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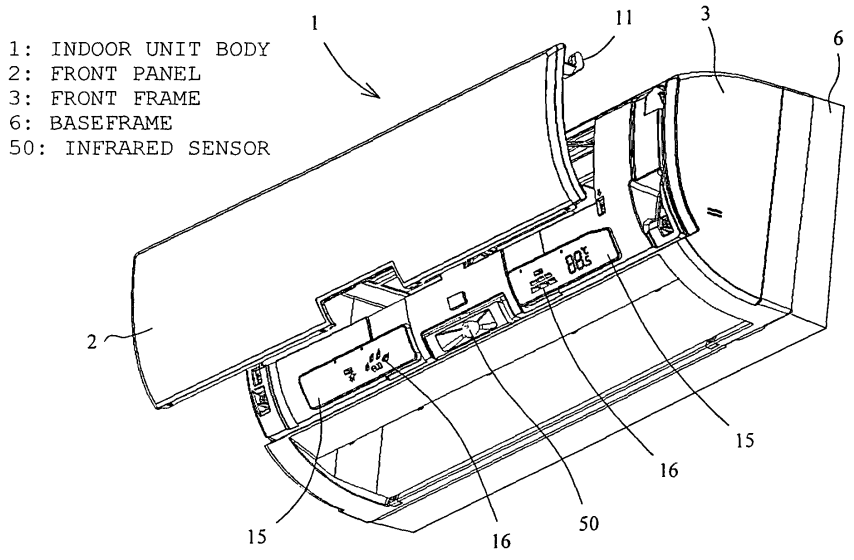
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(54) Indoor unit of air conditioner

(57) The present invention makes a display portion visually unrecognizable in a light-off state, without being subjected to a design constraint. An indoor unit of an air conditioner includes a front panel (2) openable and closable with respect to a front portion of an indoor unit body (1), and a display portion, which includes a light-emitting device (9) controllable in the lighting on and off thereof and is provided inside the indoor unit body (1) to face the front panel (2), for displaying operation information such as an indoor state or an operation setting state. The front panel (2) is formed of a transparent or translucent material and provided with a decorative layer (10) on the inner or outer surface thereof or inside thereof. The decorative layer (10) has non-reflectivity, allows the transmission therethrough of light emitted from the light-emitting device (9), and prevents the interior of the indoor unit body (1) from being seen through from outside of the indoor unit in the light-off state.

FIG. 1



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to an indoor unit of an air conditioner capable of improving the design quality of the front side of an indoor unit body.

DESCRIPTION OF THE RELATED ART

[0002] In a conventional indoor unit of an air conditioner, a housing serving as the body of the indoor unit includes a front portion constituted by a front frame, a front panel, and a display cover, and a rear portion constituted by a base frame. The front panel is attached to the front frame, and serves as a design surface. The display cover is attached to a lower portion of the front panel to extend in lateral directions from the center in the width direction thereof, and serves as a display member.
The baseframe houses a heat exchanger, an air blower, and so forth.

[0003] In such an indoor unit, the display cover is formed of a transparent or translucent synthetic resin allowing the transmission therethrough of light, and is fixed to the front panel by a wedge member. Further, the display cover is provided with a plurality of display portions on the outer surface (the front surface) or the inner surface (the back surface) thereof. The display portions are laterally provided by printing or the like and highlighted by light applied from the back side. Further, a word or phrase explaining the content of the information displayed by each of the display portions, e.g., letters such as OPERATION, TIMER, INTERNAL CLEANING, HUMIDITY, OUTDOOR, FILTER, ODOR, VENTILATION, and DUST, is printed at a position above the vicinity of the display portion on the front surface. Thus, the presence of the display portions is visually recognized even in a light-off state. Further, inside the indoor unit of the air conditioner, a light-emitting device such as an LED (light-emitting diode) is provided to be located on the back side of the display cover. As the light emitted from the light-emitting device is transmitted through the display cover, the respective display portions printed on the display cover and the contents of the corresponding display information are selectively illuminated to highlight corresponding information (patent documents No.1, for example).

[0004] Patent Documents No.1: Japanese Unexamined Patent Application Publication No. 2005-147432 (Figs. 2 to 4).

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED

[0005] In recent years, indoor units of air conditioners have been provided with a variety of functions other than heating and cooling functions, such as an air cleaning function, a deodorizing function, and an automatic filter cleaning function. Accordingly, the information desired to be displayed on the body of the indoor unit of the air conditioner has been increased. Further, to cope with the increase in the aged population, an increase in the size of the display has been desired for the improvement of the visibility of the display. In the display structure of the conventional indoor unit of an air conditioner, however, the textual information and so forth are printed on the front or back surface of the display cover integrated with the front panel, as described above. Thus, the textual information and so forth are always visible even in the light-off state of the light-emitting device. Therefore, such a display structure imposes a significant design constraint on the display of a multitude of display portions.

[0006] Such an issue can be overcome by, for example, providing a half-mirror film to a surface of the display to make the shape of the display invisible in the light-off state of the light-emitting device. In this case, however, another issue arises in that the half-mirror imposes another design constraint. In the air conditioners of recent years, to obscure the presence of the indoor unit, the dominant color of the indoor unit is white in accordance with the color of the wallpaper of a room. However, the half mirror, which is similar to a mirror surface, conversely emphasizes the presence of the indoor unit. Further, if the front surface includes a curved portion, an object reflected by the half mirror appears in a larger or smaller size than the original size thereof, and thus the presence of the indoor unit is further emphasized. As a result, another issue arises in terms of the design constraint in that the front surface can be formed only by a flat surface.

[0007] Further, as described above, in the conventional indoor unit of an air conditioner, the design surface on the front side is constituted by two components, i.e., the front panel and the transparent or translucent display cover attached to the front panel and provided with the display portions. This structure is disadvantageous in that the design surface includes a dividing line, which constitutes another significant design constraint.

[0008] In view of the above-described issues, it is an object of the present invention to make a display portion visually unrecognizable in a light-off state, without being subjected to a design constraint.

MEANS FOR SOLVING THE PROBLEMS

[0009] An indoor unit of an air conditioner according to an aspect of the present invention has the following configuration. That is, the indoor unit of an air conditioner includes a front panel and a display portion positioned at a front portion of an indoor unit body. The front panel is openable and closable. The display portion includes a light-emitting device controllable in the lighting on and off thereof, and is provided inside the indoor unit body to face the front panel, to display operation information such as an indoor state or an operation setting state. The front panel is formed of a transparent or translucent material,

and is provided with a decorative layer on the inner or outer surface thereof or inside thereof. The decorative layer has non-reflectivity, allows the transmission therethrough of light emitted from the light-emitting device, and prevents the interior of the indoor unit body from being seen through from outside of the indoor unit in a light-off state.

EFFECTS OF THE INVENTION

[0010] According to the indoor unit of an air conditioner according to the above aspect of the present invention, the front panel is formed of the transparent or translucent material. Further, on the inner or outer surface of the front panel or inside the front panel, the non-reflective decorative layer is provided which allows the transmission therethrough of the light emitted from the light-emitting device, but which prevents the interior of the indoor unit body from being seen through from outside of the indoor unit in the light-off state. In the light-off state of the light-emitting device, therefore, any depiction relating to the display portion is not shown on the front surface of the front panel. So, display contents are depicted on the front surface of the front panel only after the light-up of the light-emitting device. Accordingly, a design constraint imposed by the display contents is eliminated, and the degree of design freedom is increased.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] First Embodiment: The present invention will be described below on the basis of the embodiment illustrated in the drawings.

[0012] As illustrated in Figs. 1 and 2, in an indoor unit of an air conditioner according to the present embodiment, a housing of an indoor unit body 1 includes a front portion constituted only by a front frame 3 and a front panel 2 which is attached to the front frame 3 to be openable and closable with respect thereto and serves as a design surface, and a rear portion constituted by a base frame 6 for housing a heat exchanger 4, an air blower 5, and so forth.

[0013] More specifically, the front panel 2 is formed of a transparent or translucent material including an ABS (acrylonitrile butadiene styrene) resin having high chemical resistance and insolubility in by a paint and so forth. If the outer surface (the front surface) or the inner surface (the back surface) of the front panel 2 is not provided with anything, an object can be seen through the front panel 2, i.e., the interior of the indoor unit body 1 can always be seen through. As illustrated in Figs. 2 to 4, however, the front panel 2 is provided with a decorative layer 10, which is homogeneously painted or printed on the entire area (the entire surface) of a back surface of the front panel 2, and which has low reflectivity and a color of high brightness, such as white and beige. Accordingly, the interior of the indoor unit body 1 cannot be seen through from outside of the indoor unit. However, light emitted from inside the indoor unit body 1 can be transmitted through the decorative layer 10, as described later.

[0014] That is, the decorative layer 10 is formed into a thickness of 20 μm or more. If the decorative layer 10 is formed into a thickness of less than 20 μm, the interior of the indoor unit body 1 is seen through. That is, the thickness of 20 μm or more of the decorative layer 10 is a minimum thickness necessary for preventing the interior of the indoor unit body 1 from being seen through from outside of the indoor unit. The upper limit of the thickness of the decorative layer 10 slightly varies depending on the color of the employed paint and so forth. Irrespective of the color to be employed, however, it is needless to say that the upper limit is set to a thickness allowing the light emitted from a light-emitting device 9 described later to be transmitted through the decorative layer 10. The decorative layer 10 may alternatively be provided on the front surface of the front panel 2.

[0015] Meanwhile, In the formation of the front panel 2 using the transparent material, it is necessary to prevent the flowing direction of the resin from being generated as a line in a molding process, and to make the resin easily flow. To satisfy the requirements, it is preferred to set the thickness of the front panel 2 to 2.5 mm to 3.5 mm. Particularly, when the thickness was set to 3 mm, the molding process was carried out most easily.

[0016] Further, the back surface of the front panel 2 requires portions shaped to fix the front panel 2 to the front frame 3. If the front panel 2 is formed to be transparent, however, the portions shaped for fixation are seen through from outside of the indoor unit, even if the aforementioned paint has been applied to the back surface around the portions shaped for fixation to the front frame 3. In view of this, each of the lateral ends of the inner surface of the front panel 2 is equipped with a front panel holder 13, which is provided with a support arm 11 and a locking clamp 12 for attaching the front panel 2 to the front frame 3, to prevent the portions shaped for fixation from being seen from outside of the indoor unit. In the present example, portions of the front panel 2 to install the front panel holders 13 have also been previously provided with the decorative layer 10 such that the presence of the front panel holders 13 at the portions is hidden from outside of the indoor unit. Alternatively, the color of the front panel holders 13 may be made the same as the color of the decorative layer 10. As described above, the front panel 2 is fixed to the front frame 3 via the support arm 11 and the locking clamp 12 provided to each of the front panel holders 13, and can be attached to and detached from the front frame 3 and opened and closed with the support arm 11 functioning as a fulcrum.

[0017] The light-emitting device 9 is mounted on a display board 14. In the present example, a white LED light is employed as the light-emitting device 9. However, the light-emitting device 9 is not limited thereto. Thus, any device controllable in the lighting on and off thereof may be used. The display board 14 is held by a display board

fixing member 15. The display board fixing member 15 includes display windows 16 each formed into a shape desired to be depicted in the light-on state of the light-emitting device 9. As illustrated in Fig. 4, in the closed state of the front panel 2, the display board fixing member 15 is constantly biased forward by a coil spring 17 disposed on the back side thereof, and the display windows 16 are made in close contact with and fixed to the decorative layer 10 of the front panel 2. The size of each of the display windows 16, i.e., the size of a word or phrase or a pictogram displayed on the surface of the front panel 2 needs to be 4 mmx4 mm or more for visibility. The upper limit of the size is preferred to be set to 50 mmx50 mm or less, i.e., a size not excessively large in terms of design. Accordingly, display contents can be easily recognized, and an area provided with a necessary number of the display contents can be easily secured. Further, the shape of each of the display windows 16 determines the shape to be displayed. Therefore, a highly accurate window shape can be easily obtained.

[0018] Further, constant lighting of a large-sized display portion during the operation of the air conditioner is unfavorable in terms of design, and may make a user feel glaring at bedtime in the nighttime, for example. Taking such a possibility into account, a switch capable of changing the illuminance of the display portion and turning off the light is provided to the indoor unit body 1 or a remote controller (not illustrated) of the air conditioner. Accordingly, it is possible to turn off the light of the display portion at bedtime in the nighttime, for example, and thus to prevent the light from disturbing the sleep of the user.

[0019] As illustrated in Fig. 6, the present example includes four display contents, i.e., a temperature display 19, a human detection display 20, an energy saving level display 21, and a cleaning display 22.

[0020] The temperature display 19 displays the set temperature and the sensible temperature actually felt by a person, which is based on the room temperature, the humidity, and the temperature of the walls and floor, at intervals of 0.5°C in accordance with the situation at a given time. Alternatively, the room temperature may be displayed instead of the sensible temperature. Further, The intervals of 0.5°C may be replaced by intervals of 1°C. If the sensible temperature is displayed at the intervals of 0.5°C, subtle display of a temperature close to the temperature actually felt by a person can be provided. Accordingly, temperature setting suitable for the user can be easily performed while viewing the display portion of the indoor unit body 1. As a result, the comfort is improved.

[0021] The human detection display 20 displays the position and the range of activity of a person detected by an infrared sensor 50 provided to the indoor unit body 1. Accordingly, the user can visually understand the operational state of the indoor unit. Further, the indoor unit may be provided with a function of detecting the position and the range of activity of a person through the infrared sensor 50 and automatically changing the wind direction on the basis of the information obtained from the detection, and to use the human detection display 20 for displaying the wind direction. In this case, the user can visually understand the operational state of the indoor unit.

[0022] The energy saving level display 21 displays the level of energy saving by the number of leaves. The greater number of the leaves indicates the higher energy saving level. Further, the energy saving level can be set by the remote controller, and is changed depending on whether or not each of the temperature of the walls and floor, the position of a person, and the amount of activity of a person is activated. Accordingly, the energy saving level can be checked while viewing the display portion of the indoor unit body 1.

[0023] The cleaning display 22 is lighted up in an automatic cleaning operation of a filter and a drying operation of the heat exchanger 4.

[0024] The above-described display portion normally displays the current state of inside of the room. However, after the setting is changed, it is configured to display only a changed content of the setting for only a predetermined time. That is, upon a change in the set temperature, the temperature display 19 is lighted up and displays the changed set temperature for a predetermined time. Further, upon a change in the energy saving level, the energy saving level display 21 is lighted up and displays the changed energy saving level for a predetermined time. Accordingly, the changed contents can be checked while viewing the display portion of the indoor unit body 1. In the present example, the color of the light-emitting device 9 is all white to make the color of the decorative layer 10 appear to the front, and to unify the color of the light emitted from the light-emitting device 9. If a color other than white is used as the color of the light emitted from the light-emitting device 9, and if the color of the light is different from the color of the decorative layer 10, the color appearing to the front is the mixture of the two colors. With the use of the color of the white light, the intended color (the color of the decorative layer 10) can be obtained, and the design is simplified. Further, the intended color (the color of the decorative layer 10) can also be obtained by using the light-emitting device 9 capable of creating the same light color as the color of the decorative layer 10. Particularly, when the white light color and the white decorative layer 10 were employed, a display with a highest-class feeling was obtained. In any case, the color appearing to the front does not necessarily need to be unified. Thus, the color may be changed in accordance with the display content to permit visual distinction between the display contents, as in a case in which the energy saving level display 21 is displayed in a green color, for example.

[0025] Subsequently, operations of the indoor unit of an air conditioner according to the present embodiment will be described. Firstly, as illustrated in Fig. 5, in the light-off state of the light-emitting device 9, any depiction relating to the display portion is not shown on the front surface of the front panel 2, and only the decorative layer

10 is visible. Therefore, the presence of the display portion is unnoticed.

[0026] If the light-emitting device 9 is lighted up, the generated light is transmitted through the display windows 16 and further through the decorative layer 10, as illustrated in Fig. 6. Thus, the emitted light appears to have the shapes of the display windows 16, as viewed from the front side. In this case, the display board fixing member 15 is biased forward by the coil spring 17, and the display windows 16 are in close contact with and fixed to the decorative layer 10 of the front panel 2. Thus, a clearance allowing the leakage and spread of the light does not exist between the decorative layer 10 and the display windows 16. Therefore, the outline (the display shape) of each of the display windows 16 is distinctly displayed without being obscured.

[0027] At a low energy saving level, the temperature display 19 displays the sensible temperature based on the room temperature and the humidity. If the energy saving level is increased by one level with the use of the remote controller, the temperature display 19 shifts to the display of the sensible temperature further in consideration of the radiant heat from the walls and floor and so forth. Further, if the temperature of the floor is low in a cooling operation, the operation frequency is reduced to perform an energy saving operation, and one of the leaves of the energy saving level display 21 is lighted up.

[0028] The human detection display 20 displays the position and the range of activity of a person. If the energy saving level is increased by one level with the use of the remote controller, wind is sent to the location of the person in consideration of his position, and the air-conditioning is not performed in an area in which a person is absent. Thereby, the energy saving operation is performed, and another one of the leaves of the energy saving level display 21 is lighted up. If the energy saving level is further increased by one level, the amount of activity of a person is taken into consideration. Then, if the amount of activity is small, and if the cooling operation is being performed, the set temperature is slightly raised to perform the energy saving operation, and another one of the leaves of the energy saving level display 21 is lighted up.

[0029] Further, if the user feels that the lighting of the display portion is unfavorable in terms of design, the reduction of the illuminance and the turning off of the light can be performed with the use of the switch provided to the indoor unit body 1 or the remote controller of the air conditioner. Accordingly, the issue of the design constraint does not arise.

[0030] As described above, the front panel 2 is formed of the transparent or translucent material, and the back surface of the front panel 2 is provided with the decorative layer 10 by painting or printing. Further, the light-emitting device 9 is lighted up from the back side of the front panel 2 through the display windows 16, and decorative layer 10 prevents the interior of the indoor unit body 1 from being seen through, but allows the transmission therethrough of the light emitted from the light-emitting device 9. In the light-off state of the light-emitting device 9, therefore, any depiction relating to the display portion is not shown on the front surface of the front panel 2, and the display contents can be depicted on the front surface of the front panel 2 only after the light-up of the light-emitting device 9. Accordingly, the design constraint imposed by the display contents is eliminated, and thus an unconstrained design can be obtained.

[0031] Further, the design surface on the front side is constituted solely by the single front panel 2. Therefore, the dividing line formed by the structure constituted by a plurality of components is not generated, and thus an unconstrained design can be obtained. Further, the number of components is reduced, and thus the costs can be reduced.

[0032] Further, the decorative layer 10 is formed of the paint having low reflectivity. Therefore, diffuse reflection is not caused by the decorative layer 10. Thus, it is possible to suppress the leakage of the light emitted from the light-emitting device 9 to the outside of the display portion. Accordingly, the front panel 2 can be formed into a curved shape, and the design constraint on the shape of the front panel 2 is eliminated. As a result, the degree of design freedom is increased.

[0033] Second Embodiment: Fig. 7 is an enlarged cross-sectional view illustrating a display portion of an indoor unit of an air conditioner according to a second embodiment of the present invention, as viewed from a lateral side. In the drawing, the same components as the components of the above-described first embodiment illustrated in Fig. 4 are assigned with the same reference numerals.

[0034] As illustrated in Fig. 7, in the indoor unit of an air conditioner according to the present embodiment, the display windows 16 are formed into simple shapes such as squares and circles, and a mask-like display sheet 18, from which portions having shapes desired to be depicted have been cut out, and the remaining portion of which can block light, is stuck on the front side of the display windows 16. Needless to say, the above relationship may be reversed, i.e., the portions having shapes desired to be depicted may be formed by the display sheet 18 which can block light, and the light may be transmitted through the surroundings of the portions. The other parts of the configuration of the present embodiment are similar to those of the first embodiment described above.

[0035] In the indoor unit of an air conditioner according to the present embodiment, the display portion is formed by the display sheet 18 capable of blocking light, in which the portions having shapes desired to be depicted have been cut out or left. Accordingly, in addition to effects similar to the effects of the first embodiment described above, the present embodiment can simplify the structure of the display windows 16 and easily obtain minute display shapes.

[0036] Third Embodiment: In the first and second embodiments described above, the description has been

made about, as an example, the configuration in which the front or back surface of the front panel 2 is provided with the decorative layer 10 by painting or printing. Similar effects can be expected by adhering a sheet printed to obtain a similar action to the action of the decorative layer 10 in terms of translucency and so forth or by inserting such a sheet at the same time as the molding of the front panel 2.

[0037] Due to the adhering of the thus printed sheet or the insertion of the sheet at the same time as the molding of the front panel 2, a desired pattern, such as a woodgrain pattern and a marble pattern, can be easily depicted.

[0038] Fourth Embodiment: In recent years, it has been said that the air conditioner is the electric appliance which consumes the largest amount of electric energy among household appliances. This is attributed to the fact that one air conditioner, which had been installed per household, has been installed per room in recent years. Therefore, the air conditioner is subject to energy regulation under the Energy Saving Law, and technologies for saving energy consumed by the air conditioner are under development.

[0039] However, the improvement of the technologies has approached the limit thereof. In the future, therefore, substantial energy saving cannot be expected from the improvement of efficiency of the appliance. Accordingly, to drastically suppress global warming, it is becoming a social approach to encourage the user who consumes electricity to be conscious of energy saving.

[0040] In view of the above, for the purpose of making the user conscious of energy saving, Fig. 8 illustrates an example in which the energy consumption W during the operation of the air conditioner is displayed on the front panel 2 as a energy consumption display 23.

[0041] A display device calculates the energy consumption W from a relational expression of $W=V\cdot I\cdot\eta$ using the current value I outputted from a circuit which detects the current during the operation of the air conditioner, the value of the power factor η predetermined on the basis of the operational rotation rate or the current value of a compressor, and the power supply voltage V of the appliance.

[0042] With the energy consumption during the operation thus largely displayed on the front panel 2 as the energy consumption display 23, how much power is currently used by the air conditioner can be understood at a glance by the user. It is therefore possible to raise awareness to energy saving and promote actions for energy saving, such as moderate setting of the set temperature of the air conditioner and frequent turning off of the air conditioner in the absence of a person in the room. As a result, energy saving can be achieved.

[0043] Fig. 9 illustrates an example in which an amount of electric energy consumption from the start of the operation or the amount of energy consumption consumed from the start to the end of the operation is displayed on the front panel 2 as an energy consumption display 24. Herein, the energy consumption W detected as described above and the operation time h are multiplied to calculate the amount of energy consumption kWh.

[0044] The amount of energy consumption is displayed upon pressing of an energy consumption display button 26 on a remote controller 25 by the user. However, the display of the amount of energy consumption is not limited thereto. For example, the amount of energy consumption consumed from the start to the end of the latest operation may be displayed for a predetermined time after the stop of the air conditioner. Alternatively, the amount of energy consumption may be constantly displayed during the operation. Further, it may be configured such that the amount of energy consumption consumed in the latest operation is displayed upon pressing of the energy consumption display button 26 by the user after the stop of the air conditioner.

[0045] Furthermore, it may be configured such that the amount of energy consumption in each operation is stored to selectively display, for example, the amount of energy consumption used in the past month, the amount of energy consumption from an arbitrary date to the present date, and the amount of energy consumption in a predetermined time period in the past.

[0046] With the amount of energy consumption thus largely displayed on the front panel 2 as the energy consumption display 24, the user can check the amount of energy consumption from the start of the operation or the amount of energy consumption from the start to the end of the operation. Therefore, similarly to the display of the energy consumption as the energy consumption display 23 (Fig. 8), it is possible to obtain the effects of raising awareness of the user to energy saving and promoting actions of the user for energy saving, such as moderate setting of the set temperature of the air conditioner and frequent turning off of the air conditioner in the absence of a person in the room.

[0047] Fig. 10 illustrates an example in which the display of the amount of energy consumption as described above is displayed in another form. In the example illustrated herein, the electricity cost accumulated from the start of the operation or the electricity cost accumulated from the start to the stop (or the end) of the operation is displayed on the front panel 2 as an electricity cost display 27. Specifically, the amount of energy consumption calculated as described above is converted into the electricity cost by the rate of 22 yen per kWh, for example, to calculate and display the electricity cost for the operation.

[0048] With the electricity cost thus largely displayed on the front panel 2 as the electricity cost display 27, it is possible to raise awareness of the user to energy saving and promote actions of the user for energy saving, similarly to the display of the amount of energy consumption (Fig. 9).

[0049] Further, as compared with the display of the amount of energy consumption (Fig. 9), the display of the used electricity cost is the display of the numerical

value related to daily life for the user. Thus, it becomes easier for the user to understand or interpret the display content. As a result, it is possible to obtain the effects of further raising awareness of the user to energy saving and promoting actions of the user for energy saving.

[0050] Similarly to the display of the amount of energy consumption as described above, the electricity cost is displayed upon pressing of an electricity cost display button 28 on the remote controller 25 by the user. Also in this case, however, the display of the electricity cost is not limited thereto. For example, the electricity cost used in the latest operation may be displayed for a predetermined time after the stop of the air conditioner. Alternatively, the electricity cost may be constantly displayed during the operation. Further, it may be configured such that the electricity cost used in the latest operation is displayed upon pressing of the electricity cost display button 28 by the user after the stop of the air conditioner.

[0051] Furthermore, it may be configured such that the amount of energy consumption in each operation is stored so as to selectively display the electricity cost per month, the electricity cost from an arbitrary date to the present date, and the electricity cost in a predetermined time period in the past.

[0052] Particularly, the display of the electricity cost per month clarifies the ratio of the electricity cost of the air conditioner in the electricity cost paid each month by a household. Accordingly, it is possible to substantially raise awareness of the user to energy saving of the air conditioner.

[0053] Fig. 11 illustrates an example in which the display of the amount of energy consumption as described above is displayed in still another form. Herein, the amount of energy consumption used from the start of the operation is converted into the amount of CO_2 (carbon dioxide) emissions, and the converted value is displayed on the front panel 2 as a CO_2 emission amount display 29. Specifically, the CO_2 emission amount display 29 displays the amount of CO_2 generated to produce the electricity used (consumed) in the operation of the air conditioner. The used amount of energy consumption is converted into the rate of 0.4 kg per kWh, for example, to calculate and display the amount of CO_2 emissions.

[0054] The amount of CO_2 emissions is displayed upon pressing of a CO_2 emission amount display button 30 on the remote controller 25 by the user. Also in this case, however, the display of the amount of CO_2 emissions is not limited thereto. For example, the amount of CO_2 emissions in the latest operation may be displayed for a predetermined time after the stop of the air conditioner. Alternatively, the amount of CO_2 emissions may be continuously displayed during the operation. Further, it may be configured such that the amount of CO_2 emissions in the latest operation is displayed upon pressing of the CO_2 emission amount display button 30 by the user after the stop of the air conditioner.

[0055] Furthermore, it may be configured such that the amount of energy consumption in each operation is stored to selectively display the amount of CO_2 emissions per month, the amount of CO_2 emissions from an arbitrary date to the present date, and the amount of CO_2 emissions in a predetermined time period in the past.

[0056] As for the suppression of global warming, the government appeals to the people for a reduction in the amount of CO_2 emissions by 1 kg per person per day. If the used amount of energy consumption is converted into the amount of CO_2 emissions and largely displayed on the front panel 2 as the CO_2 emission amount display 29, as described above, the effect of raising awareness of the user to the reduction in the amount of CO_2 emissions can be obtained. That is, the user can grasp the amount of CO_2 emissions as a specific numerical value. Therefore, the user is motivated to reduce the amount of CO_2 emissions by, for example, moderately setting the set temperature of the air conditioner and frequently turning off the air conditioner in the absence of a person in the room. Accordingly, it is possible to make the user contribute to the suppression of global warming.

[0057] As described above, with the configuration in which the front panel 2 largely displays the energy consumption during the operation of the air conditioner, the amount of energy consumption used in the operation, the electricity cost, or the amount of CO_2 emissions, the awareness of the user to energy saving and prevention of global warming is raised, and the user is motivated to actually perform the energy saving operation.

[0058] A specific example relating to the display of a variety of information on the front panel 2 will be herein described. During the operation of the air conditioner, the operational states of the air conditioner, such as the current room temperature state, the air-conditioned area, the location of a person, and the energy saving operation state, are displayed. With this configuration, the user is enabled to check whether or not the power saving operation is on in the current operational state. If the power saving operation is off, the user aware of the off state is motivated to take action to turn on the power saving operation.

[0059] Further, the present example is configured to display the amount of energy consumption used in the operation, the electricity cost, or the amount of CO_2 emissions for a predetermined time after the stop of the operation. With this configuration, the user can grasp the result of his efforts for the energy saving operation as the specific numerical value. Accordingly, it is possible to raise consciousness of the user toward the energy saving operation, and to provide the user with a sense of achievement and satisfaction from his energy saving actions.

[0060] As described above, the variety of information can be largely displayed on the front panel 2 of the indoor unit body 1. Therefore, the visibility of the information for the user is improved, and a greater amount of information can be provided to the user. Accordingly, it is possible to raise consciousness of the user toward the energy saving operation, as described above. Further, the display of

the information enables the user to check the result of the energy saving operation. Therefore, the user can obtain the sense of achievement and satisfaction from his energy saving actions. As a result, energy saving can be further promoted.

BRIEF DESCRIPTION OF THE DRAWINGS

[0061] Fig. 1 is an exploded perspective view of an indoor unit of an air conditioner according to a first embodiment of the present invention, with a front panel detached from the indoor unit;

Fig. 2 is a cross-sectional view illustrating the indoor unit of an air conditioner according to the first embodiment of the present invention, as viewed from a lateral side;
Fig. 3 is a perspective view of the front panel of the indoor unit of an air conditioner according to the first embodiment of the present invention, as viewed from a back side;
Fig. 4 is an enlarged cross-sectional view illustrating a display portion of the indoor unit of an air conditioner according to the first embodiment of the present invention, as viewed from a lateral side;
Fig. 5 is a front view illustrating a light-off state of the display portion of the indoor unit of an air conditioner according to the first embodiment of the present invention;
Fig. 6 is a front view illustrating a light-on state of the display portion of the indoor unit of an air conditioner according to the first embodiment of the present invention;
Fig. 7 is an enlarged cross-sectional view of a display portion of an indoor unit of an air conditioner according to a second embodiment of the present invention, as viewed from a lateral side;
Fig. 8 is a front view illustrating an example of energy consumption display at a display portion of an indoor unit of an air conditioner according to a fourth embodiment of the present invention;
Fig. 9 is a front view illustrating the relationship between a remote controller and an example of energy consumption display at the display portion of the indoor unit of the air conditioner according to the fourth embodiment of the present invention;
Fig. 10 is a front view illustrating the relationship between the remote controller and an example of electricity cost display at the display portion of the indoor unit of the air conditioner according to the fourth embodiment of the present invention; and
Fig. 11 is a front view illustrating the relationship between the remote controller and an example of CO_2 emission amount display at the display portion of the indoor unit of the air conditioner according to the fourth embodiment of the present invention.

REFERENCE NUMERALS

[0062] 1: indoor unit body, 2: front panel, 3: front frame, 6: base frame, 9: emitting device, 10: decorative layer, 11: support arm, 12: locking clamp, 13: front panel holder, 14: display board, 15: display board fixing member, 16: display window, 17: coil spring (biasing device), 18: display sheet, 19: temperature display, 20: human detection display, 21: energy saving level display, 22: cleaning display, 23: energy consumption display, 24: energy consumption display, 27: electricity cost display, 29: CO_2 emission amount display, 50: infrared sensor

Claims

1. An indoor unit of an air conditioner comprising:

a front panel (2) openable and closable with respect to a front portion of an indoor unit body (1); and
a display portion (14,15,16), which includes a light-emitting device (9) controllable in the lighting on and off thereof, and is provided inside the indoor unit body (1) to face the front panel (2), for displaying operation information such as an indoor state or an operation setting state,

wherein the front panel (2) is formed of a transparent or translucent material and is provided with a decorative layer (10) on the inner or outer surface thereof or inside thereof, and the decorative layer (10) has non-reflectivity, allows the transmission therethrough of light emitted from the light-emitting device (9), and prevents the interior of the indoor unit body (1) from being seen through from outside of the indoor unit in a light-off state.

2. The indoor unit of an air conditioner according to Claim 1,
wherein the decorative layer (10) is formed into an entirely homogeneous layer.

3. The indoor unit of an air conditioner according to either one of Claims 1 and 2,
wherein the color of the light emitted from the light-emitting device (9) is the same as the color of the decorative layer (10) provided to the front panel (2).

4. The indoor unit of an air conditioner according to either one of Claims 1 and 2,
wherein the color of the light emitted from the light-emitting device (9) is white.

5. The indoor unit of an air conditioner according to either one of Claims 1 and 2,
wherein the color of the light emitted from the light-emitting device (9) is changed in accordance with a

display content.

6. The indoor unit of an air conditioner according to any one of Claims 1 to 5,
wherein the size of a word or phrase or a pictogram displayed in the display portion (14, 15, 16) is 4 mmx4 mm or more and 50 mmx50 mm or less.

7. The indoor unit of an air conditioner according to any one of Claims 1 to 6,
wherein the decorative layer (10) is formed by painting into a thickness of 20 μm or more.

8. The indoor unit of an air conditioner according to any one of Claims 1 to 7,
wherein the temperature displayed in the display portion is sensible temperature in consideration of room temperature, humidity, and radiant heat.

9. The indoor unit of an air conditioner according to any one of Claims 1 to 8,
wherein the temperature displayed in the display portion (14, 15, 16) is displayed at intervals of 0.5°C.

10. The indoor unit of an air conditioner according to any one of Claims 1 to 9,
wherein the display portion (14, 15, 16) displays an indoor state or a setting state, but upon an operation for a change in setting with the use of a remote controller or a switch provided to the indoor unit body, it only displays the content of the change for a predetermined time.

11. The indoor unit of an air conditioner according to any one of Claims 1 to 10,
wherein the change in illuminance and the turn-off of the light emitted from the light-emitting device (9) can be performed through an operation of a remote controller or a switch provided to the indoor unit body.

12. The indoor unit of an air conditioner according to any one of Claims 1 to 11,
wherein, upon a correction from the room temperature to the sensible temperature, the display portion (14, 15, 16) displays the level of the correction.

13. The indoor unit of an air conditioner according to Claim 12,
wherein, upon a change in the level of the correction from the room temperature to the sensible temperature with the use of a remote controller or a switch provided to the indoor unit body, the display portion (14, 15, 16) displays the correction level of the correction.

14. The indoor unit of an air conditioner according to any one of Claims 1 to 13,
wherein the display portion (14, 15, 16) includes a human detection display portion for displaying, upon detection of the position of a person, the detected position of the person.

15. The indoor unit of an air conditioner according to any one of Claims 1 to 13,
wherein the display portion (14, 15, 16) includes a wind direction display portion for displaying, upon detection of the position of a person and a change in the wind direction based on the information of the detection, the changed wind direction.

16. The indoor unit of an air conditioner according to any one of Claims 1 to 15,
wherein the display portion displays (14, 15, 16) the energy consumption during the operation of the air conditioner, the amount of energy consumption or the electricity cost used in the operation, or the amount of CO_2 emissions converted from the used amount of energy consumption.

17. The indoor unit of an air conditioner according to any one of Claims 1 to 16,
wherein the light-emitting device (9) is mounted on a display board (14), and the display board is attached to a display board fixing member (15) including display windows (16) to depict the operation information in accordance with the shapes of the display windows.

18. The indoor unit of an air conditioner according to Claim 17, further comprising:

a biasing device (17) for biasing the display board fixing member (15) including the display windows (16) toward the inner surface of the front panel (2).

19. The indoor unit of an air conditioner according to any one of Claims 1 to 18,
wherein the front panel (2) is formed of an acrylonitrile butadiene styrene resin having high chemical resistance.

20. The indoor unit of an air conditioner according to any one of Claims 1 to 19,
wherein the thickness of the front panel (2) is set to 3 mm so as to allow a resin easily flow in a molding stage.

21. The indoor unit of an air conditioner according to any one of Claims 1 to 20,
wherein front panel holders (13) each provided with a support arm (11) and a locking clamp (12) for attaching the front panel (2) to a front frame of the indoor unit body are attached to the inner surface of the front panel.

FIG. 1

1: INDOOR UNIT BODY
2: FRONT PANEL
3: FRONT FRAME
6: BASEFRAME
50: INFRARED SENSOR

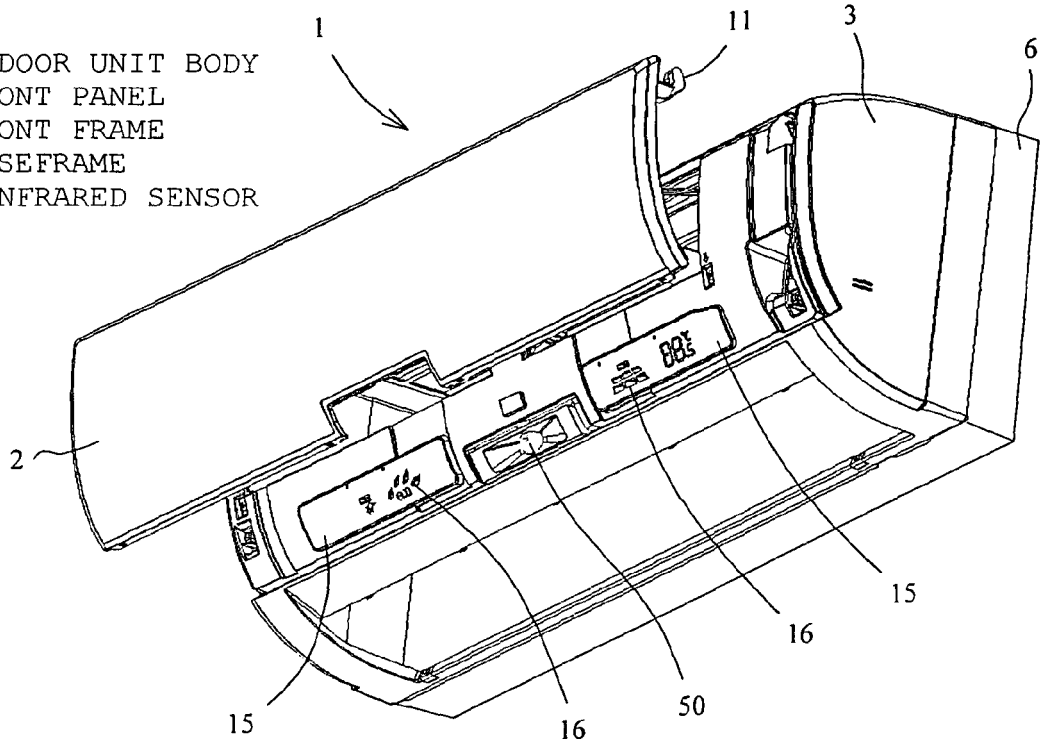


FIG. 2

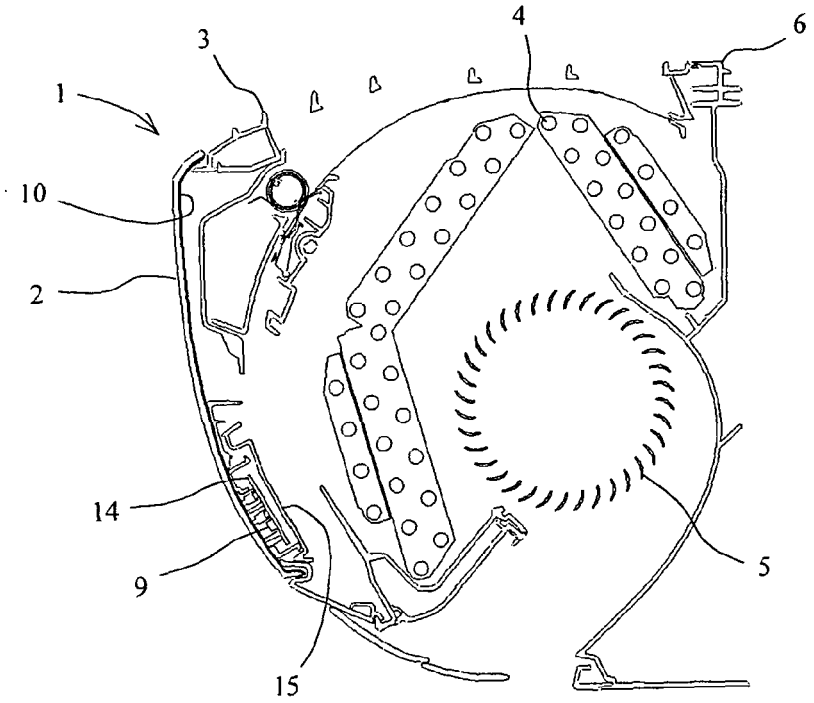
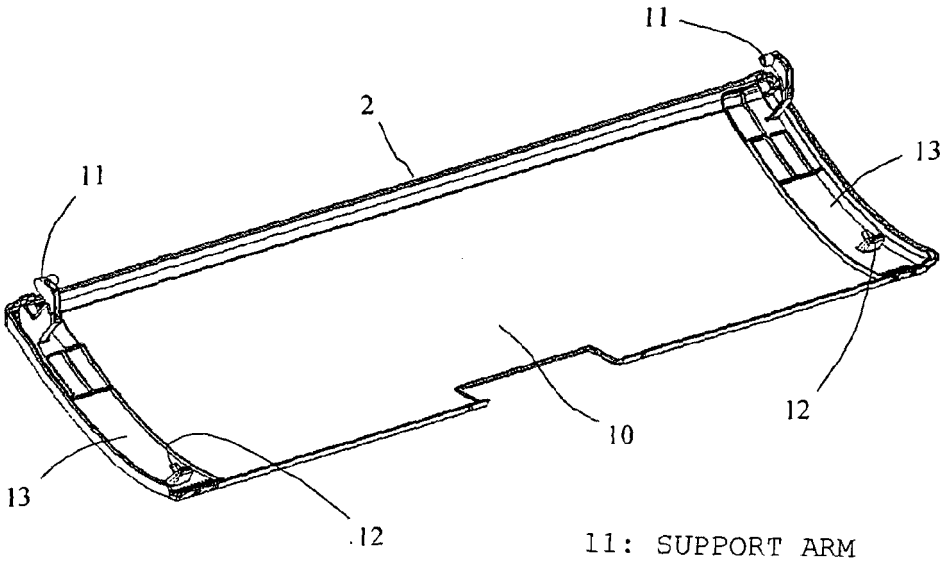
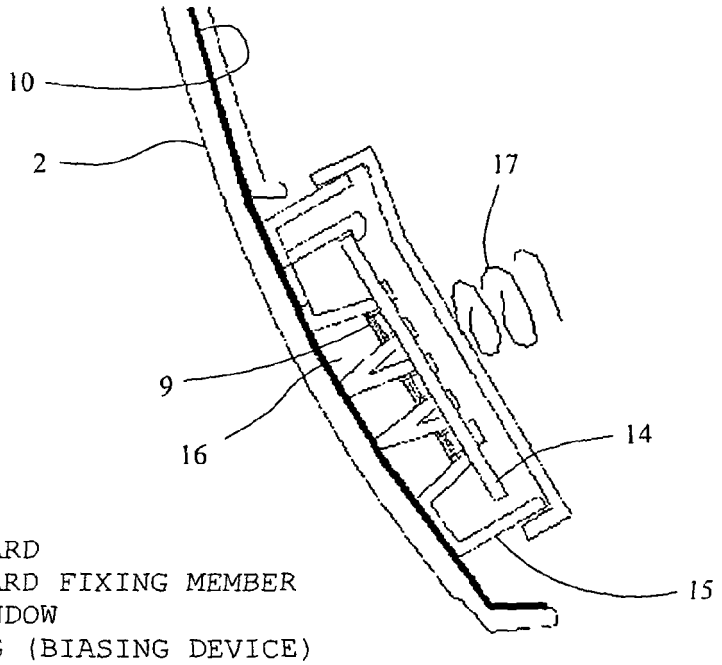


FIG. 3



11: SUPPORT ARM
12: LOCKING CLAMP
13: FRONT PANEL HOLDER

FIG. 4



14: DISPLAY BOARD
15: DISPLAY BOARD FIXING MEMBER
16: DISPLAY WINDOW
17: COIL SPRING (BIASING DEVICE)

FIG. 5

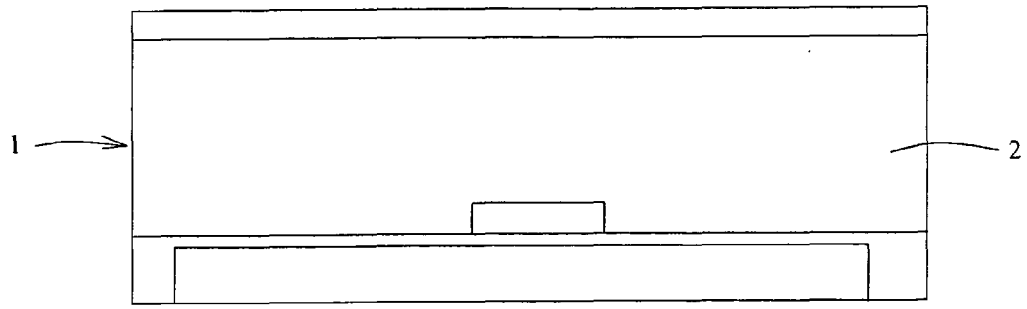
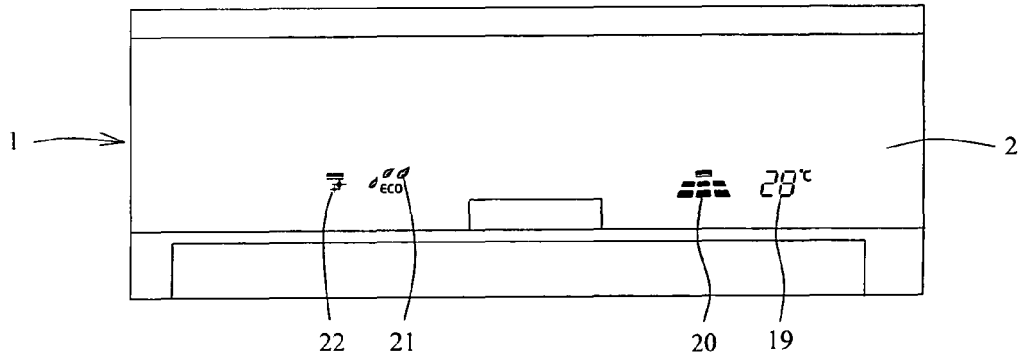
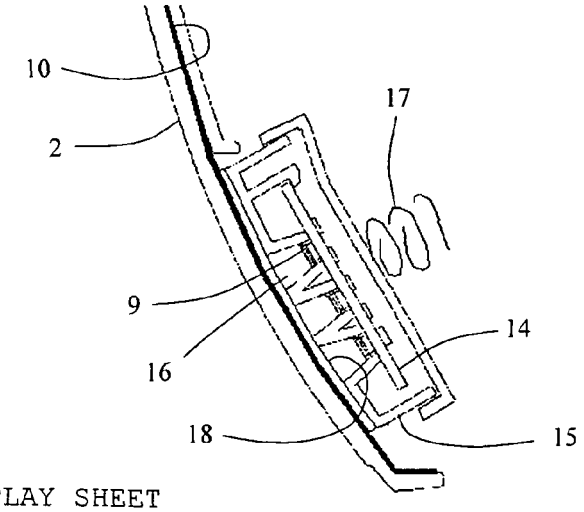


FIG. 6



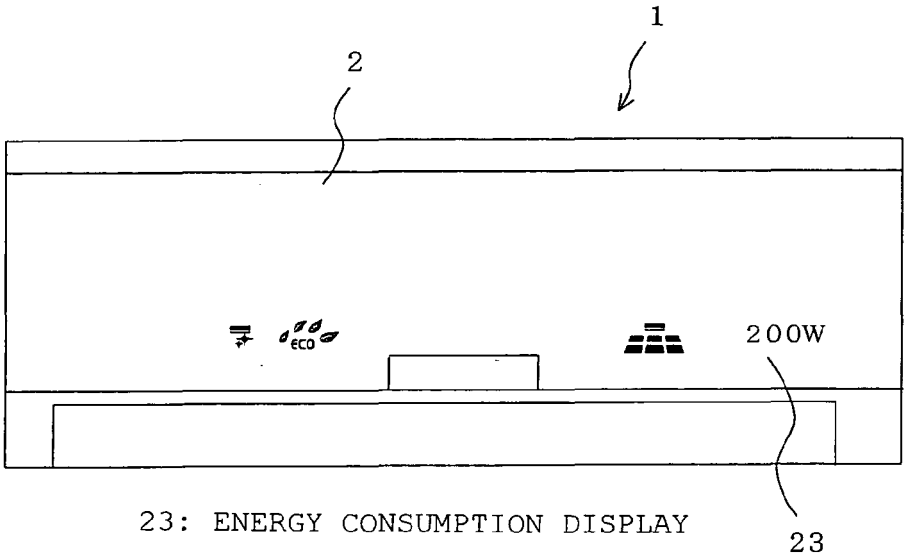
19: TEMPERATURE DISPLAY
20: HUMAN DETECTION DISPLAY
21: ENERGY SAVING LEVEL DISPLAY
22: CLEANING DISPLAY

FIG. 7



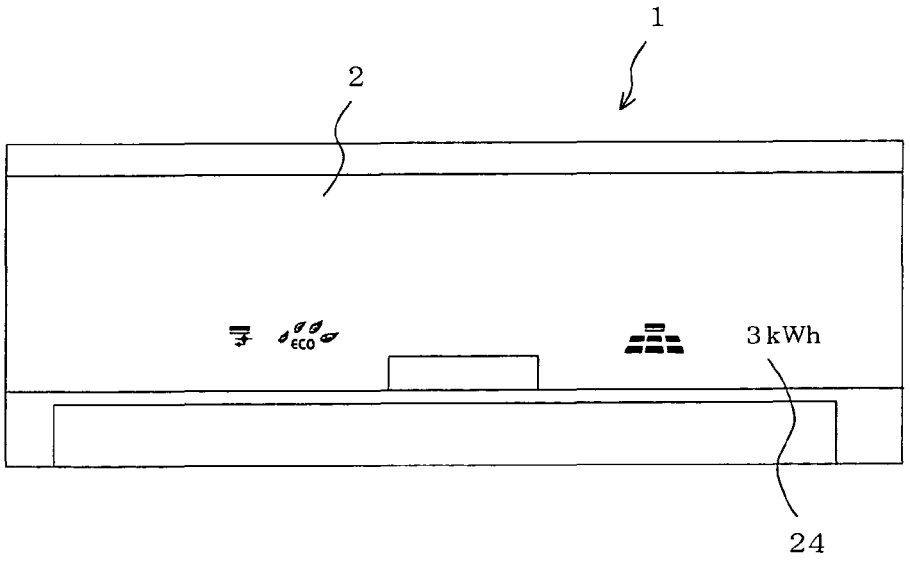
18: DISPLAY SHEET

FIG. 8



23: ENERGY CONSUMPTION DISPLAY

FIG. 9



24: ENERGY CONSUMPTION DISPLAY

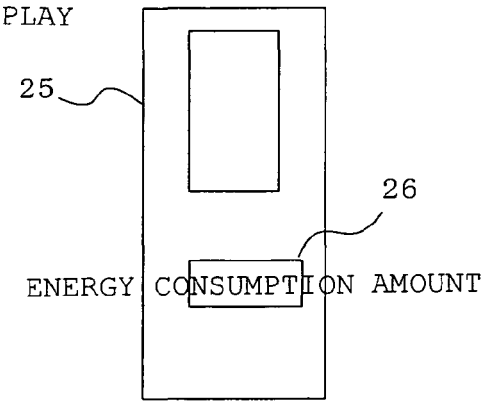
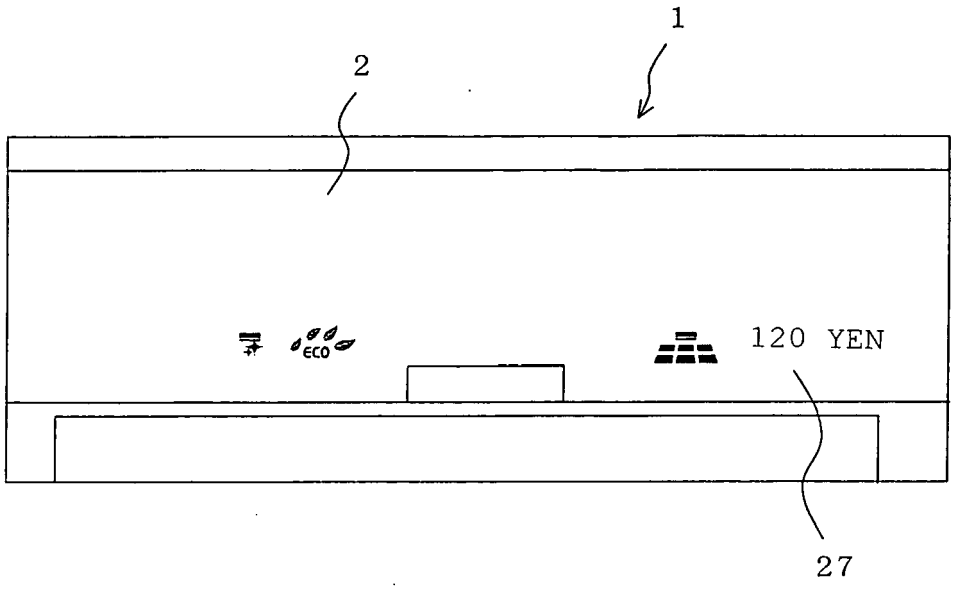


FIG. 10



27: ELECTRICITY COST DISPLAY

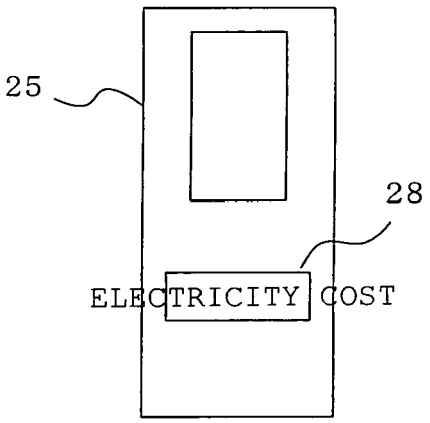
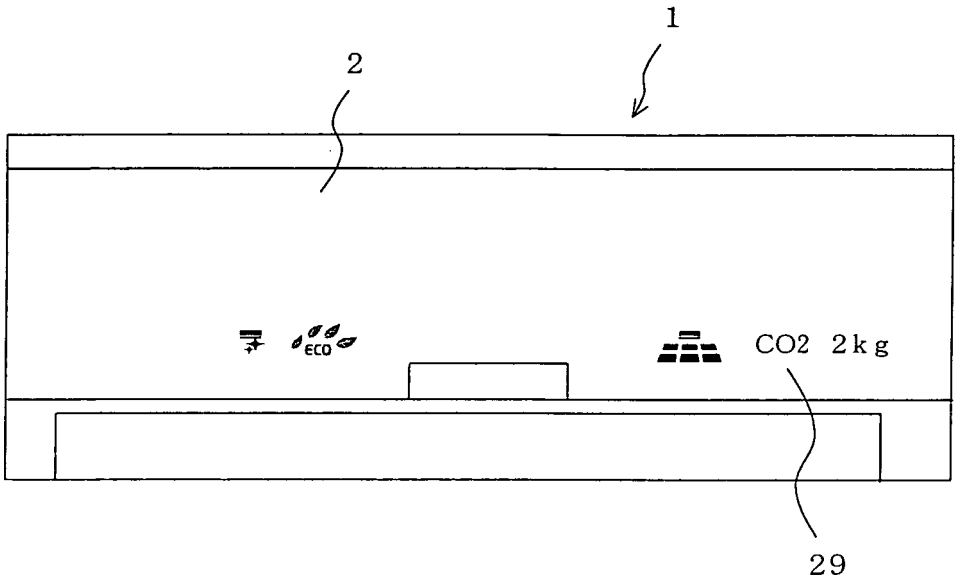
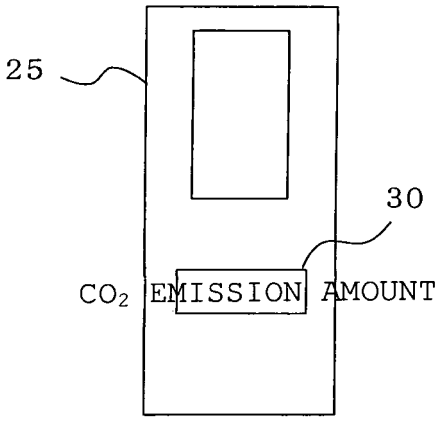


FIG. 11



29: CO_2 EMISSION AMOUNT DISPLAY



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005147432 A **[0004]**