elements in the operation device of Embodiment 3 are displayed, on which first light sources are superposed. As illustrated in Fig. 25, on a surface component 8, a function selection block 10, a function explanation block 11, and a function setting block 12 are arranged in a vertical line.

[0067]

First light sources 15 provided in display elements 9 displayed in the function explanation block 11, that is, at text 11a and a marking 11b in this example, emit light toward corresponding light guide plates 16 from a direction perpendicular to the line

direction of the blocks, that is, from the right-left direction. When the blocks are arranged in a horizontal line, the first light sources 15 emit light toward the light guide plates 16 from the up-down direction. First light sources 15 provided in display elements 9 displayed in the function selection block 10 and the function setting block 12, that is, at an icon 10a, icons 10b, icons 12a, and text 12b in this example, emit light toward corresponding light guide plates 16 from a direction parallel to the line direction of the blocks, that is, from the up-down direction. When the blocks are arranged in a horizontal line, the first light sources 15 emit light toward the light guide plates 16 from the right-left direction.

[0068]

The first light sources 15 provided in the display elements 9 displayed in the function selection block 10, that is, at the icon 10a and the icons 10b in this example, are disposed on the lower sides of the corresponding light guide plates 16. The first light sources 15 provided in the display elements 9 displayed in the function setting block 12, that is, at the icons 12a and the text 12b in this example, are disposed on the upper sides of the corresponding light guide plates 16. When the blocks are arranged in a horizontal line, the first light sources 15 provided in the display elements 9 displayed in the block on the right side of the function explanation block 11 are disposed on the left sides of the corresponding light guide plates 16. The first light sources 15 provided in the display elements 9 displayed in the block on the left side of the function explanation block 11 are disposed on the right sides of the corresponding light guide plates 16.

[0069]

Next, the effects of the operation device of Embodiment 3 will be described.

The function explanation block 11 is provided at the height substantially equal to the height of the gaze of the user of standard height when the user views from the front side while standing upright. The user's gaze points upward when viewing the function selection block 10, and the user's gaze points downward when viewing the function setting block 12.

[0070]

Similarly to the operation device of Embodiment 1 and the operation device of Embodiment 2, in the operation device of Embodiment 3, a bulb shape appearing phenomenon illustrated in Figs. 12 and 13, which occurs when the optical axis of any of the first light sources 15 meets the user's gaze, does not occur. This relieves the difficulty in reading the display elements 9.

Similarly to the operation device of Embodiment 1 and the operation device of Embodiment 2, in the operation device of Embodiment 3, the frequency of the occurrence of the bulb shape appearing phenomenon illustrated in Figs. 14 and 15, which is caused by entry of the light emitting portion of any of the first light sources 15 in sight of the user when the user's gaze shifts, is reduced. This relieves the difficulty in reading the display elements 9.

[0071]

In the operation device of Embodiment 3, the first light sources 15 provided in the display elements 9 displayed in the function selection block 10 and the function setting block 12 emit light toward the corresponding light guide plates 16 from the up-down direction. Hence, compared to the operation device of Embodiment 1, it is possible to further reduce the frequency at which the bulb shape appearing phenomenon occurs when any of the display elements 9 displayed in the function selection block 10 and the function setting block 12 is viewed.

[0072]

In the operation device of Embodiment 3, the first light sources 15 provided in the display elements 9 displayed in the function explanation block 11 emit light toward the corresponding light guide plates 16 from the right-left direction. Hence, unlike the operation device of Embodiment 2, it is unnecessary to consider variations in the height of the user, for example, by forming a space between the display area of the text 11a and the display area of the marking 11b.

[0073]

In the operation device of Embodiment 3, the first light sources 15 provided in the display elements 9 displayed in the function explanation block 11 emit light toward the light guide plates 16 from the right-left direction. Hence, unlike the operation

device of Embodiment 2, it is unnecessary to dispose the first light sources 15 between the display elements 9 of the text 11a and the marking 11b displayed in the function explanation block 11. Hence, it is possible to arrange the display elements 9 of the text 11a and the marking 11b at a shorter interval and to thereby reduce the size of the operation device 7.

[0074]

Fig. 26 illustrates a state in which all of the display elements in the operation device of Embodiment 3 are displayed, on which the first light sources are superposed. While the first light sources 15 provided at the text 12b displayed in the function setting block 12 emit light toward the corresponding light guide plates 16 from the direction parallel to the line direction of the blocks, that is, from the up-down direction in the operation device of Embodiment 3, they may emit light toward the light guide plates 16 from the direction perpendicular to the line direction of the blocks, that is, from the right-left direction, as illustrated in Fig. 26. According to this structure, the optical axis direction of the first light sources 15 provided in the horizontally long display element 9 coincides with the longitudinal direction of the display element 9, and the display element 9 can be uniformly displayed with a small number of first light sources 15.

[0075]

In the operation device of Embodiment 3, the first light sources 15 in all of the display elements 9 displayed in the function explanation block 11 are arranged in the right-left direction of the light guide plates 16, the first light sources 15 in all of the display elements 9 displayed in the function selection block 10 are disposed on the lower sides of the light guide plates 16, and the first light sources 15 in all of the display elements 9 displayed in the function setting block 12 are disposed on the upper sides of the light guide plates 16. However, only the first light sources 15 in some of the display elements 9 may be arranged in that manner. When the first light sources 15 in all of the display elements 9 are arranged in that way, the frequency of a bulb shape appearing phenomenon can be reduced further.

[0076]

Embodiment 4

An operation device according to Embodiment 4 is different from the operation devices of Embodiments 1 to 3 in the structures of a surface component and display means.

The structures of the surface component and the display means in the operation device of Embodiment 4 will be described below. Descriptions overlapping with those of the operation devices of Embodiments 1 to 3 are appropriately simplified or omitted.

First, with reference to Fig. 27, a description will be given of the structures of a surface component and display means of displaying display elements that do not function as input means in the operation device of Embodiment 4.

Fig. 27 illustrates the cross-sectional structures of the surface component and display means of displaying the display elements that do not function as input means in the operation device of Embodiment 4. As illustrated in Fig. 27, display means 13 are provided between a surface component 8 and a printed board 14.

[0077]

Each display means 13 includes a first light source 15 and a shielding wall 17. A transmissive member 8c in the surface component 8 has a projection C in an area having a display element, and the projection C projects between shielding walls 17. On a surface of the transmissive member 8c opposed to the printed board 14, a light scattering pattern D is provided. When light enters from the first light source 15 provided beside, the surface component 8 emits planar light by the diffusion action of the light scattering pattern D (the transmissive member 8c having the light scattering pattern D corresponds to "light emitting member" in the present invention). The light scattering pattern D may be provided in a member different from the transmissive member 8c, and the different member may be provided on the rear side of the surface component 8 (the different member having the light scattering pattern D corresponds to "light emitting member" in the present invention). In this case, the surface component 8 and the different member may be combined.

[0078]

Next, with reference to Fig. 28, a description will be given of the structures of the surface component and display means of displaying display elements functioning as input means in the operation device of Embodiment 4. The display means of displaying the icons 10b, that is, the icons to be touched by the user to select the function to be set each include a second light source 19, similarly to the operation device of Embodiment 1.

Fig. 28 illustrates the cross-sectional structures of the surface component and the display means of displaying the display elements functioning as input means in the operation device of Embodiment 4. As illustrated in Fig. 28, each display means 13 includes a first light source 15, a shielding wall 17, and an input means 18.

[0079]

The input means 18 is an electrode of a capacitive touch sensor. The input means 18 is attached to the surface of the printed board 14. The input means 18 is provided on the rear side of a light scattering pattern D. The input means 18 detects the change in capacitance value via the surface component 8 when the user touches a display area of a display element 9 on the surface component 8, and transmits a signal to a control means (not illustrated).

[0080]

Fig. 29 illustrates an example of a surface component in the operation device of Embodiment 4. For example, when text 11a is displayed on a single surface component 8, the surface component 8 is formed in a shape illustrated in Fig. 29. In this example, first light sources 15 are disposed in areas A on the outer sides of the surface component 8 in the right-left direction. Shielding walls 17 are provided between projections C. On the rear surface of the surface component 8, light scattering patterns D are provided. The light scattering patterns D are formed such that the pattern density increases with increasing distance from the first light sources 15. According this structure, the display state of display elements 9 can be uniformized further.

[0081]

While the light scattering patterns D are provided in the surface component 8 in the operation device of Embodiment 4, the light guide plates 16 may be provided on the rear surface of the surface component 8, as in the operation device of Embodiment 1, and the light scattering patterns D may be formed on the light guide plates 16.

[0082]

While Embodiments 1 to 4 have been described above, the present invention is not limited to the description of Embodiments. For example, Embodiments and modifications can be combined.

Reference Signs List

[0083]

1: refrigerator-freezer, 2: refrigerating compartment, 2a, 2b: door, 3: ice-making compartment, 4: temperature switch compartment, 5: freezing compartment, 6: crisper compartment, 7: operation device, 8: surface component, 8a: first layer, 8b: second layer, 8c: transmissive member, 9: display element, 10: function selection block, 10a: icon, 10b: icon, 11: function explanation block, 11a: text, 11b: marking, 12: function setting block, 12a: icon, 12b: text, 12c: icon, 13: display means, 14: printed board, 15: first light source, 16: light guide plate, 17: shielding wall, 18: input means, 19: second light source, 20: mark, A: area, B: groove or hole, C: projection, D: light scattering pattern

20133008208 08 Jan 2015

CLAIMS

[Claim 1]

An operation device comprising at least:

a layer having a plurality of marked portions having at least any of an icon, text and a marking,

a light emitting member provided on a rear side of the layer and having a surface opposed to the marked portions, the light emitting member emitting incident light from the surface; and

a plurality of light sources at least one of which is provided for each of the marked portions to cause the light to enter the light emitting member, the light sources being disposed such that optical axes thereof are substantially parallel to the layer,

wherein at least some of the plurality of marked portions form at least three blocks,

wherein the three blocks are arranged in a line,

wherein the three blocks are formed such that, when a figure including the three blocks and having a minimum total peripheral length is drawn, a width dimension of the figure in a direction perpendicular to a line direction of the line is smaller than a width dimension in a direction parallel to the line direction of the line, and

wherein the light source provided in correspondence with at least one of the marked portions that forms the center block of the three blocks is disposed such that an optical axis thereof is substantially perpendicular to the line direction of the line.

[Claim 2]

The operation device of claim 1, wherein the light source provided in correspondence with at least one of the marked portions that forms the block on an outer side of the center block of the three blocks is disposed such that an optical axis thereof is substantially parallel to the line direction of the line and

08 Jan 2015 20133008820

such that the light enters the light emitting member from a side close to the center block.

[Claim 3]

An operation device comprising at least:

a layer having a plurality of marked portions having at least any of an icon, text and a marking,

a light emitting member provided on a rear side of the layer and having a surface opposed to the marked portions, the light emitting member emitting incident light from the surface; and

a plurality of light sources at least one of which is provided for each of the marked portions to cause the light to enter the light emitting member, the light sources being disposed such that optical axes thereof are substantially parallel to the layer,

wherein at least some of the plurality of marked portions form at least three blocks,

wherein the three blocks are arranged in a line,

wherein the three blocks are formed such that, when a figure including the three blocks and having a minimum total peripheral length is drawn, a width dimension of the figure in a direction perpendicular to a line direction of the line is smaller than a width dimension in a direction parallel to the line direction of the line, and

wherein the light source provided in correspondence with at least one of the marked portions that forms the block located on an outer side of the center block of the three blocks is disposed such that an optical axis thereof is substantially parallel to the line direction of the line and such that the light enters the light emitting member from a side close to the center block.

[Claim 4]

08 Jan 2015 20133008820

The operation device of any one of claims 1 to 3, wherein the marked portion that forms the center block includes at least the marked portion having information explaining a function.

[Claim 5]

The operation device of claim 4,

wherein the marked portion that forms one of the blocks located on outer sides of the center block includes at least the marked portion having information used to select the function, and

wherein the marked portion that forms the other of the blocks located on the outer sides of the center block includes at least the marked portion having information used to set the function.

[Claim 6]

The operation device of any one of claims 1 to 5, wherein the three blocks are arranged in series.

[Claim 7]

The operation device of any one of claims 1 to 6,

wherein the layer is provided on a transmissive member,

wherein the light emitting member is a light guide plate, and

wherein the light guide plate is combined with a rear side of the transmissive member.

[Claim 8]

The operation device of any one of claims 1 to 6,

wherein the layer is provided on a transmissive member,

wherein the transmissive member has a light scattering pattern, and

wherein the light emitting member is the transmissive member.

[Claim 9]

The operation device of claim 8, wherein the light scattering pattern is formed such that a pattern density increases with increasing distance from the light source.

08 Jan 2015 2013300820

[Claim 10]

The operation device of any one of claims 1 to 9,

wherein input means is provided on a rear side of the light emitting member, and

wherein the input means is an electrode of a capacitive touch sensor.

[Claim 11]

A refrigerator-freezer comprising at least the operation device of any one of claims 1 to 10.

[Claim 12]

The refrigerator-freezer of claim 11, wherein the three blocks are arranged in a vertical line.

[Claim 13]

The refrigerator-freezer of claim 11 or 12, wherein the center block is provided at a height substantially equal to a height of a gaze of a user of standard height when the user views from a front side while standing upright.

FIG. 1

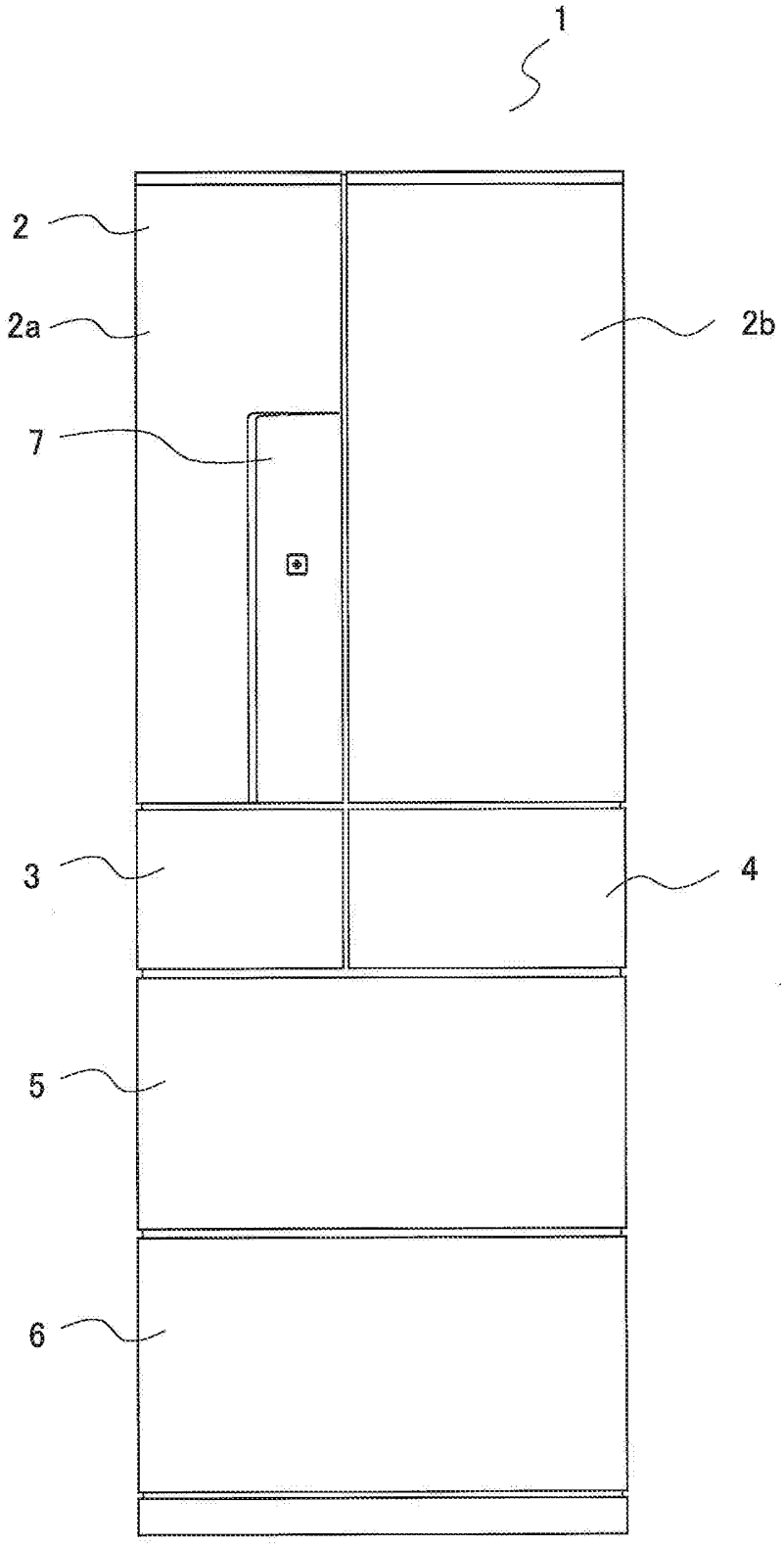

FIG. 2

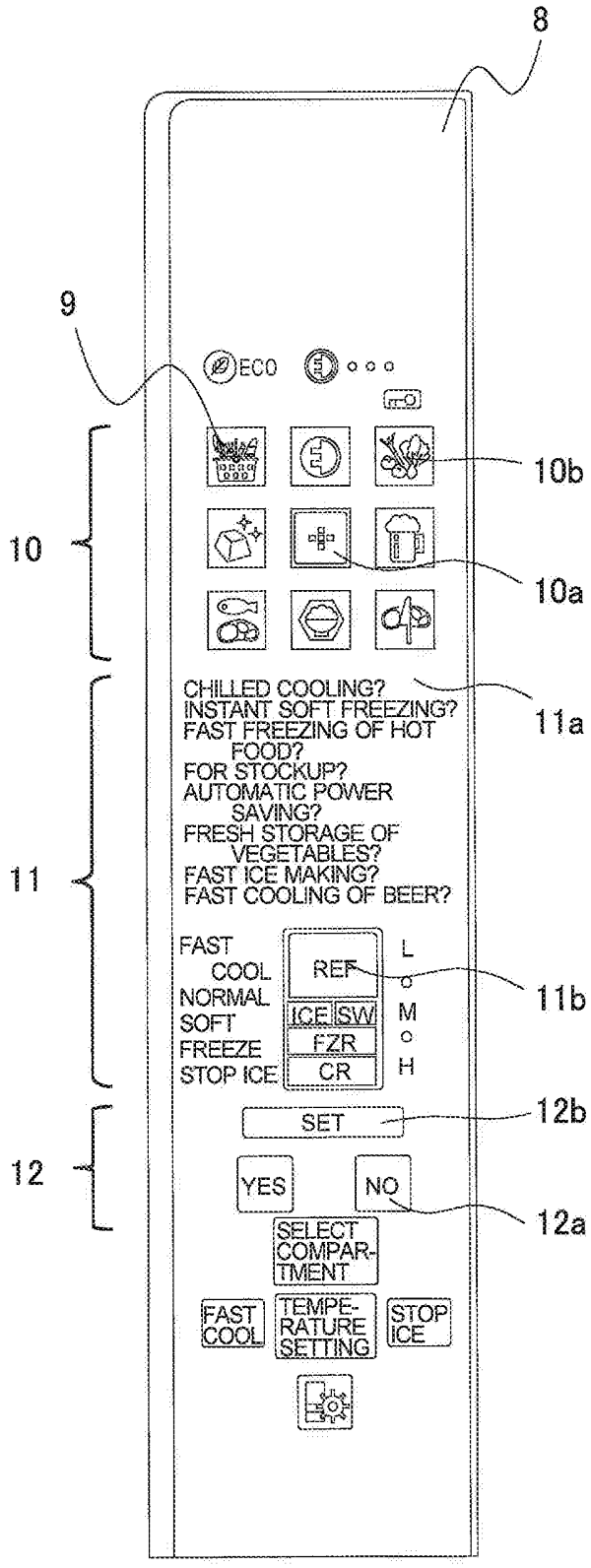
8
9
ECO
10
10b
10a
11
CHILLED COOLING?
INSTANT SOFT FREEZING?
FAST FREEZING OF HOT FOOD?
FOR STOCKUP?
AUTOMATIC POWER SAVING?
FRESH STORAGE OF VEGETABLES?
FAST ICE MAKING?
FAST COOLING OF BEER?
11a
FAST COOL
NORMAL
SOFT
FREEZE
STOP ICE
REF
ICE SW
FZR
CR
L
M
H
11b
12
SET
12b
YES
NO
12a
SELECT COMPAR-TMENT
FAST COOL
TEMPE-RATURE SETTING
STOP ICE

FIG. 3

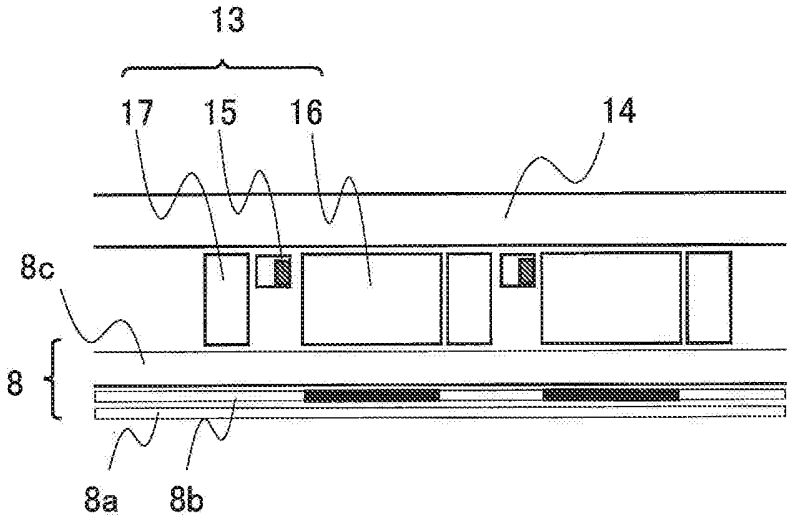

FIG. 4

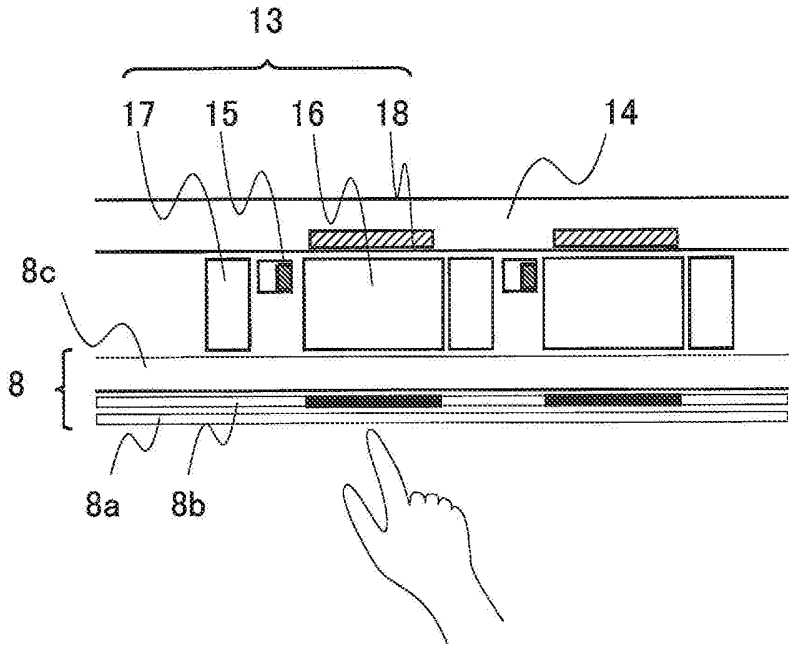

FIG. 5

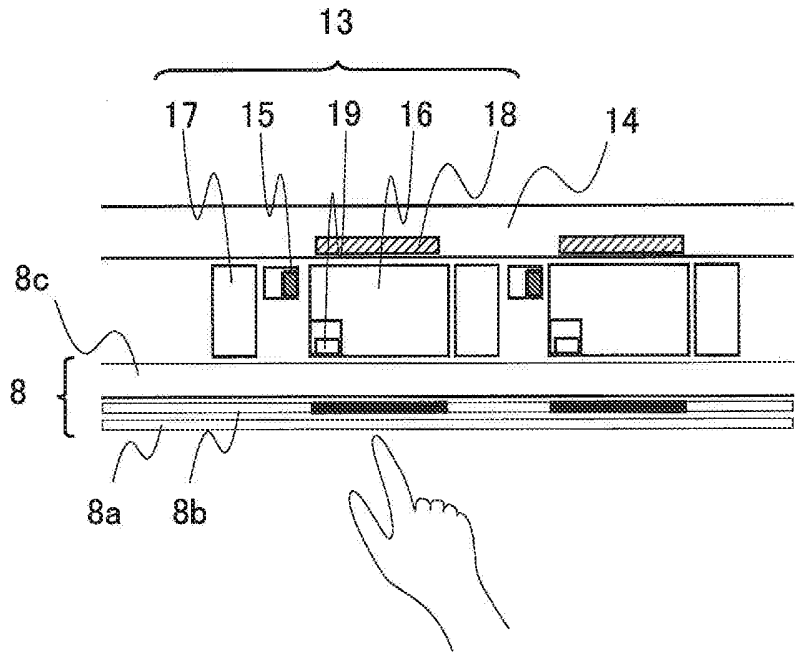

FIG. 6

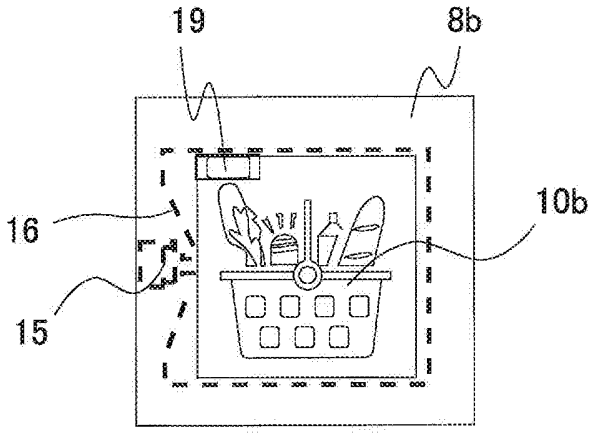

FIG. 7

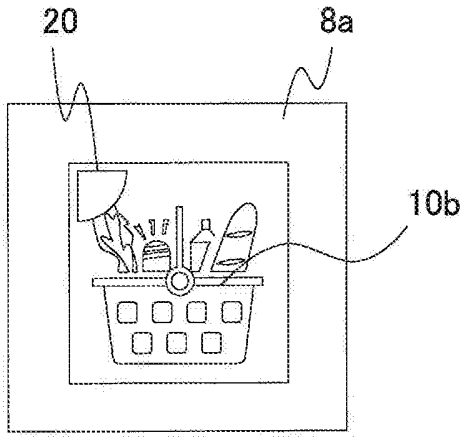

FIG. 8

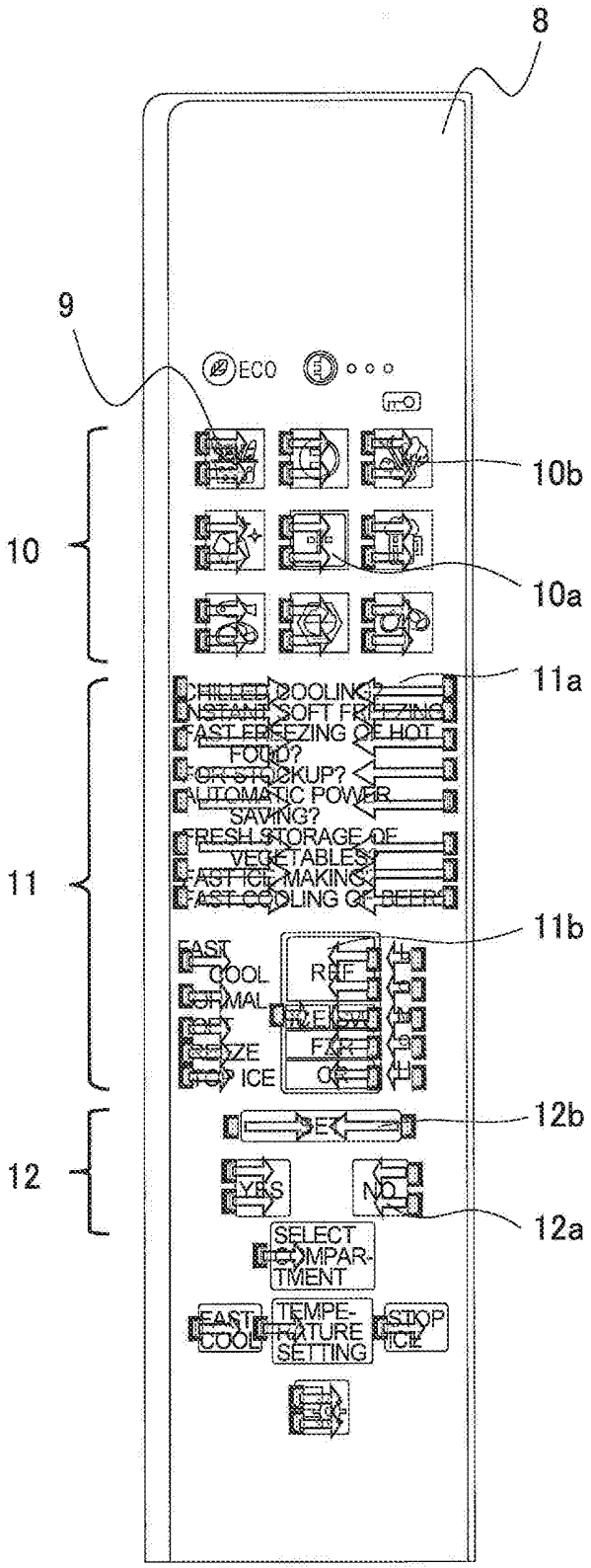
8
9
ECO
10
10b
10a
11
11a
11b
12
12b
12a
YES
NO
SELECT COMPAR-TMENT
TEMPE-RATURE SETTING
STOP ICE

FIG. 9

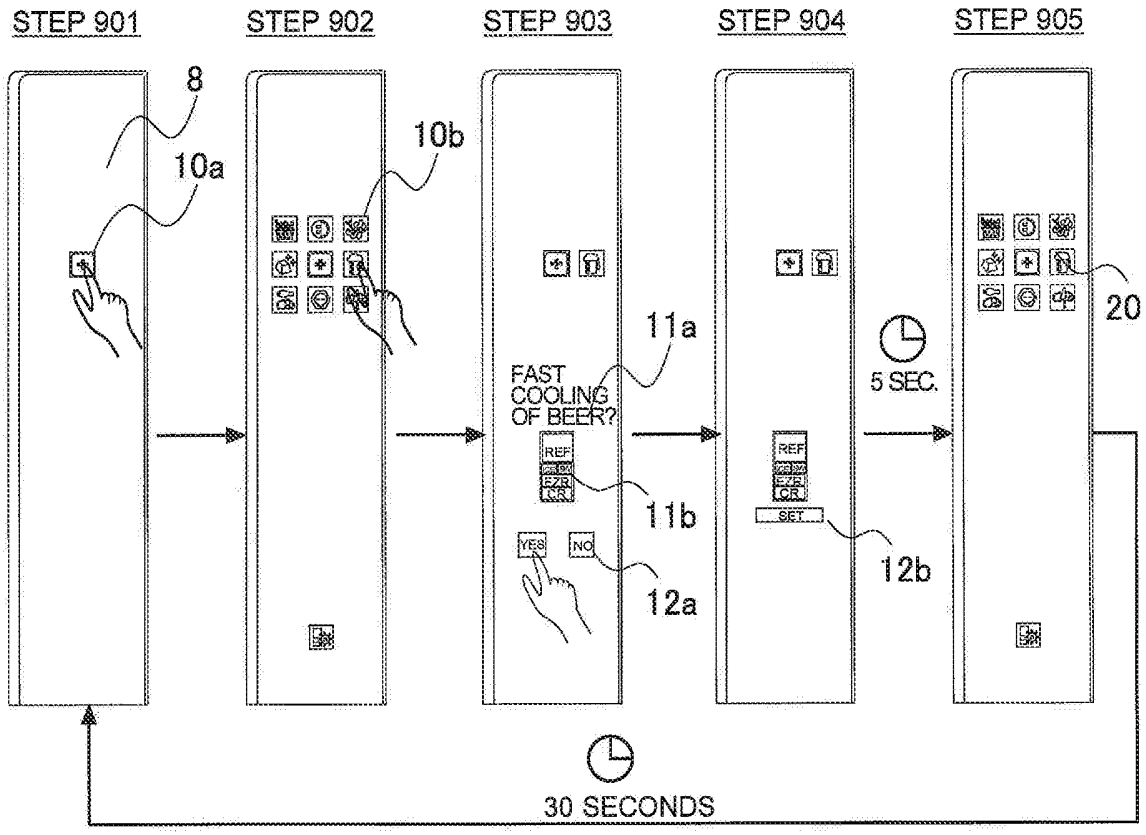
STEP 901
STEP 902
STEP 903
STEP 904
STEP 905
8
10a
10b
11a
FAST
COOLING
OF BEER?
REF
FZR
CR
11b
YES
NO
12a
SET
12b
5 SEC.
20
30 SECONDS

FIG. 10

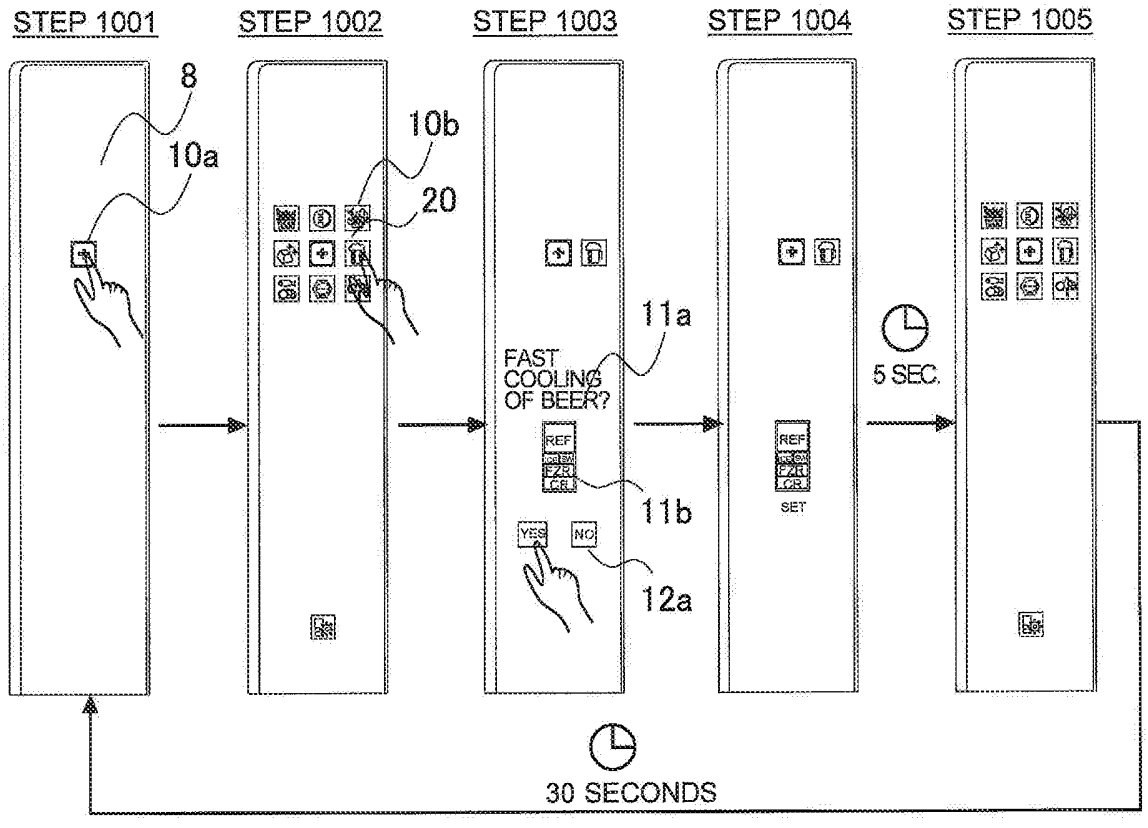
STEP 1001
STEP 1002
STEP 1003
STEP 1004
STEP 1005
8
10a
10b
20
11a
FAST
COOLING
OF BEER?
REF
FZR
CR
11b
YES
NO
12a
SET
5 SEC.
30 SECONDS

FIG. 11

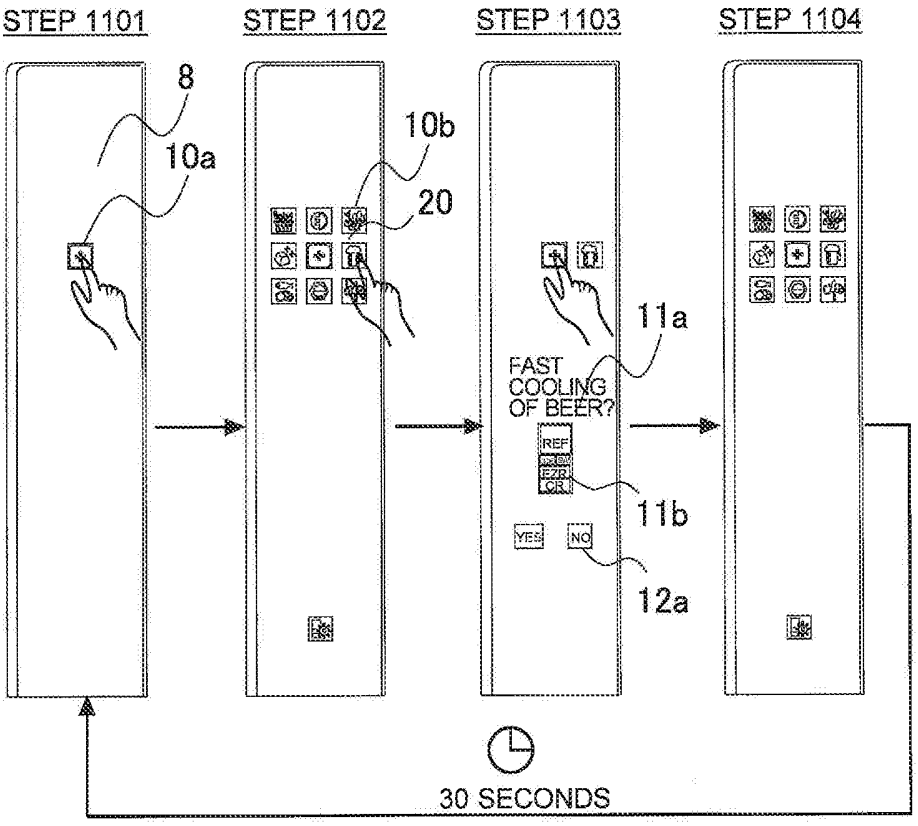
STEP 1101
STEP 1102
STEP 1103
STEP 1104
8
10a
10b
20
11a
FAST
COOLING
OF BEER?
REF
FZR
CR
11b
YES
NO
12a
30 SECONDS

FIG. 12

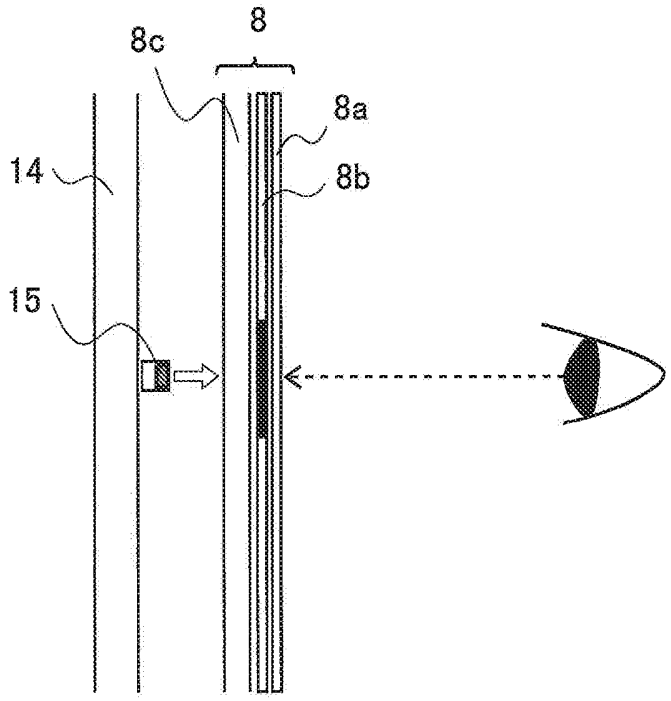

FIG. 13

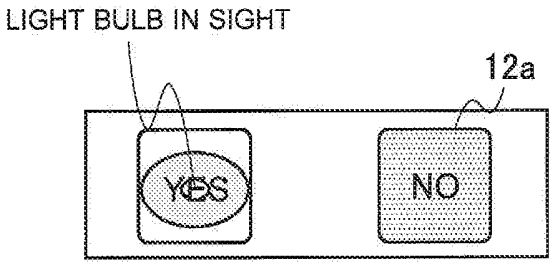

FIG. 14

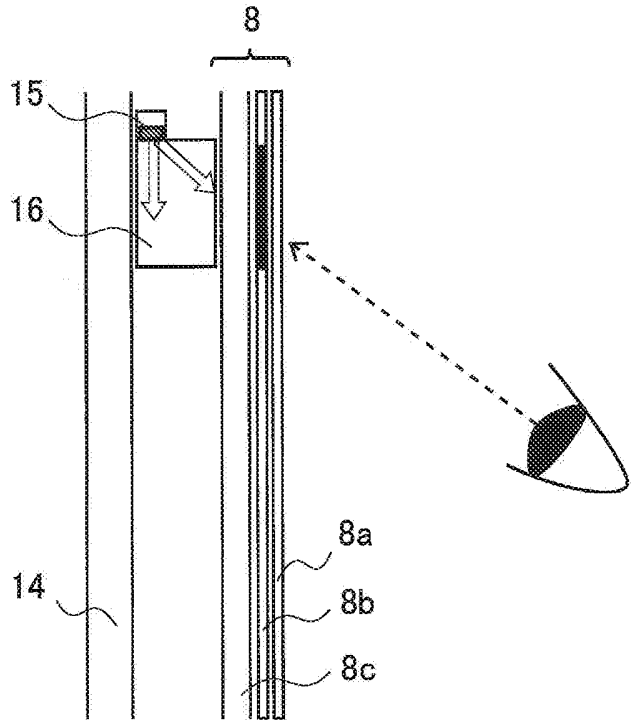

FIG. 15

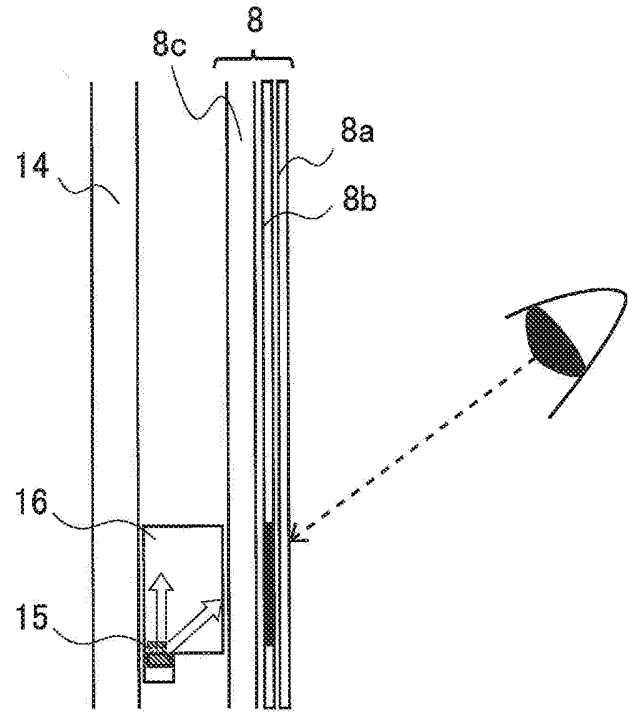

FIG. 16

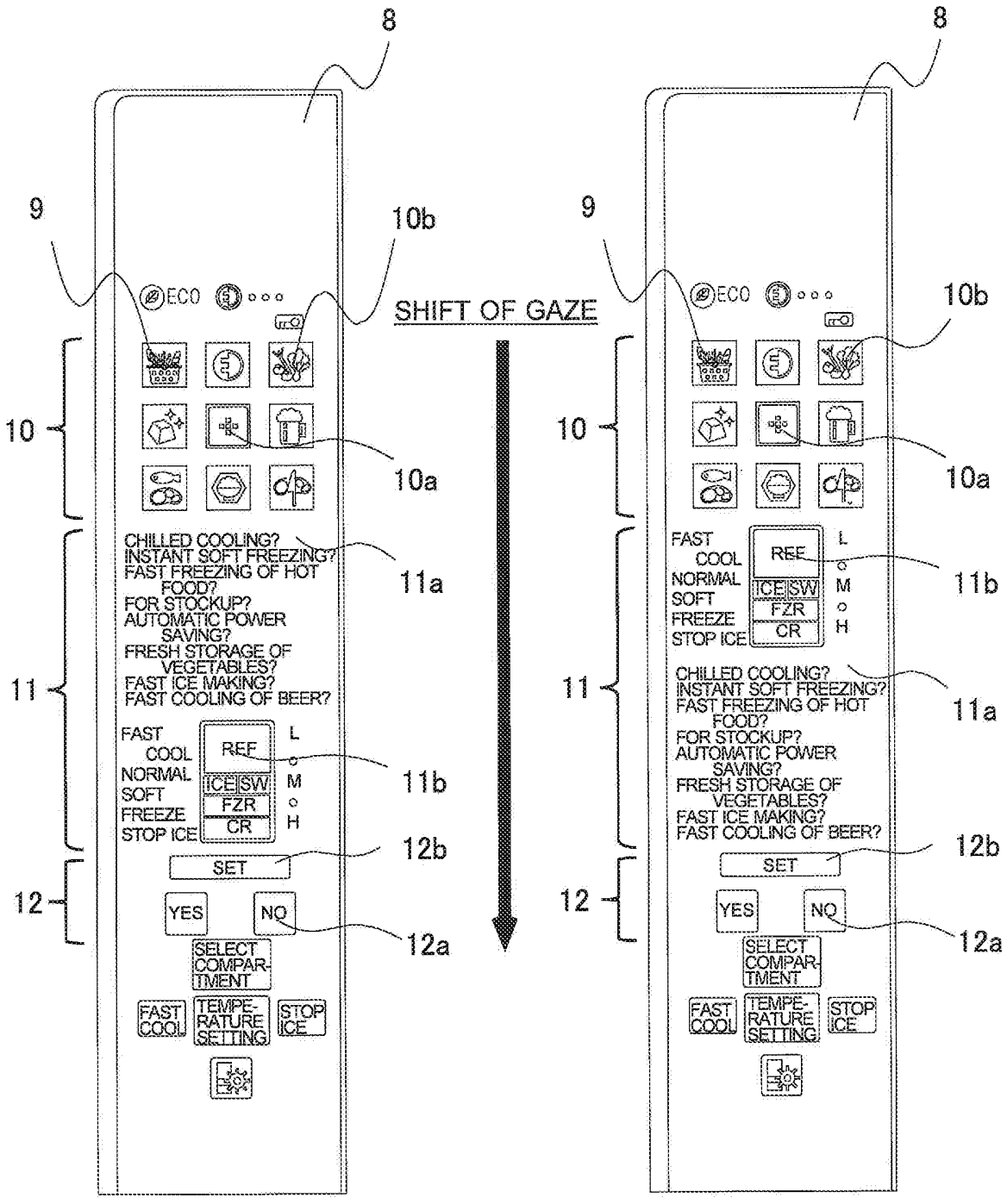
8
9
10b
10
10a
11
11a
11b
12
12b
12a
ECO
CHILLED COOLING?
INSTANT SOFT FREEZING?
FAST FREEZING OF HOT FOOD?
FOR STOCKUP?
AUTOMATIC POWER SAVING?
FRESH STORAGE OF VEGETABLES?
FAST ICE MAKING?
FAST COOLING OF BEER?
FAST COOL
NORMAL
SOFT
FREEZE
STOP ICE
REF
ICE SW
FZR
CR
L
M
H
SET
YES
NO
SELECT COMPARTMENT
FAST COOL
TEMPERATURE SETTING
STOP ICE
SHIFT OF GAZE

FIG. 17

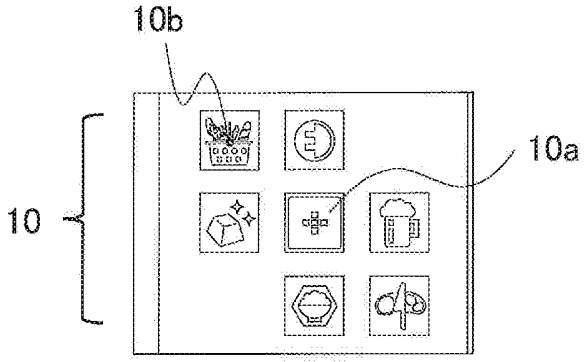

FIG. 18

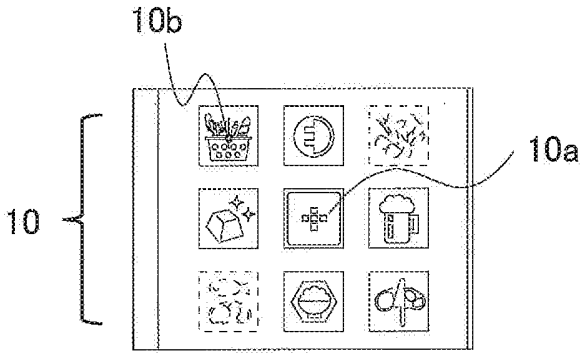

FIG. 19

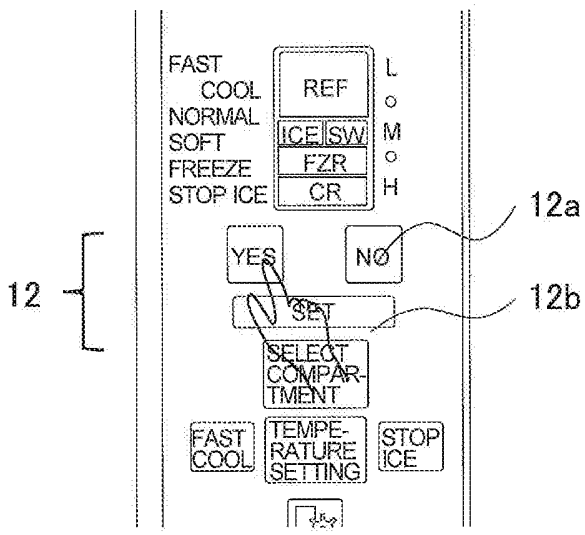

FIG. 20

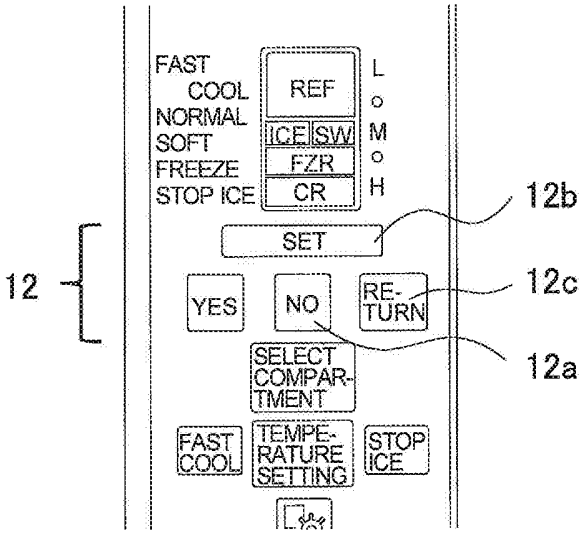
FAST COOL
NORMAL
SOFT
FREEZE
STOP ICE
REF
ICE
SW
FZR
CR
L
M
H
12b
SET
12
YES
NO
RE-TURN
12c
12a
SELECT COMPAR-TMENT
FAST COOL
TEMPE-RATURE SETTING
STOP ICE

FIG. 21

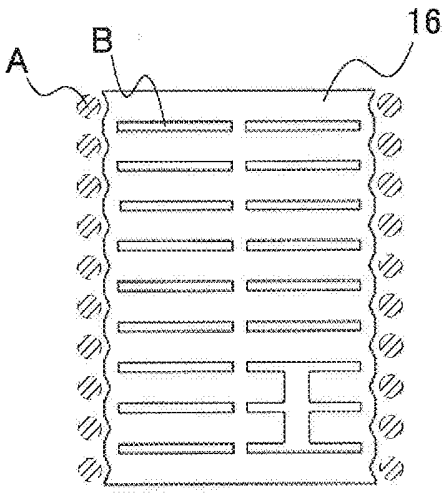
A
B
16

FIG. 22

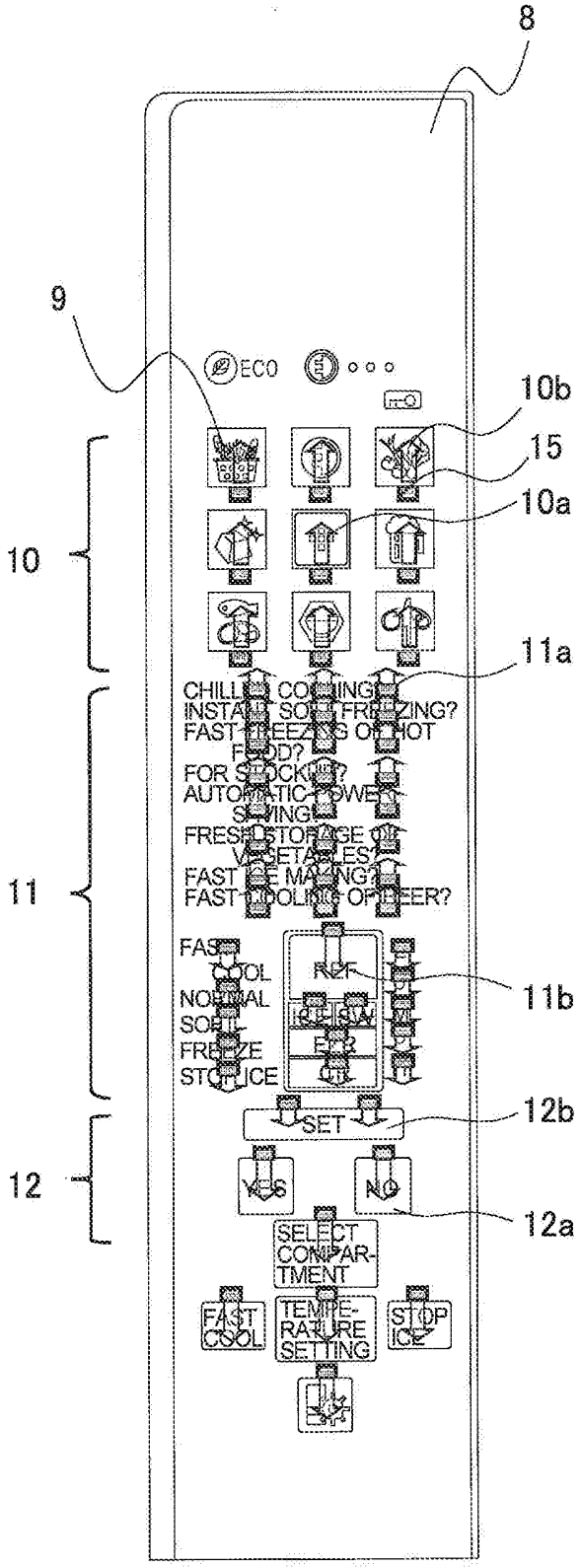
8
9
ECO
10b
15
10a
10
11a
11
11b
12b
12
12a
SET
YES
NO
SELECT COMPAR-TMENT
FAST COOL
TEMPE-RATURE SETTING
STOP ICE

FIG. 23

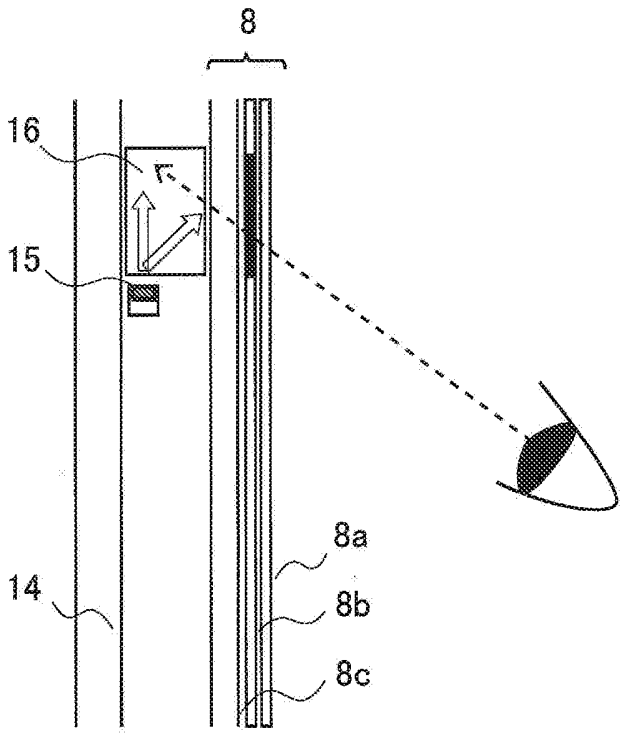

FIG. 24

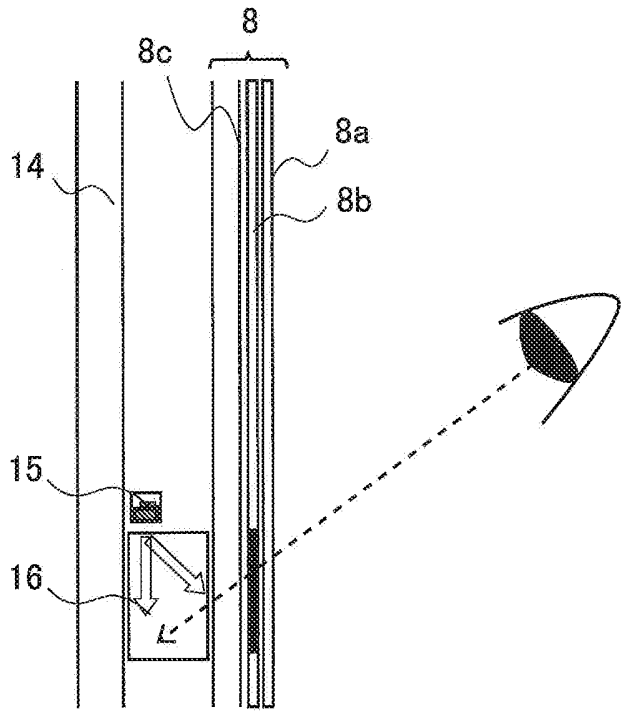

FIG. 25

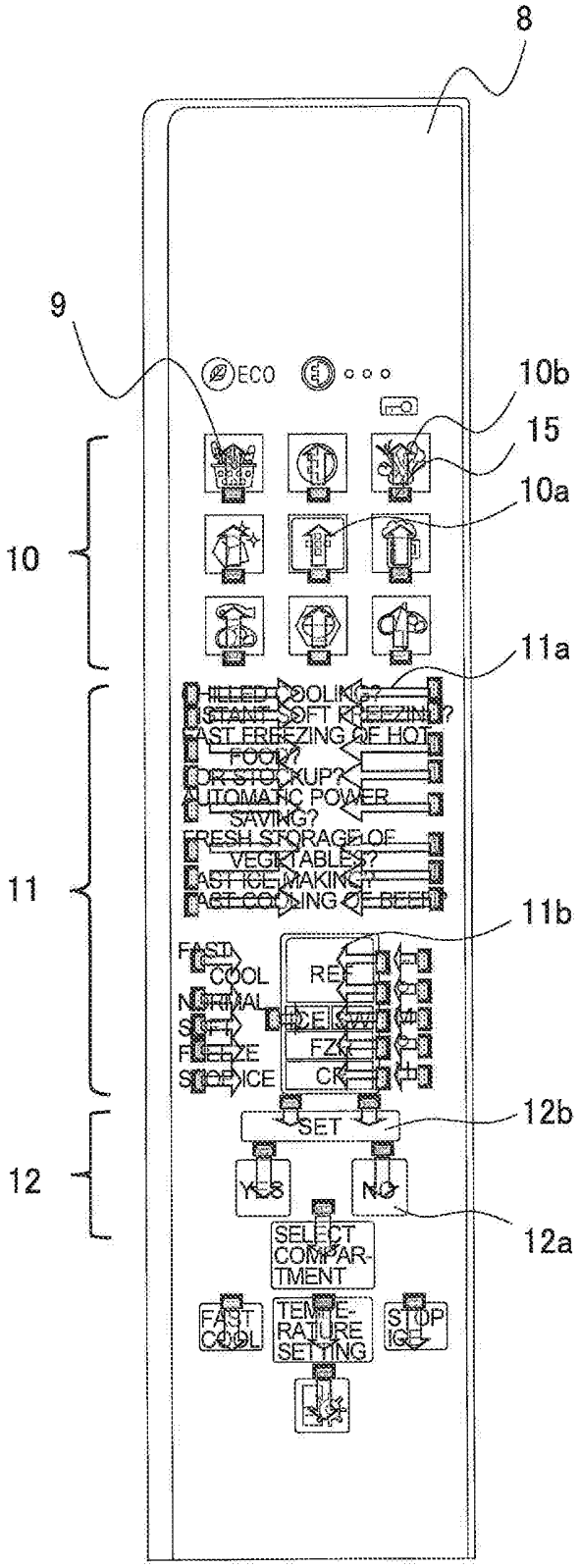
8
9
ECO
10b
15
10a
10
11a
11
11b
FAST COOL
SET
12b
YES
NO
12
12a
SELECT COMPARTMENT
TEMPERATURE SETTING

FIG. 26

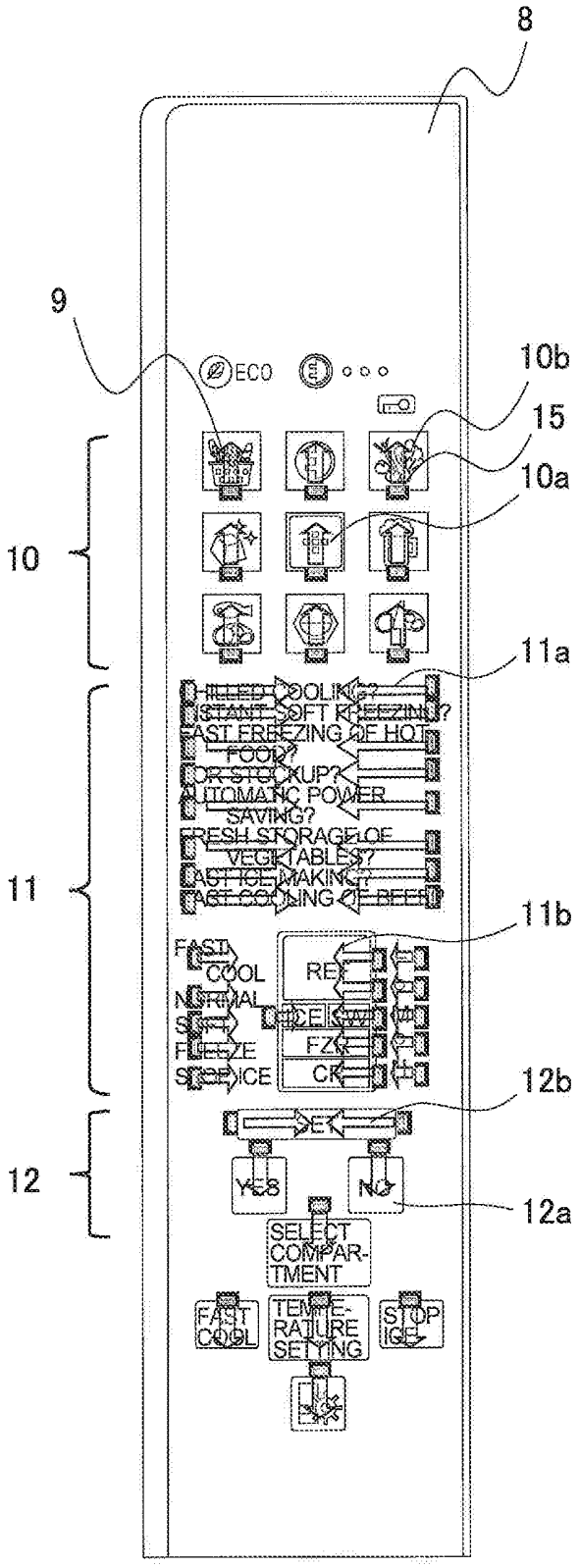
8
9
10
11
12
10b
15
10a
11a
11b
12b
12a
ECO
YES
NO
SELECT COMPAR-TMENT
TEMPE-RATURE SETTING

FIG. 27

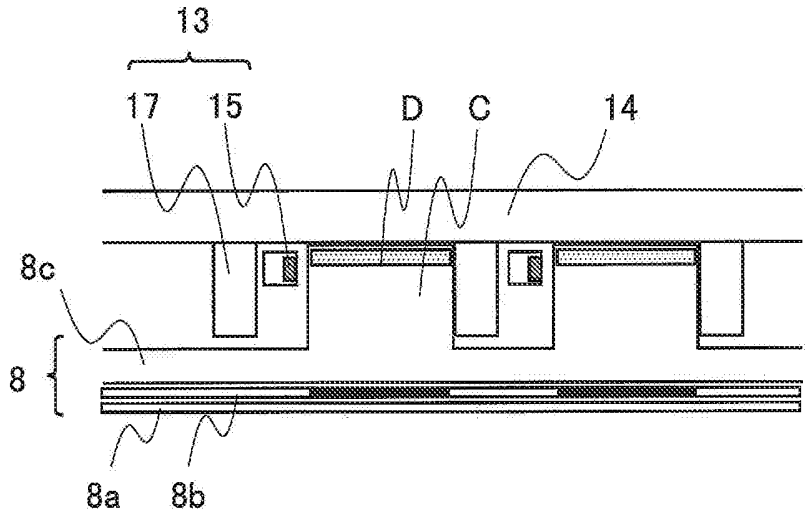

FIG. 28

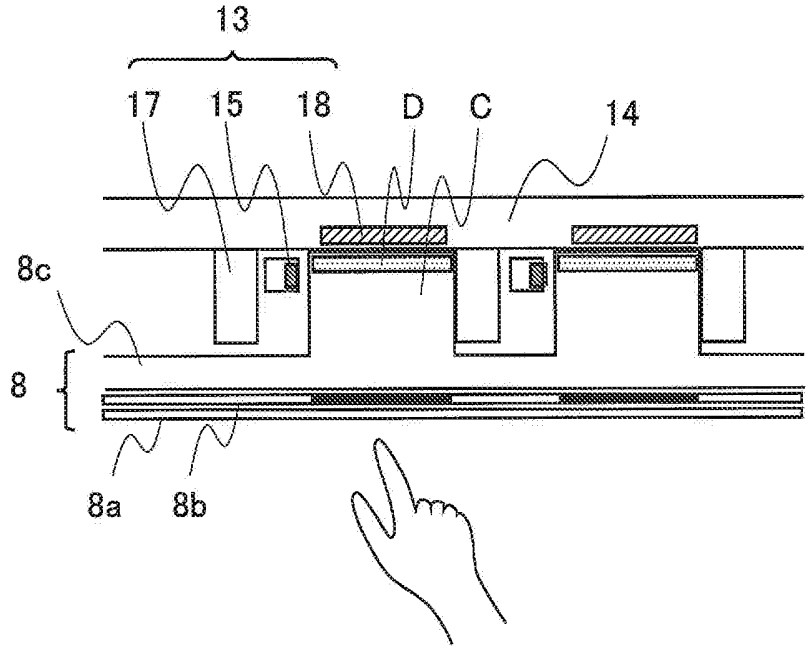

FIG. 29