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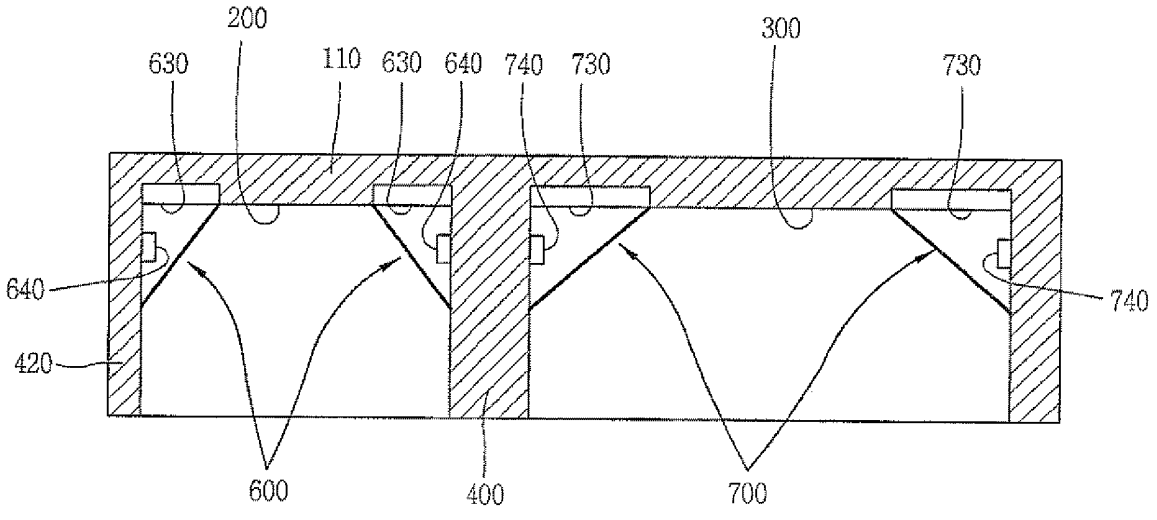
(54) Refrigerator

(57) A refrigerator includes cooling air ducts (600,700) for guiding cool air into a refrigerating chamber and a freezing chamber. The ducts may be made of a material that allows light to transmit therethrough. LEDs (640,740) are installed within the cooling air ducts to illuminate the interiors of the refrigerating chamber and the freezing chamber. Reflection mirrors (630,730) may be installed within the cooling air ductd to reflect light generated by the LEDs. A separate space for installing the LEDs is not necessary, and thus an internal capacity of the refrigerator can be increased. Also, by providing the LEDs at various locations, the interior of the refrigerator can be uniformly illuminated.

FIG. 4



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Description

[0001] The present invention relates to a refrigerator and, more particularly, to a refrigerator having a lighting system capable of uniformly illuminating the interior of the refrigerator.

[0002] In general, a refrigerator includes a freezing chamber and a refrigerating chamber separated by a separation wall. The freezing chamber maintains a quite low internal temperature to keep items frozen. The refrigerating chamber maintains a low temperature at which items are not frozen, but are maintained in a fresh state.

[0003] Typically, a lighting system is provided in the freezing chamber and the refrigerating chamber to allow a user to check items kept therein. The internal construction and the construction of the lighting system of the related art refrigerator will now be described with reference to FIGs. 1 and 2. FIG. 1 is a sectional view showing an internal structure of the related art refrigerator and FIG. 2 is a sectional view showing the structure of a lighting system of the refrigerator in FIG. 1. As shown in FIGs. 1 and 2, in the related art refrigerator 10, a cooling air inlet 24 is formed at a lower portion of a freezing chamber 20. Air, which has performed a cooling operation by circulating through the freezing chamber 20 and the refrigerating chamber 30 is introduced back into the refrigeration apparatus through the air inlet. An evaporator 23 is installed above the cooling air inlet 24. Air being introduced through the inlet 24, which has an increased temperature after cooling the interior chambers of the refrigerator, passes over the evaporator 23 to be cooled back down to a low temperature. A fan 22 for blowing cooling air is installed above the evaporator 23. In this refrigerator, the evaporator 23 and the fan 22 are installed only adjacent the freezing chamber 20, not adjacent the refrigerating chamber 30.

[0004] A cooling air duct 21 for providing the cool air to the freezing chamber 20 is formed above the fan 22. A plurality of cooling air outlets 21a for providing the cooling air into the interior of the freezing chamber 20 are formed on the cooling air duct 21. The cooling air duct 21 is installed along a rear wall (not shown) of the freezing chamber 20.

[0005] In the refrigerating chamber 30, a cooling air duct 31 is installed along a rear wall (not shown) of the refrigerating chamber 30 and communicates with the cooling air duct 21 of the freezing chamber 20. A plurality of cooling air outlets 31a for providing cooling air to the refrigerating chamber 30 are formed on the cooling air duct 31 of the refrigerating chamber 30.

[0006] As mentioned above, lighting devices for providing illumination are provided in the freezing chamber 20 and the refrigerating chamber 30. As shown in FIG. 2, the lighting system includes a freezing chamber lighting apparatus 28 installed within the freezing chamber 20 and a refrigerating chamber lighting apparatus 36 installed within the refrigerating chamber 30. The illumination systems are switched on and off depending on whether doors (not shown) installed at a front side of the freezing chamber 20 and the refrigerating chamber 30 are opened or closed. In addition, a lighting apparatus 51 can be installed in a control box 50 that controls a temperature of the refrigerator 10.

[0007] Reference numeral 25 denotes a freezing chamber fan grill, 27 denotes a freezing chamber lighting room, and 35 denotes a refrigerating chamber lighting room. Arrows shown in FIG. 2 indicate a flow of cooling air.

[0008] A lighting system of a refrigerator 10 having the construction as described above is limited to illuminating only the portions of the freezing chamber 20 and the refrigerating chamber 30 immediately adjacent the lighting apparatuses 28, 36 and 51. As a result, light is not uniformly provided to the entirety of the freezing chamber 20 and the refrigerating chamber 30.

[0009] In addition, because the lighting apparatuses are installed at only a few positions within the freezing chamber 20 and the refrigerating chamber 30, when there are many storage items in the freezing chamber 20 and the refrigerating chamber 30, the storage items tend to block light emitted by the lighting apparatuses.

[0010] Moreover, most related art lighting apparatuses 28, 36 and 51, utilize light bulbs, such as incandescent electric lamps or a glow lamp, etc., which have a relatively short life span and which consume relatively large amounts of power. Further, the internal capacity of the refrigerator is reduced by the installation space required for the lighting apparatus.

[0011] The embodiments will be described in detail with reference to the following drawings, in which like reference numerals refer to like elements, and wherein:

FIG. 1 is a sectional view showing an internal structure of a related art refrigerator;

FIG. 2 is a sectional view showing the structure of lighting apparatuses of the related art refrigerator in FIG. 1;

FIG. 3 is a sectional view showing the structure of cooling air ducts of a refrigerator according to one exemplary embodiment; and

FIG. 4 is a sectional view taken along line IV-IV in FIG. 3 showing lighting apparatuses of the refrigerator.

DETAILED DESCRIPTION OF THE INVENTION

[0012] As shown in FIGs. 3 and 4, a refrigerator includes a freezing chamber 200 and a refrigerating chamber 300 separated by a separation wall 400. Freezing chamber cooling air ducts 600 and refrigerating chamber cooling air ducts 700 are installed along corners formed where the side wall surfaces 400 and 410 join the rear wall surface 110. Cooling air outlets 610 and 710 are formed in the cooling air ducts 600 and 700. The outlets discharge cool air generated by a refrigerating apparatus into the interior of the refrigerator. Light emitting diode

(LEDs) 640 and 740 are installed within the cooling air ducts 600 and 700. In some embodiments, a plurality of LEDs may be installed at each location where light is to be generated. The plurality of LEDs may extend vertically or horizontally within the cooling air ducts 600 and 700. Thus, the lighting devices identified with reference numerals 640 and 740 in FIG. 4 may actually be a plurality of LEDs. Reflection mirrors 630 and 730 for reflecting light generated by the LEDs 640 and 740 are also installed in the cooling air ducts 600 and 700. The arrows in FIG. 3 indicate a flow of cooling air.

[0013] Here, the lighting apparatus of the freezing chamber 200 and that of the refrigerating chamber 300 have the same construction, so only the lighting apparatus of the freezing chamber 200 will now be described in detail for the sake of brevity.

[0014] The cooling air ducts 600, into which cool air is blown by a fan 22, are formed along the internal corners of the freezing chamber 200. Specifically, the cooling air ducts 600 are formed at both sides of the freezing chamber 200 along the corners formed by the side wall surfaces 400 and 410 and the rear wall surface 110 of the freezing chamber 200. In addition, a cooling air duct 600 can be installed along an upper corner as well as along the left and right side corners. A plurality of cooling air outlets 610 are formed to discharge the cool air to the freezing chamber 200. A plurality of cooling air outlets 610 can be formed in various patterns and in various sizes as necessary.

[0015] The LEDs 640 are installed within the cooling air ducts 600. As noted above, the LEDs may be arranged to extend vertically or horizontally along the side wall surfaces 400 and 410 of the freezing chamber 200. If a cooling air duct is provided along the corner formed by the top wall and the rear wall of the freezing chamber, LEDs may also be mounted on the top wall. In alternate embodiments, the LEDs could be formed within the cooling air ducts 600 along the rear wall 110.

[0016] Because the LEDs 640 are installed within the cooling air ducts 600, a separate space for installing the LEDs 640 is not necessary. Thus, the internal capacity of the freezing chamber 200 can be larger than in the prior art, where light bulbs are installed in housings that are separate from, and in addition to, the cooling air ducts.

[0017] Even if the LEDs 640 were directly installed within the freezing chamber 200, and not within the cooling air ducts 600, because the LEDs are so small, a separate housing or space for installing the LEDs 640 is not necessary. Thus, the internal capacity of the freezing chamber 200 can be increased when LEDs are used.

[0018] In this embodiment, reflection mirrors 630 can be installed near the LEDs to better direct the light generated by the LEDs into the freezing chamber. By varying an installation angle of the reflection mirrors 630, an amount and direction of light reflected from the reflection mirrors 630 can be controlled.

[0019] A LED is a sort of semiconductor and creates electroluminescence, an illumination phenomenon generated when voltage is applied to the semiconductor. The LED emits light by using energy generated when electrons, a plurality of carriers of an N region, move to a P region by overpassing a potential barrier of a junction as a junction diode becomes forward biased. Depending on the materials used to make the LED, various colors of light such as red, green, yellow, orange, blue or even infrared light can be generated.

[0020] The LEDs 640 can be installed at the cooling air outlets 610 formed in the cooling air duct 600. In some embodiments, the LEDs 640 would be installed at the side wall surfaces 400 and 410 of the freezing chamber 200, or on the rear wall 110, at locations corresponding to positions of the cooling air outlets 610. As noted above, multiple LEDs may be mounted adjacent each cooling air outlet 610. When the LEDs are mounted in this fashion, they illuminate cool air exiting the outlets 610, which gives a cooling air visible effect. In other words, air introduced into the freezing chamber 200 can be seen by the user's eyes. Also, by varying a kind of impurities added to the LEDs 640, light in various colors can be emanated to give a visual aesthetic sense to users.

[0021] In alternate embodiments, a fluorescent material can be coated on an inner surface of the cooling air duct 600 to obtain light in various colors.

[0022] The LED is small in size and has a long life span compared with the incandescent light bulbs used in the related art lighting apparatus. And because the LED directly converts electric energy into light energy, power consumption can be reduced.

[0023] In alternate embodiments, an OLED (Organic Light Emitting Diode) can be used instead of the LED 640.

[0024] In order to effectively illuminate the interior of the freezing chamber 200 by using light of the LEDs 640, the cooling air duct 600 is preferably made of a relatively transparent material that allows light to be transmitted transmit therethrough. In addition, the cooling air duct 600 where the LED is installed can be made of a translucent material. In this case, light will not shine directly into the user's eyes, and the user can be prevented from being dazzled by the light emanated from the LED 640.

[0025] In order to increase the lighting effect, the LEDs 640 can be installed at the side wall surfaces 400 and 410 of the freezing chamber 200 within the cooling air duct 600, and reflection mirrors 630 can be installed at the corresponding rear wall surfaces 110 of the freezing chamber 200 within the cooling air duct 600. Alternately, the LEDs could be mounted on the rear wall, and the mirrors could be mounted on the side walls. Accordingly, light emitted from the LEDs 640 can be directly irradiated into the interior of the freezing chamber 200 through the cooling air duct 600, and also be irradiated into the interior of the freezing chamber 200 after being reflected by the reflection mirrors 630. This helps to uniformly illuminate the interior of the freezing chamber 200, and more light can be provided into the freezing chamber 200. By varying the installation angle of the reflection mirrors 630, the amount and direction of light irradiated into the freez-

ing chamber 200 can be controlled.

[0026] With such a structure, the entirety of the cooling air duct 600 in which the LEDs 640 and the reflection mirror 630 are installed can serve as a lighting chamber, so the interior of the freezing chamber 200 can be uniformly illuminated from both corners.

[0027] A refrigerator having the lighting apparatuses described above has many advantages. First, because the LEDs and the reflection mirrors are installed within the cooling air ducts, a separate space for installing the lighting apparatus is not necessary and thus the internal capacity of the refrigerator can be increased. Second, because light is emitted from both sides of the freezing chamber or the refrigerating chamber, the interior of the freezing chamber or the refrigerating chamber can be illuminated more brightly, evenly and uniformly. Third, because the LEDs and the reflection mirror are installed vertically or horizontally within the cooling air ducts, the interior of the refrigerator can be uniformly illuminated. And because the LEDs and the reflection mirror are installed at the cooling air outlets of the cooling air duct, the cooling air visible effect can be obtained. Fourth, because LEDs are used as light sources, the life span of the light sources can be lengthened and power consumption can be reduced.

[0028] As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims. All changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

[0029] Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

[0030] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

1. A refrigerator, comprising:

a housing;
at least one cooling air duct installed in the housing and configured to guide cool air into a storage chamber of the refrigerator; and
at least one light emitting diode (LED) installed in at least one cooling air duct and configured to illuminate an interior of the storage chamber.

2. The refrigerator of claim 1, further comprising a reflection mirror installed adjacent to the at least one LED.

3. The refrigerator of any of claims 1 to 3, wherein a plurality of LEDs are installed in the at least one cooling air duct, wherein reflection mirrors are installed adjacent each LED, and wherein the reflection mirrors are installed at different angles.

4. The refrigerator of any of claims 1 to 3, wherein cooling air ducts are installed, respectively, at opposite sides of the storage chamber, and wherein LEDs are installed in each of the cooling air ducts.

5. The refrigerator of any of claims 1 to 4, wherein a cooling air outlet is formed in the at least one cooling air duct, and wherein the at least one LED is installed adjacent the cooling air outlet.

6. The refrigerator of any of claims 1 to 5, wherein the at least one cooling air duct is installed in a corner of the storage space formed by the intersection of a rear wall and a side wall of the storage space.

7. The refrigerator of any one of preceding claims, wherein the portions of the cooling air ducts adjacent the LEDs are formed of a translucent material which allows light generated by the LEDs to pass through the cooling air ducts and into an interior of the storage chamber.

8. The refrigerator of any of claims 1 to 7, wherein the at least one LED is an Organic Light Emitting Diodes (OLED).

9. The refrigerator of any of claims 1 to 8, wherein a fluorescent material is coated on one surface of the at least one cooling air duct and the fluorescent material is configured to generate light to illuminate the

storage chamber.

10. The refrigerator of claim 9, wherein reflection mirrors are mounted in the at least one cooling air duct and, wherein the reflection mirrors are configured to reflect light generated by the fluorescent material into the interior of the storage chamber.

FIG. 1
CONVENTIONAL ART

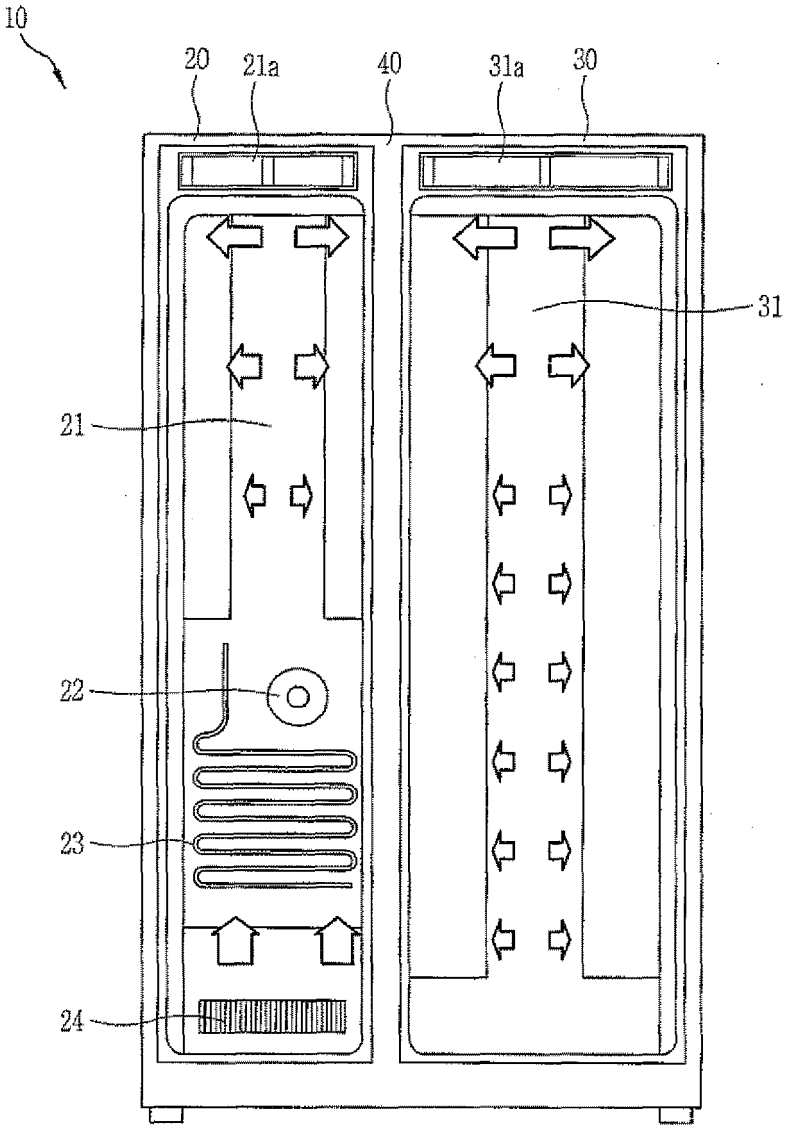

FIG. 2
CONVENTIONAL ART

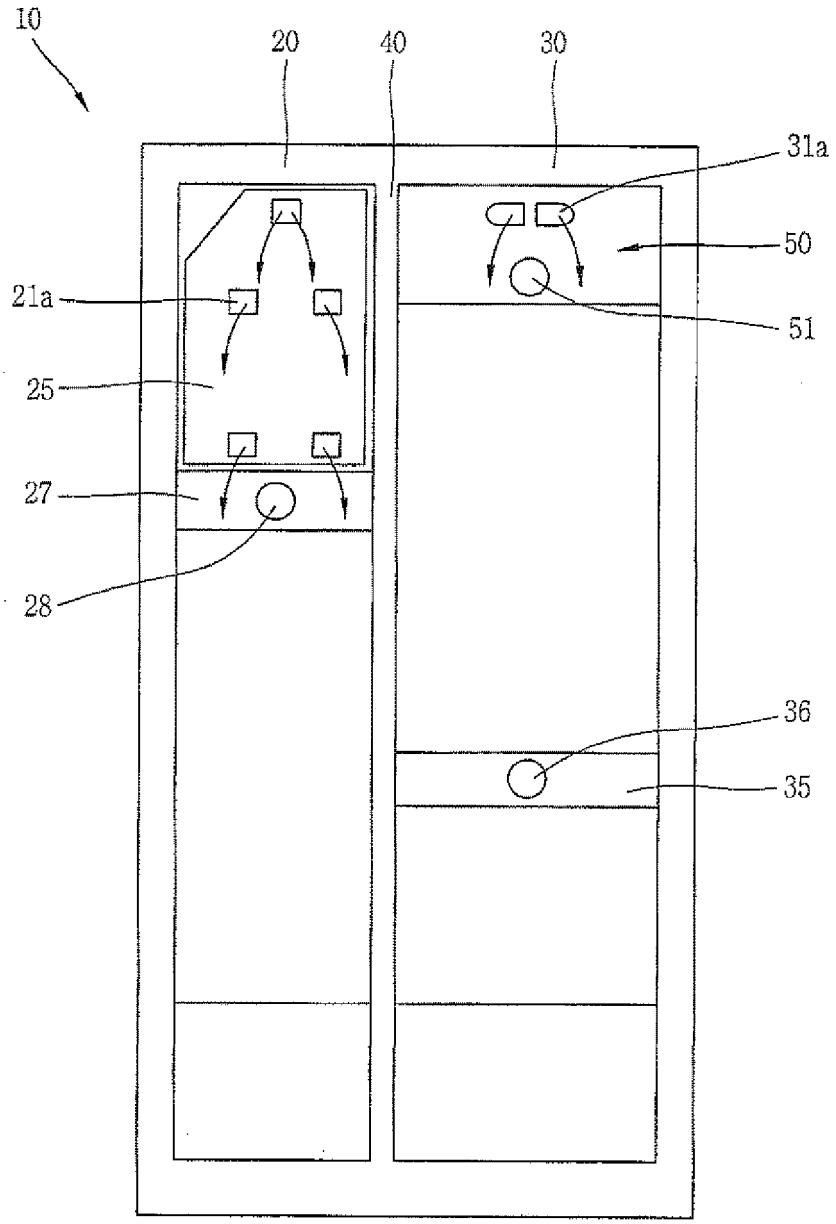

FIG. 3

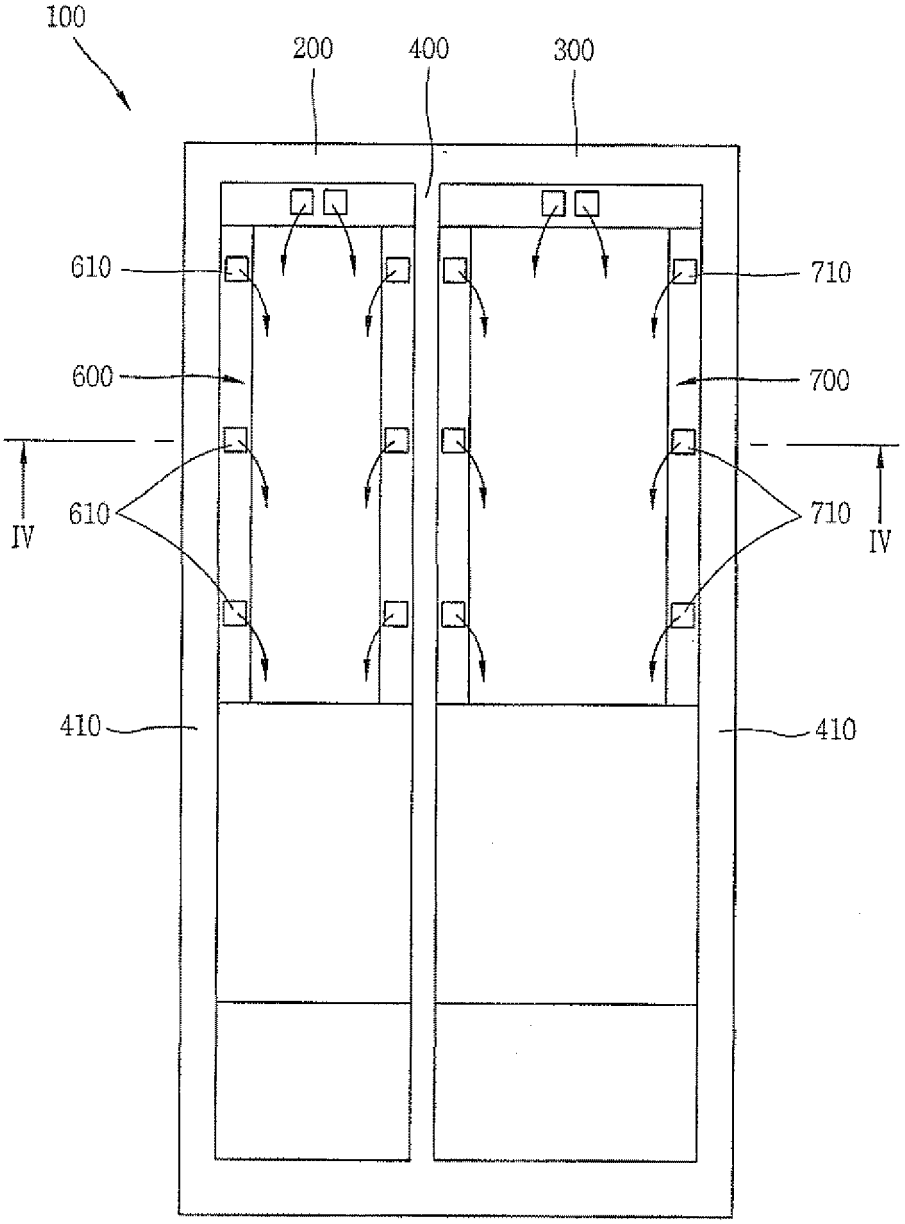

FIG. 4