



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.05.2007 Bulletin 2007/21

(51) Int Cl.:
F25D 17/04 (2006.01)

(21) Application number: **06008557.8**

(22) Date of filing: **25.04.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **17.11.2005 KR 20050110217**
17.11.2005 KR 20050110218

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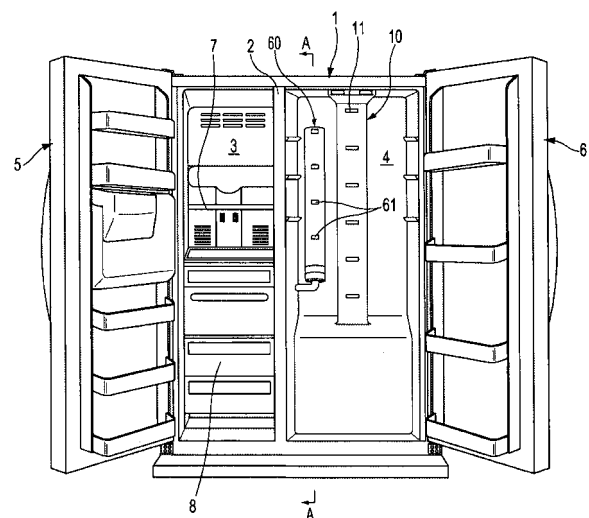
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(54) **Refrigerator having independent sterilization duct**

(57) A refrigerator includes a chilled air duct (10) and a sterilizer duct (60) independently installed in the vertical direction to uniformly emit active hydrogen and negative ions for sterilization and deodorization into an entire space of a compartment (4). The sterilizer duct (60) is vertically installed in the compartment (4) in parallel relation to the chilled air duct (10) and an MPI generator (40) for the sterilization and deodorization is installed in an end thereof. In the first embodiment of the present invention, the sterilizer duct (60) is coupled with a blower duct (70) in which a blower fan (75) for blowing air into the sterilizer duct (60), and the blower duct (70) may be coupled with a rotation duct (80) connected to a driving motor (91) installed in a housing (90). In the second embodiment, the sterilizer duct (20) and the chilled air duct (10) have a single entrance (20) and two exits (11,21) and may be coupled with respective exits of a distribution duct (30) in which a damper (50) is installed.

Fig.1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a refrigerator, and more particularly, to a refrigerator in which a sterilization duct is arranged independently from a chilled air duct for distributing chilled air into compartments to sterilize and deodorize so that the compartments can be maintained clean.

2. Description of the Related Art

[0002] Generally, a refrigerator is structured to maintain compartments such as a freezer compartment and a refrigerator compartment at suitable temperatures for accommodating foods so that the foods accommodated in the compartments can be kept fresh for a long time. In this refrigerator, vegetables, meat, fish, and various raw and cooked foods are accommodated.

[0003] Thus, unless the compartments are cleaned periodically, the compartments become impregnated with odors emitted from various foods and mold, bacteria, and viruses propagate in the compartments so that the compartments can be considered unhealthy and unpleasant for a user.

[0004] In order to remove bacteria, viruses, and odors, there is proposed a refrigerator in which a sterilizer and a deodorizer are installed in the compartments, for example, Japanese Laid-Open Patent Publication No. 6-82151.

[0005] The sterilizer and the deodorizer of the conventional refrigerator includes a cover having an inlet for suctioning air from the compartments and a discharge port for discharging the suctioned air to the compartments again, a high voltage generator and an ozone generating electrode, which are installed in the cover, an ion generating electrode, and a blower fan such that air introduced into the cover is sterilized and deodorized in the cover by ozone gas and is emitted into the compartments again so that the air circulating within the compartments becomes clean.

[0006] However, since the sterilizer and the deodorizer of the conventional refrigerator are disposed between shelves and the sterilized and deodorized air is discharged into their vicinity, the sterilized and deodorized air does not propagate into the space of the compartments uniformly so that the sterilizing and deodorizing effect is deteriorated.

[0007] Moreover, since the sterilizer and the deodorizer of the conventional refrigerator sterilizes and deodorizes air only therein, the sterilizer and the deodorizer of the conventional refrigerator cannot effectively sterilize and deodorize air in the compartments.

SUMMARY OF THE INVENTION

[0008] The present invention has been made in view of the above-mentioned problems, and an aspect of the invention is to provide a refrigerator in which a sterilizer duct is disposed in the vertical direction independent from a chilled air duct to discharge air containing active hydrogen and negative ions uniformly into compartments through a sterilizer duct.

[0009] It is another aspect of the present invention to provide a refrigerator in which an ion generator for generating active hydrogen and sterilizing ions is installed near an end of a sterilizer duct to improve the sterilizing and deodorizing effect.

[0010] It is a still another aspect of the present invention to provide a refrigerator in which a sterilizer duct is installed to rotate such that air passing through the sterilizer duct can be discharged into compartments in multiple directions.

[0011] It is a still another aspect of the present invention to provide a refrigerator capable of conveniently adjusting quantity and rate of air passing through a sterilizer duct.

[0012] In accordance with one aspect, the present invention provides a refrigerator including at least one compartment, a chilled air duct for supplying chilled air to the compartment, a sterilizer duct installed in the compartment independent from the chilled air duct, and an ion generator for supplying sterilizing air through the sterilizer duct to the compartment.

[0013] The refrigerator further includes a cooling fan for blowing the chilled air to the chilled air duct, and a blower fan for blowing air in the compartment to the sterilizer duct, wherein a plurality of chilled air discharge ports and sterilized air discharge ports are respectively formed in the chilled air duct and the sterilizer duct at regular intervals.

[0014] The chilled air duct may be disposed at the central region of the rear side of the compartment, and the sterilizer duct may be disposed at a corner of the rear side of the compartment.

[0015] The ion generator may be made of a micro plasma ion generator (MPI) for generating negative ions and active hydrogen, and may be disposed in the sterilizer duct.

[0016] The refrigerator further includes a blower duct, coupled with the sterilizer duct, in which the blower fan is installed, a rotation duct coupled with the blower duct, and a driving motor for rotating the rotation duct, wherein the sterilizer duct is installed to rotate together with the blower duct.

[0017] The driving motor is installed in a housing fixed to a rear wall of the compartment, and a rotation shaft of the driving motor is coupled with a hub provided in the center of the rotation duct to rotate the rotation duct.

[0018] The blower fan is coupled with a fan motor fixed in a hub provided at the center of the blower duct to rotate.

[0019] The sterilizer duct, the blower duct, and the ro-

tation duct may have a cylindrical shape and rotate.

[0020] An insertion protrusion and an insertion recess may be formed in the end rims of the blower duct, and insertion protrusions and insertion recesses may be formed in respective ends of the blower duct and the rotation duct such that the insertion protrusion of the sterilizer duct is inserted into the insertion recess of the blower duct and the insertion protrusion of the blower duct is inserted into the insertion recess of the rotation duct for the convenient separation from and coupling with each other.

[0021] The inner surface of the sterilizer duct is coated with anti-electrification material, such as polyethylene.

[0022] The refrigerator further includes a distribution duct installed between the sterilizer duct and the chilled air duct to communicate and block the chilled air duct to and from the sterilizer duct, wherein the ion generator is installed in the sterilizer duct or the distribution duct.

[0023] The distribution duct may have first and second exits, and a cooling fan disposed in an entrance of the distribution duct. The sterilizer duct and the chilled air duct are respectively connected to the first and second exits of the distribution duct such that chilled air blown by the cooling fan flows the sterilizer duct and the chilled air duct through the distribution duct.

[0024] The refrigerator further includes a damper installed between the first and second exits within the distribution duct to open and close the first and second exits. The damper is driven by a driving motor to adjust an opening degree of the first and second exits.

[0025] The ion generator may be disposed at the side of the first exit connected to the sterilizer duct within the distribution duct.

[0026] The refrigerator further includes a chilled air supply duct connected to the entrance of the distribution duct, wherein a plurality of introducing holes for introducing air in the compartment is formed in the front side of the chilled air supply duct, and an evaporator is installed in the chilled air supply duct together with the cooling fan.

[0027] Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a front view illustrating a refrigerator, in which a sterilizer duct for sterilizing and deodorizing air in compartments is disposed in a refrigerator compartment parallel to a chilled air duct according to a first embodiment of the present invention;

FIG. 2 is an exploded perspective view illustrating a

structure of the sterilizer duct according to the first embodiment of the present invention for enabling the sterilizer duct to rotate;

FIG. 3 is a vertical sectional view of the structure of the sterilizer duct in FIG. 2;

FIGS. 4 to 6 are views illustrating directional change of a discharge port of the sterilizer duct according to the first embodiment of the present invention, in which FIG. 4 shows the direction of the discharge port is changed such that air containing sterilizing ions is emitted toward a wall of a compartment, FIG. 5 shows the direction of the discharge port is changed such that air containing sterilizing ions is discharged toward the central region of the compartment, and FIG. 6 shows the direction of the discharge port is changed such that air containing sterilizing ions is discharged toward a rear wall of the compartment; and

FIG. 7 is a sectional view taken along the line A-A in FIG. 1 and shows the air discharged from the sterilizer duct according to the first embodiment of the present invention distributed into the compartments; FIG. 8 is a front view illustrating a refrigerator, in which a sterilizer duct for sterilizing and deodorizing air in compartments is disposed in a refrigerator compartment parallel to a chilled air duct according to a second embodiment of the present invention;

FIG. 9 is an enlarged perspective view of a part of the sterilizer duct in FIG. 8 and shows that chilled air is distributed into the sterilizer duct and the chilled air duct through a distribution duct in which a damper and an ion generator are installed;

FIGS. 10 to 12 are views illustrating operation of the damper installed in the distribution duct according to the second embodiment of the present invention, in which FIG. 10 shows that the damper installed in the distribution duct closes the chilled air duct completely and opens the sterilizer duct fully such that all the chilled air discharged from a cooling fan is supplied into the sterilizer duct, FIG. 11 shows that the damper opens the chilled air duct fully and closes the sterilizer duct completely such that all the chilled air is supplied into the chilled air duct, and FIG. 12 shows that the damper opens the chilled air duct fully and partially opens the sterilizer duct such that some of the chilled air is supplied into the sterilizer duct; and FIG. 13 is a sectional view taken along the line B-B in FIG. 8 and shows the chilled air containing active hydrogen and sterilizing ions, generated by the ion generator, is uniformly distributed into the compartments through the sterilizer duct.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0029] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein

like reference numerals refer to the like elements throughout. The embodiments are described below to explain the present invention by referring to the figures.

[0030] FIG. 1 is a front view illustrating a refrigerator, in which a sterilizer duct for sterilizing and deodorizing air in compartments is disposed in a refrigerator compartment parallel to a chilled air duct according to a first embodiment of the present invention. As shown in FIG. 1, the refrigerator according to the first embodiment of the present invention has an open-front box-shaped cabinet 1 having a space for accommodating foods, a partition 2 for partitioning the cabinet 1 into two compartments 3 and 4, and two doors 5 and 6 hinged to the front side of the cabinet 1 to open and close the compartments 3 and 4.

[0031] Generally, the two compartments 3 and 4 serve as a freezer compartment 3 for accommodating foods under 0 (zero) degrees centigrade (preferably, 16 degrees centigrade below zero to 21 degrees centigrade below zero) and as a refrigerator compartment 4 for accommodating foods above zero degrees centigrade (preferably, 3 degrees centigrade to 5 degrees centigrade), thus, hereinafter the compartment 3 is referred to as the freezer compartment 3 and the compartment 4 is referred to as the refrigerator compartment 4.

[0032] In order to arrange various foods accommodated in the freezer compartment 3 and the refrigerator compartment 4 effectively, the freezer compartment 3 and the refrigerator compartment 4 have shelves 7 and accommodating boxes 8 (See FIG. 7).

[0033] In the rear side of the refrigerator compartment 4, a chilled air duct 10 is disposed in the vertical direction to distribute the chilled air into the oval space of the refrigerator compartment 4 uniformly, and a sterilizer duct 60 is disposed in the vertical direction independently from the chilled air duct 10 to discharge the sterilized and deodorized air and a great deal of active hydrogen and negative ions into the refrigerator.

[0034] In the rear side of the refrigerator compartment 4, a blower fan 17 and an evaporator 18 communicate with the chilled air duct 10 to supply the chilled air into the chilled air duct 10 (See FIG. 7), and in the chilled air duct 10 and the sterilizer duct 60, a plurality of chilled air discharge ports 11 and sterilized air discharge ports 61 are arranged at regular intervals.

[0035] The chilled air duct 10 is disposed at the central region of the refrigerator compartment 4, and the sterilizer duct 60 installed independently from the chilled air duct 10 is disposed at a corner of the refrigerator compartment 4, thereby supplying the chilled air and the sterilized and deodorized air into the refrigerator compartment 4, respectively.

[0036] Alternatively, the chilled air duct 10 and the sterilizer duct 60 may be disposed at each corner of the rear side of the refrigerator compartment 4, or the chilled air duct 10 may be disposed at a corner and the sterilizer duct 60 may be disposed at the central region.

[0037] The sterilizer duct 60 is installed to rotate in the

refrigerator compartment 4 to sterilize and deodorize air in the refrigerator compartment 4 rapidly and effectively. Hereinafter, a structure in which the sterilizer duct 60 is installed to rotate in the refrigerator compartment 4 is described with reference to FIGS. 2 to 6.

[0038] FIG. 2 is an exploded perspective view illustrating a structure of the sterilizer duct according to the first embodiment of the present invention for enabling the sterilizer duct to rotate, and FIG. 3 is a vertical sectional view of the structure of the sterilizer duct in FIG. 2.

[0039] As shown in FIGS. 2 and 3, the refrigerator according to the first preferred embodiment of the present invention includes a blower duct 70 for circulating air in the refrigerator compartment 4, a rotation duct 80 for rotating the sterilizer duct 60 forward and backward such that the air passed through the sterilizer duct 60 is distributed into the refrigerator compartment 4 uniformly, and a housing 90 for rotatably supporting the rotation duct 80.

[0040] The sterilizer duct 60, in which a plurality of sterilized air discharge ports 61 is formed, has a cylindrical shape having an opened lower side and a closed upper side, and includes an ion generator 40 installed in the vicinity of the opened lower side to discharge a great deal of active hydrogen and negative ions into the refrigerator compartment 4 through the sterilizer duct 60.

[0041] Generally, the sterilizer duct 60 is made of expanded polystyrene having a surface resistivity higher than $10^{12} \Omega/\text{sq}$ and causes an electrification phenomenon with the ions emitted from the ion generator 40, thereby annihilating the ions and decreasing the quantity of emitted ions. In order to remove the electrification of the ions, the inner surfaces of the sterilizer duct 60 are coated with polyethylene, an anti-electrification material.

[0042] The ion generator 40 is a micro plasma ion (MPI) generator designed to generate only hydrogen ions (H^+) by a plasma discharge under atmospheric pressure. The MPI generator generates electrons around the MPI generator to generate active hydrogen (hydrogen atoms) and the active hydrogen reacts with ambient active oxygen to neutralize harmful active oxygen, to annihilate source bacteria by being absorbed in cells of source bacteria such as viruses and mold, and to be able to sterilize without discharging unhealthy positive ions in the air.

[0043] The ion generator 40 implemented by the MPI generator includes a ceramic plate 41 serving as a positive ion generator and a needle-shaped electrode 42 serving as a negative ion generator. When a positive high voltage is applied to the ceramic plate 41, water (H_2O) in the air is ionized due to the plasma discharge so that hydrogen ions (H^+) are generated, and when a negative high voltage is applied to the needle-shaped electrode 42, positive ions are accumulated around the needle-shaped electrode 42 due to the plasma discharge and a great deal of electrons are emitted from the needle-shaped electrode 42 to the air.

[0044] Since a great deal of the electrons emitted to air are very unstable, the electrons are captured by ox-

xygen molecules (O_2) to generate super-oxide anions (O_2^-) so that the needle-shaped electrode 42 generates electrons and the super-oxide anions.

[0045] When the needle-shaped electrode 42 discharges the electrons, the electrons are generated from the ceramic plate 41 and are combined with hydrogen ions passing near the needle-shaped electrode 42 to generate hydrogen atoms (or active hydrogen). As such, the hydrogen ions generated from the ceramic plate 41 are combined with the electrons emitted from the needle-shaped electrode 42 to form hydrogen atoms, thus emitted elements finally become hydrogen atoms and super-oxide anions.

[0046] The hydrogen atoms and the super-oxide anions are mixed with air passing through the sterilizer duct 60 and finally discharged into the refrigerator compartment 4 so that bacteria and viruses are sterilized and source bacteria of mold are removed and the air is thereby deodorized.

[0047] The blower duct 70 has a cylindrical shape having the same diameter as that of the sterilizer duct 60 and opened ends to circulate air in the refrigerator compartment 4 through the sterilizer duct 60 and is coupled with the sterilizer duct 60, and includes a blower fan 75 installed therein.

[0048] In order to install the blower fan 75 in the blower duct 70, at the center of the blower duct 70, a hub 73 connected to a plurality of ribs 74 extended from the inner circumference of the blower duct 70 is provided, and a fan motor 76 is installed in the hub 73 so that the blower fan 75 is coupled with the fan motor 76.

[0049] Thus, the fan motor 76 is coupled with the hub 73 of the blower duct 70, a rotation shaft 77 of the fan motor 76 is inserted into a shaft hole 75a formed at the center of the blower fan 75 so that the blower fan 70 is installed in the blower duct 70, whereby air in the refrigerator compartment 4 can be supplied into the sterilizer duct 60 through the blower duct 70.

[0050] The rotation duct 80 is provided with a hub 83 connected to a plurality of ribs 84 extended from the inner circumference of the blower duct 80 at the center thereof, and the hub 83 is formed with a shaft hole 83a such that the rotation duct 80 is allowed to be connected to a driving motor 91 described later.

[0051] Like the blower duct 70, the rotation duct 80 has a cylindrical shape having the same diameter as that of the blower duct 70 and is coupled with the blower duct 70 coupled with the sterilizer duct 60. To this end, in the lower rims of the sterilizer duct 60 and the blower duct 70, insertion protrusions 62 and 72 are formed respectively, and in the upper rims thereof, insertion recesses 71 and 81 are formed respectively.

[0052] The housing 90 fixed to the rear wall of the refrigerator compartment 4 includes the driving motor 91 for rotating the rotation duct 80. The driving motor 91 includes a rotation shaft 92 upwardly protruded and inserted into the shaft hole 83a formed in the hub 83 of the rotation duct 80. The housing 90 may be coupled with

the rear wall of the refrigerator compartment 4 by screws or other ways.

[0053] Thus, as shown in FIG. 3, the rotation shaft 92 of the driving motor 91 is inserted into the shaft hole 83a of the rotation duct 80 such that the rotation duct 80 is installed to rotate in the housing 90, the insertion protrusion 72 of the blower duct 70 is inserted into the insertion recess 81 of the rotation duct 80, the insertion protrusion 62 of the sterilizer duct 60 is inserted into the insertion recess 71 of the blower duct 70 such that the sterilizer duct 60 is coupled with the blower duct 70, so that the sterilizer duct 60, the blower duct 80, and the rotation duct 80 are rotatably supported by the housing 90.

[0054] The sterilizer duct 60, the blower duct 70, and the rotation duct 80 are separated from each other easily and quickly.

[0055] FIGS. 4 to 6 are views illustrating directional change of a discharge port of the sterilizer duct according to the first embodiment of the present invention, and FIG. 7 shows the air discharged from the sterilizer duct according to the first embodiment of the present invention is distributed into an oval space in the compartments.

[0056] As shown in FIG. 4, when an ion detector installed in the refrigerator compartment 4 and a contaminant detector (not shown) determine that a great deal of active hydrogen and ion is required for sterilization and deodorization of the refrigerator compartment 4, the ion generator 40 is driven simultaneously with driving the fan motor 76 to rotate the blower fan 75 such that air in the refrigerator compartment 4 is introduced into the blower duct 70 through the lower side of the rotation duct 80 by the blower fan 75 so that the introduced air flows through the sterilizer duct 60 and is mixed with a great deal of the active hydrogen and negative ions emitted from the ion generator 40.

[0057] The sterilized and deodorized air by being mixed with the active hydrogen and negative ions flows upward in the sterilizer duct 60, and is distributed uniformly toward a side wall of the refrigerator compartment 4 in the vertical direction through the respective sterilized air discharge ports 61, so that as shown in FIG. 7, the sterilized and deodorized air sterilizes and deodorizes the whole refrigerator compartment 4 rapidly.

[0058] In order to concentrate the active hydrogen and the negative ions to the central region of the refrigerator compartment 4, the driving motor 91 is driven to rotate the rotation shaft 92 at a predetermined angle counterclockwise, then, as shown in FIG. 5, the rotation duct 80 coupled with the driving motor 91 and the blower duct 70 and the sterilizer duct 60 coupled with the rotation duct 80 rotate together so that the sterilized air discharge ports 61 of the sterilizer duct 60 are disposed toward the central region of the refrigerator compartment 4.

[0059] Moreover, in order to concentrate the active hydrogen and the negative ions to the rear wall of the refrigerator compartment 4, the driving motor 91 is further driven to rotate the rotation shaft 92 at a predetermined angle counterclockwise, then, as shown in FIG. 6, the

rotation duct 80, the blower duct 70, and the sterilizer duct 60 rotate together so that the sterilized air discharge ports 61 of the sterilizer duct 60 are disposed toward the rear wall of the refrigerator compartment 4.

[0060] When the driving motor 91 is driven to continuously rotate the rotation shaft 92 of the driving motor 91 clockwise and counterclockwise within a predetermined angular range, air containing a great deal of the active hydrogen and the negative ions can be distributed into the whole space of the refrigerator compartment 4 through the sterilizer duct 60 more rapidly.

[0061] When the ion detector and the contaminant detector determine that air in the refrigerator compartment 4 is sterilized and deodorized to some degree, the rotation speed of the blower fan 75 is reduced so that the quantity and rate of airflow passing through the sterilizer duct 60 can be reduced.

[0062] After a predetermined time has lapsed, when it is determined that the sterilization and the deodorization of air in the refrigerator compartment 4 is completed, the ion generator 40, the fan motor 76, and the driving motor 71 are stopped to prevent further sterilization and deodorization by the sterilizer duct 60.

[0063] Although in the first embodiment of the present invention the sterilizer duct, the blower duct, and the rotation duct have circular cross-sections, but the shapes are not limited to this, and may have a polygonal shape.

[0064] Next, a refrigerator according to a second embodiment of the present invention will be described in detail with reference to FIGS. 8 to 13. Hereinafter, in the refrigerator according to this embodiment, identical numerals are assigned to the similar components of the refrigerator according to the first embodiment of the present invention, and thus the detailed description will be omitted.

[0065] FIG. 8 is a front view illustrating a refrigerator, in which a sterilizer duct for sterilizing the refrigerator compartment and deodorizing air in compartments is disposed in the refrigerator compartment parallel to a chilled air duct according to the second embodiment of the present invention. As shown in FIG. 8, in the rear side of the refrigerator compartment 4 of the refrigerator according to the second preferred embodiment of the present invention, are disposed, a chilled air duct 10 installed in the vertical direction such that the chilled air is uniformly distributed into the refrigerator compartment 4, and a sterilizer duct 20 installed parallel to the chilled air duct 10 in the vertical direction to discharge sterilized and deodorized air and to emit a great deal of active hydrogen and negative ion to the whole space of the refrigerator compartment 4.

[0066] Moreover, in the rear side of the refrigerator compartment 4 are disposed a distribution duct 30 connected to the sides (depicted as the lower sides in FIG. 8) of the chilled air duct 10 and the sterilizer duct 20, and a chilled air supply duct 15 connected to the distribution duct 30 and provided with a cooling fan 17 and an evaporator 18 installed therein.

[0067] In the front sides of the chilled air duct 10 and the sterilizer duct 10 is formed, a plurality of chilled air discharge ports 11 and sterilized air discharge ports 21 arranged at regular intervals, and in the front side of the chilled air supply duct 15 is formed, a plurality of air introducing holes 16 for introducing air in the refrigerator compartment 4 into the chilled air supply duct 15 (See FIG. 13).

[0068] Inside the distribution duct 30 are installed a damper 50 for adjusting the chilled air blown by the cooling fan 17 passing through the chilled air duct 10 and the sterilizer duct 20, and an ion generator 40 for emitting a great deal of active hydrogen and negative ions into the refrigerator compartment 4 through the sterilizer duct 20.

[0069] Like the sterilizer duct 60 according to the first embodiment of the present invention, the sterilizer duct 20 according to the second embodiment of the present invention is made of expanded polystyrene having surface resistivity higher than $10^{12} \Omega/\text{sq}$ and the inner surfaces of the sterilizer duct 20 are coated with polyethylene, an anti-electrification material.

[0070] Thus, when the cooling fan 17 is driven, air introduced into the chilled air duct 15 is chilled through the evaporator 18, flows to the chilled air duct 10 and/or the sterilizer duct 20 through the distribution duct 30, is discharged from the chilled air discharge ports 11 and the sterilized air discharge ports 21, and then is distributed into the refrigerator compartment 4.

[0071] FIG. 9 is an enlarged perspective view of a part of the sterilizer duct in FIG. 8 and shows that chilled air is distributed into the sterilizer duct and the chilled air duct through the distribution duct in which the damper and an ion generator are installed. As shown in FIG. 9, the distribution duct 30 has an approximately Y-shaped structure coupled with a cover plate 30a and having an entrance 31 and first and second exits 32 and 33, respectively formed in ends thereof.

[0072] The chilled air duct 15 is inserted into and coupled with the entrance 31, the sterilizer duct 20 is inserted into and coupled with the first exit 32, and the chilled air duct 10 is inserted into and coupled with the second exit 33. Thus, the chilled air blown from the chilled air supply duct 15 to the distribution duct 30 is distributed into the chilled air duct 10 and the sterilizer duct 20.

[0073] Between the first and second exits 32 and 33 in the distribution duct 30, the damper 50 is installed to selectively open the first and second exits 32 and 33. The damper 50 is made of a plate of the same size as cross-sections of the first and second exits 32 and 33, has an end connected to a driving motor 51 and an opposite end hinged to the cover plate 30a of the distribution duct 30 to be rotated by the driving motor 51 so as to control the opening degree of the first and second exits 32 and 33.

[0074] The ion generator 40 is disposed at a side of the first exit connected to the sterilizer duct 20 within the distribution duct 30 such that the sterilized and deodorized air and a great deal of active hydrogen and negative

ions are distributed to the sterilizer duct 20. Naturally, the ion generator 40 may be installed in the entrance of the sterilizer duct 20.

[0075] As described in the first embodiment, the ion generator 40 implemented by the MPI generator includes a ceramic plate 41 serving as a positive ion generator and a needle-shaped electrode 42 serving as a negative ion generator. Hydrogen atoms and super-oxide anions generated by the interaction between the ceramic plate 41 and the needle-shaped electrode 42 flow from the first exit 32 to the sterilizer duct 20 to sterilize bacteria and viruses contained in air and to remove source bacteria of mold.

[0076] The damper 50 controls the quantity and flow rate of the chilled air sent to the sterilizer duct 20 to adjust opening degree of the first exit 32 of the distribution duct 30 such that the quantity of the active hydrogen and ions generated by the ion generator 40, more precisely the quantity of super-oxide anions is optimized, and it will be described hereafter with reference to FIGS. 10 to 12.

[0077] As shown in FIG. 10, when the ion detector installed in the refrigerator compartment 4 and the contaminant detector (not shown) determine that there is a great deal of active hydrogen and ions required for the purpose of sterilization and deodorization of the refrigerator 4, the damper 50 activates the driving motor 51 to close the second exit 33 connected to the chilled air duct 10 completely and to fully open the first exit 32 connected to the sterilizer duct 20.

[0078] In this status, the cooling fan 17 and the ion generator 50 are activated, all the chilled air sent from the chilled air supply duct 15 to the distribution duct 30 flows through the sterilizer duct 20 so that a great deal of active hydrogen and ions are emitted to the chilled air in a short time, resulting in sterilizing and deodorizing the chilled air. Further, as shown in FIG. 13, the chilled air containing a great deal of active hydrogen and ions goes out of the sterilized air discharge port 21 of the sterilizer duct 20 and is uniformly distributed into an entire space of the refrigerator 4, resulting in rapidly sterilizing and deodorizing the refrigerator 4.

[0079] As shown in FIG. 11, the ion detector and the contaminant detector determine that the sterilization and deodorization of air in the refrigerator 4 is completed, the damper 50 drives the driving motor 51 to fully open the second exit 33 connected to the chilled air duct 10 and to close the first exit 32 connected to the sterilizer duct 20 completely, and stops the ion generator 40 to send chilled air without negative ions and active hydrogen to the chilled air duct 10.

[0080] Meanwhile, as shown in FIG. 12, when the damper 50 opens the chilled air duct 10 fully and the sterilizer duct 20 partially to control the opening degree of the second exit 32, the flow rate of the chilled air flowing through the sterilizer duct 20 is very fast so that the chilled air containing the active hydrogen and negative ions rapidly flows out of the sterilizer duct 20, thus to more effectively prevent the electrification phenomenon of the neg-

ative ions in the sterilizer duct 20 and to send the chilled air containing the active hydrogen and negative ions far away from the refrigerator 4.

[0081] As described above, the refrigerator of the present invention includes the sterilizer duct disposed in the vertical direction in the refrigerator compartment independent from the chilled air duct to emit active hydrogen and negative ions into the entire space of the refrigerator compartment uniformly through the sterilizer duct so that the entire space of the refrigerator compartment can be effectively sterilized and deodorized.

[0082] Moreover, in the refrigerator according to the present invention, since the sterilizer duct is installed to rotate such that the flow direction and flow rate of air passing through the sterilizer duct are conveniently controlled, the emission amount, the emission rate, and the emission direction of the active hydrogen and negative ions can be optimized.

[0083] Further, since the damper is installed in the distribution duct connected to the sterilizer duct to conveniently control the quantity and flow rate of air passing through the sterilizer duct, the emission amount and the emission rate of the active hydrogen and negative ions, and the operation time of the ion generator can be optimized, thus the power consumption is also reduced.

[0084] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents, and that various may be made with reference to the embodiments of the present invention.

Claims

1. A refrigerator comprising:

- at least one compartment;
- a chilled air duct for supplying chilled air to the compartment;
- a sterilizer duct installed in the compartment independent from the chilled air duct; and
- an ion generator for supplying sterilizing air through the sterilizer duct to the compartment.

2. The refrigerator according to claim 1, further comprising:

- a cooling fan for blowing the chilled air to the chilled air duct; and
 - a blower fan for blowing air in the compartment to the sterilizer duct,
- wherein a plurality of chilled air discharge ports and sterilized air discharge ports are respectively formed in the chilled air duct and the sterilizer duct at regular intervals.

3. The refrigerator according to claim 1, wherein the chilled air duct is disposed at the central region of the rear side of the compartment, and the sterilizer duct is disposed at a corner of the rear side of the compartment.
4. The refrigerator according to claim 1, wherein the ion generator is made of a micro plasma ion (MPI) generator for generating negative ions and active hydrogen, and is disposed in the sterilizer duct.
5. The refrigerator according to claim 2, further comprising:
 - a blower duct, coupled with the sterilizer duct, in which the blower fan is installed;
 - a rotation duct coupled with the blower duct; and
 - a driving motor for rotating the rotation duct, wherein the sterilizer duct is installed to rotate together with the blower duct
6. The refrigerator according to claim 5, wherein the driving motor is installed in a housing fixed to a rear wall of the compartment, and a rotation shaft of the driving motor is coupled with a hub provided in the center of the rotation duct to rotate the rotation duct.
7. The refrigerator according to claim 5, wherein the blower fan is coupled with a fan motor fixed in a hub provided at the center of the blower duct to rotate.
8. The refrigerator according to claim 5, wherein the sterilizer duct, the blower duct, and the rotation duct have a cylindrical shape and rotate.
9. The refrigerator according to claim 8, wherein an insertion protrusion and an insertion recess are formed in the end rims of the blower duct, and insertion protrusions and insertion recesses are formed in respective ends of the blower duct and the rotation duct such that the insertion protrusion of the sterilizer duct is inserted into the insertion recess of the blower duct and the insertion protrusion of the blower duct is inserted into the insertion recess of the rotation duct for the convenient separation from and coupling with each other.
10. The refrigerator according to claim 1, wherein the inner surface of the sterilizer duct is coated with anti-electrification material.
11. The refrigerator according to claim 10, wherein the anti-electrification material comprises polyethylene.
12. The refrigerator according to claim 1, further comprising a distribution duct installed between the sterilizer duct and the chilled air duct to communicate and block the chilled air duct to and from the sterilizer duct,
 - wherein the ion generator is installed in the sterilizer duct or the distribution duct.
13. The refrigerator according to claim 12, wherein the sterilizer duct includes a plurality of sterilized air discharge ports formed at regular intervals such that negative ions generated by the ion generator are uniformly distributed into the entire space of the compartment through the respective sterilized air discharge ports.
14. The refrigerator according to claim 13, wherein the ion generator is made of a micro plasma ion (MPI) generator for generating active hydrogen and the negative ions.
15. The refrigerator according to claim 13, wherein the distribution duct has first and second exits, and a cooling fan disposed in an entrance of the distribution duct;
 - the sterilizer duct and the chilled air duct are respectively connected to the first and second exits of the distribution duct such that chilled air blown by the cooling fan flows the sterilizer duct and the chilled air duct through the distribution duct.
16. The refrigerator according to claim 15, further comprising a damper installed between the first and second exits within the distribution duct to open and close the first and second exits.
17. The refrigerator according to claim 15, wherein the damper is driven by a driving motor to adjust an opening degree of the first and second exits.
18. The refrigerator according to claim 15, wherein the ion generator is disposed at the side of the first exit connected to the sterilizer duct within the distribution duct.
19. The refrigerator according to claim 15, further comprising a chilled air supply duct connected to the entrance of the distribution duct,
 - wherein a plurality of introducing holes for introducing air in the compartment is formed in the front side of the chilled air supply duct, and an evaporator is installed in the chilled air supply duct together with the cooling fan.
20. The refrigerator according to claim 1, wherein the ion generator comprises:
 - a ceramic plate serving as a positive ion generator; and
 - a needle-shaped electrode serving as a negative ion generator.

Fig.1

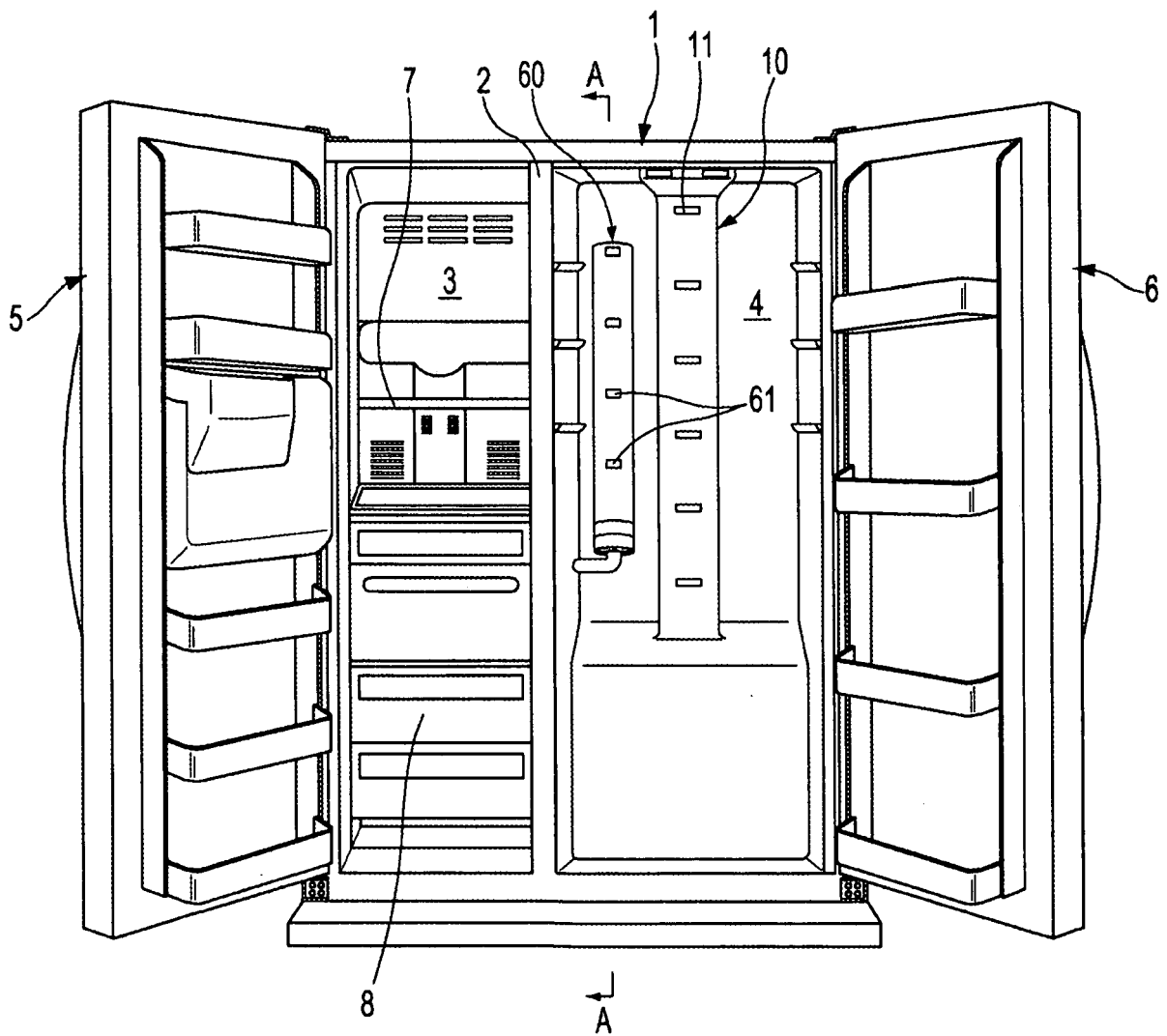


Fig.2

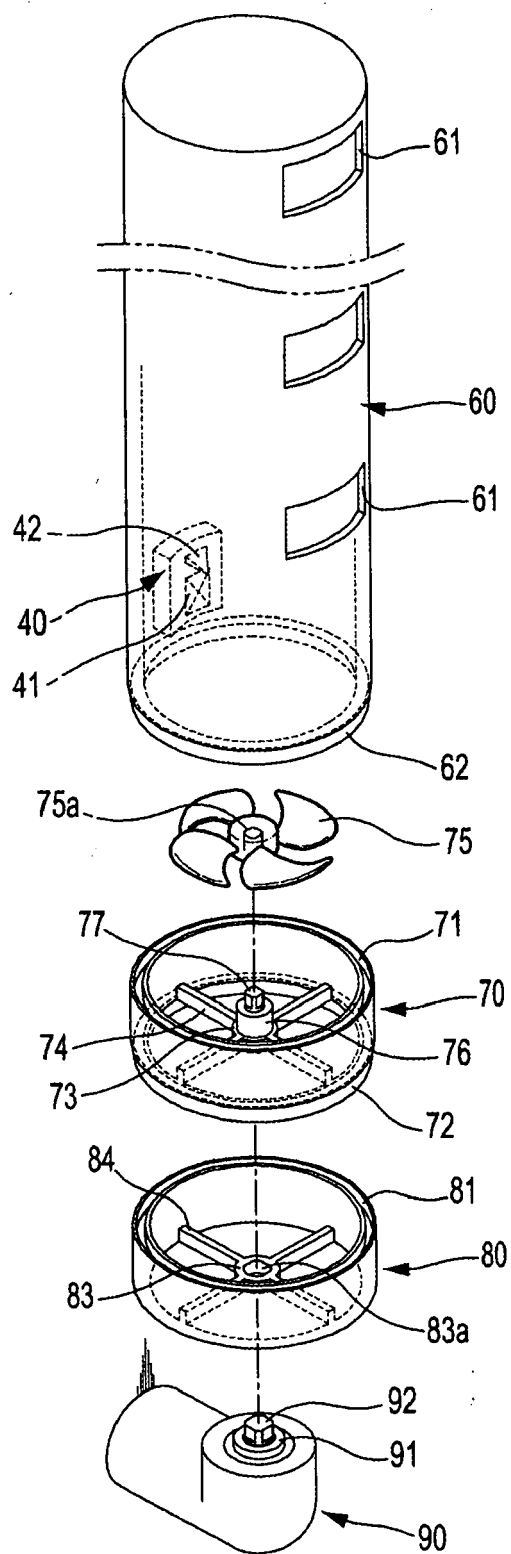


Fig.3

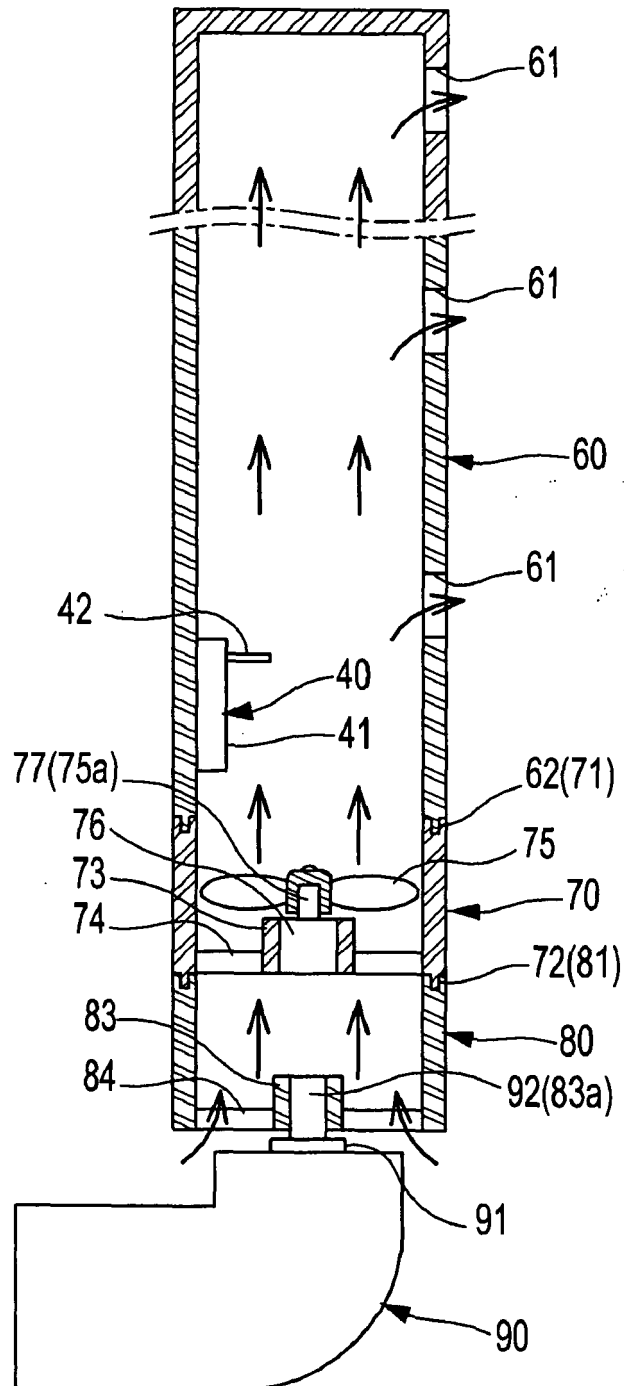


Fig.4

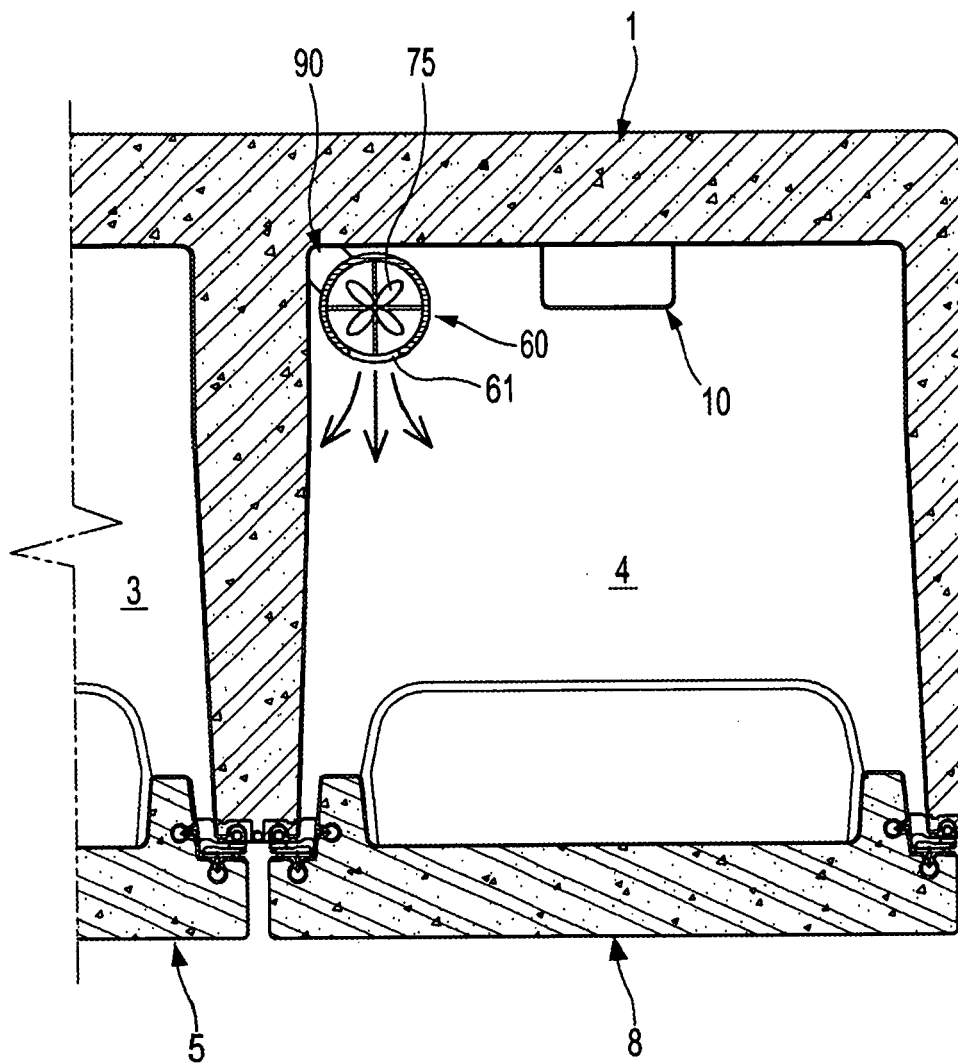


Fig.5

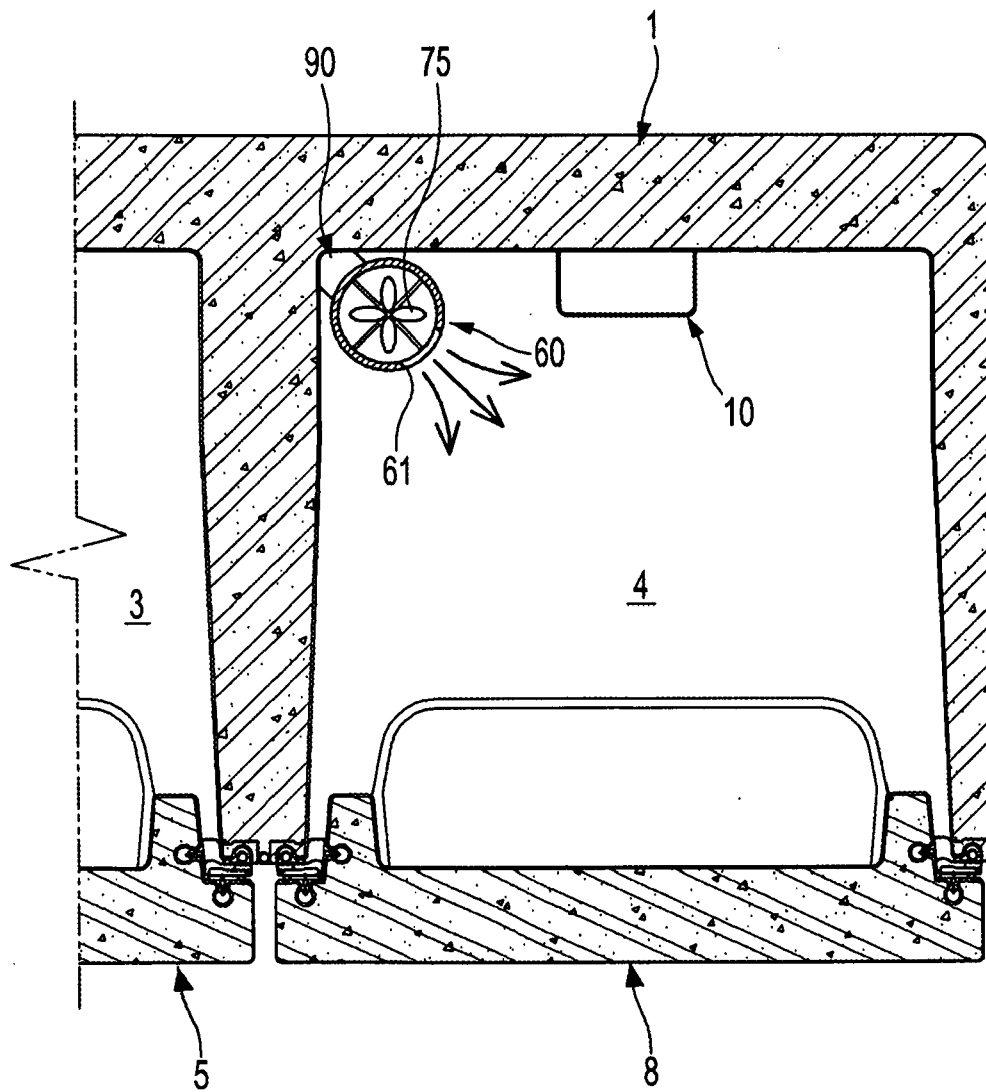


Fig.6

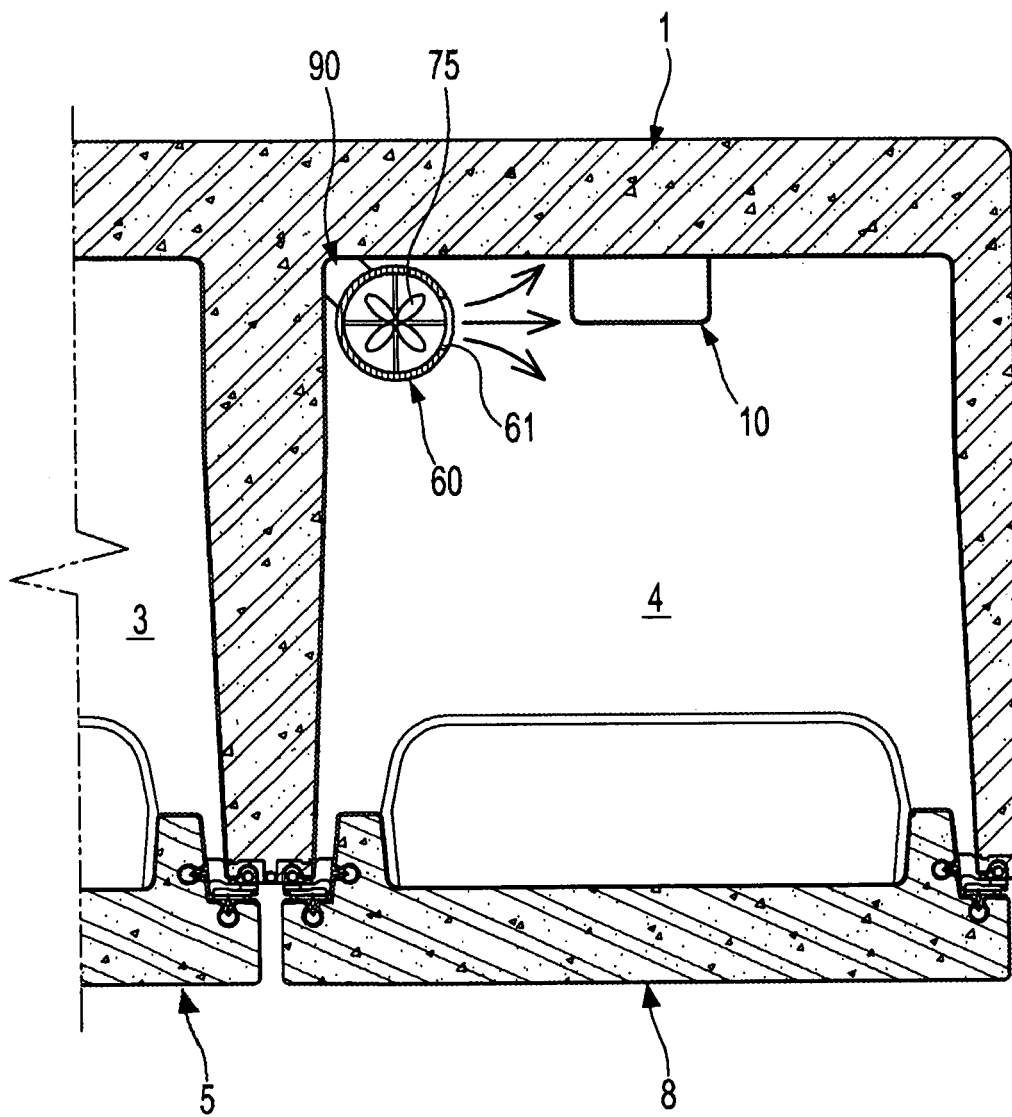


Fig.7

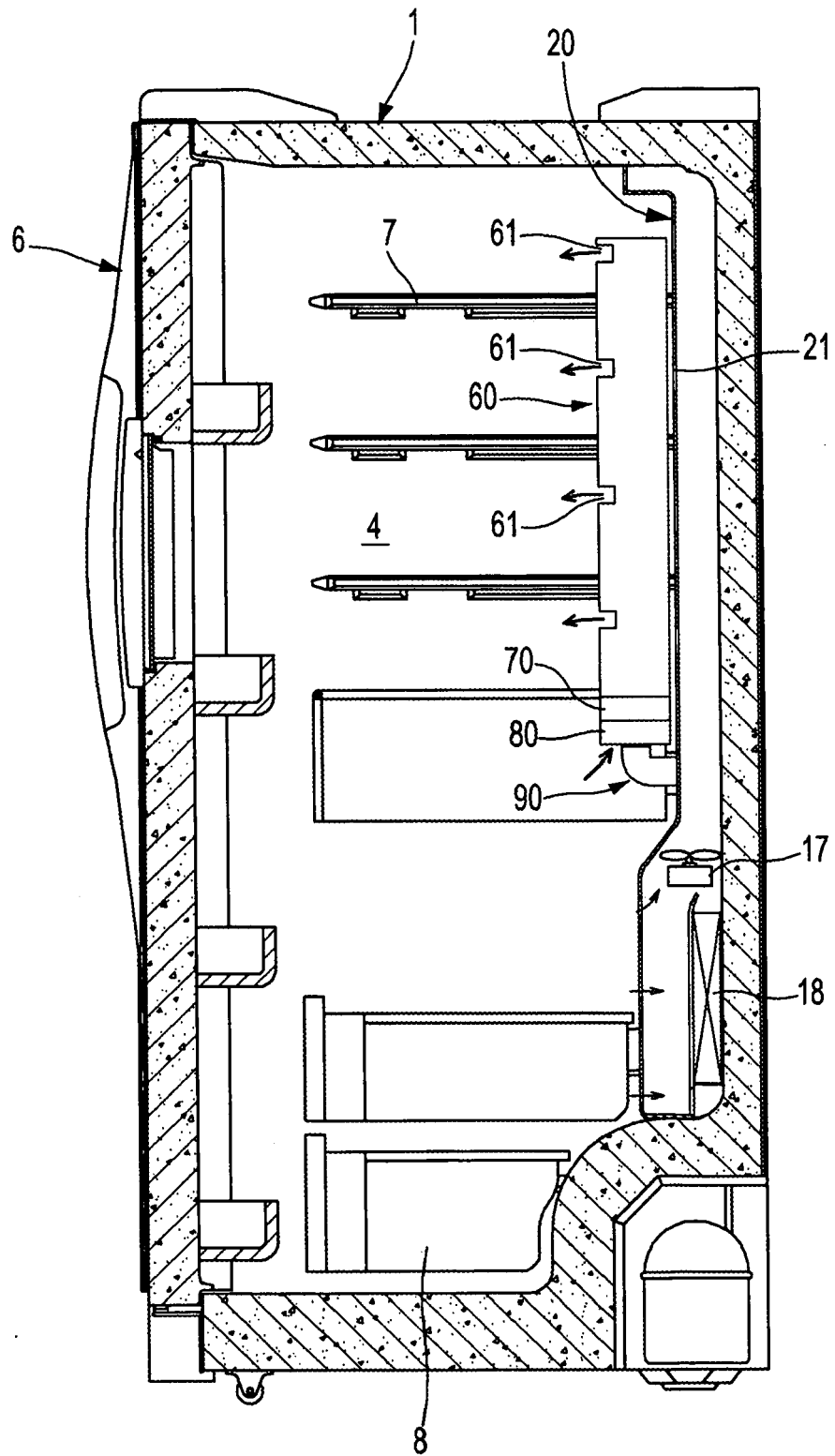


Fig.8

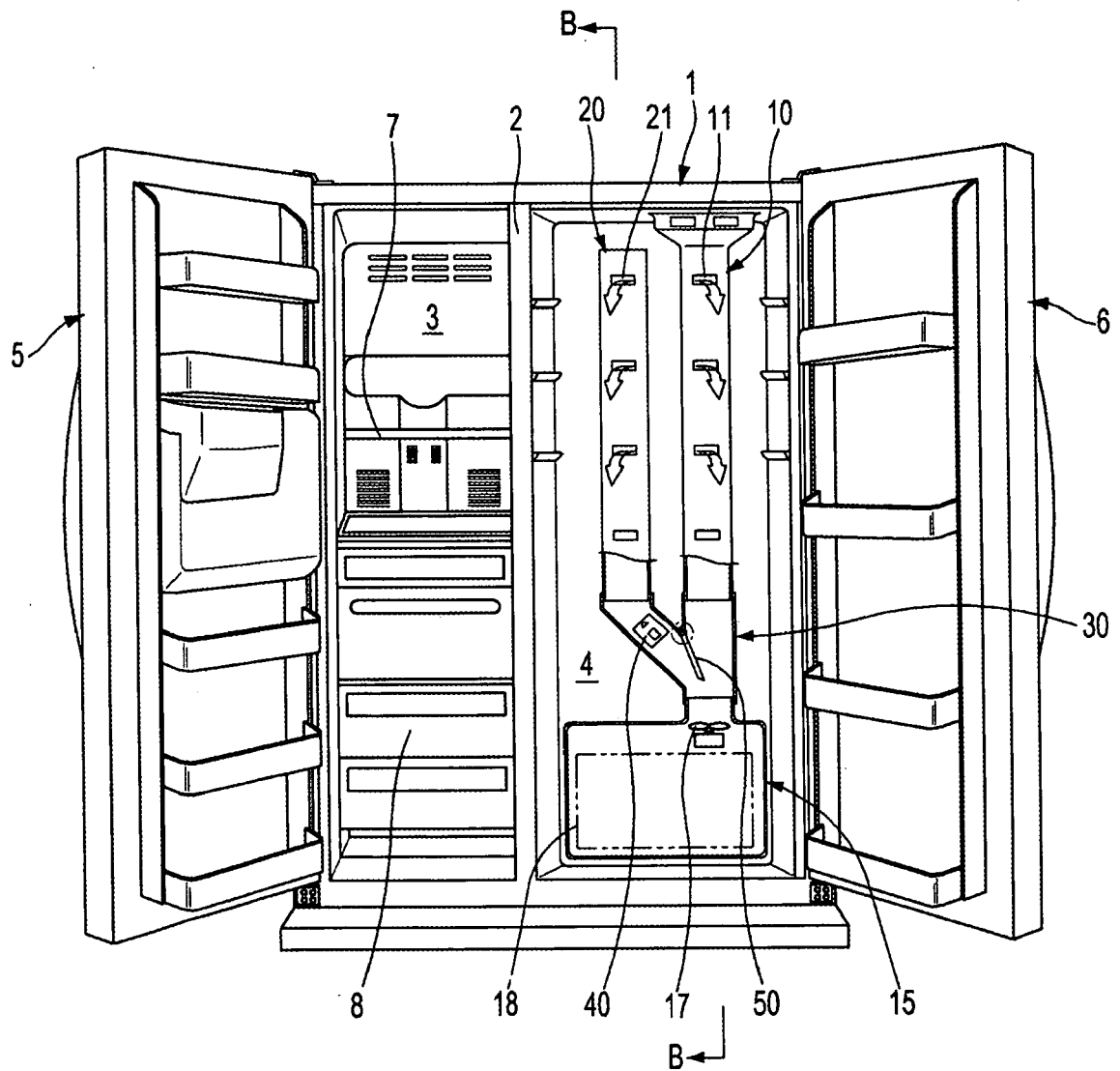


Fig.9

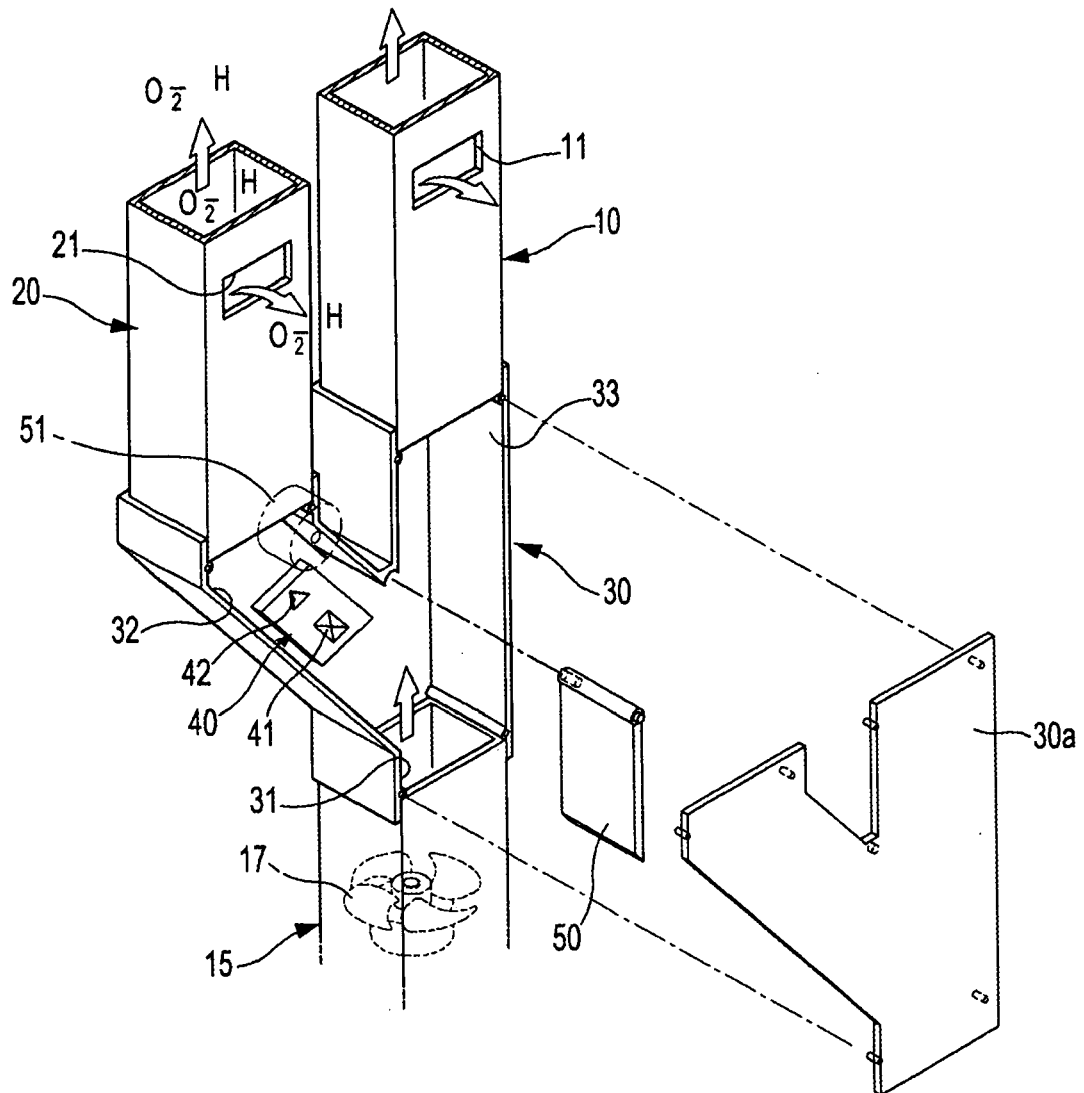


Fig.10

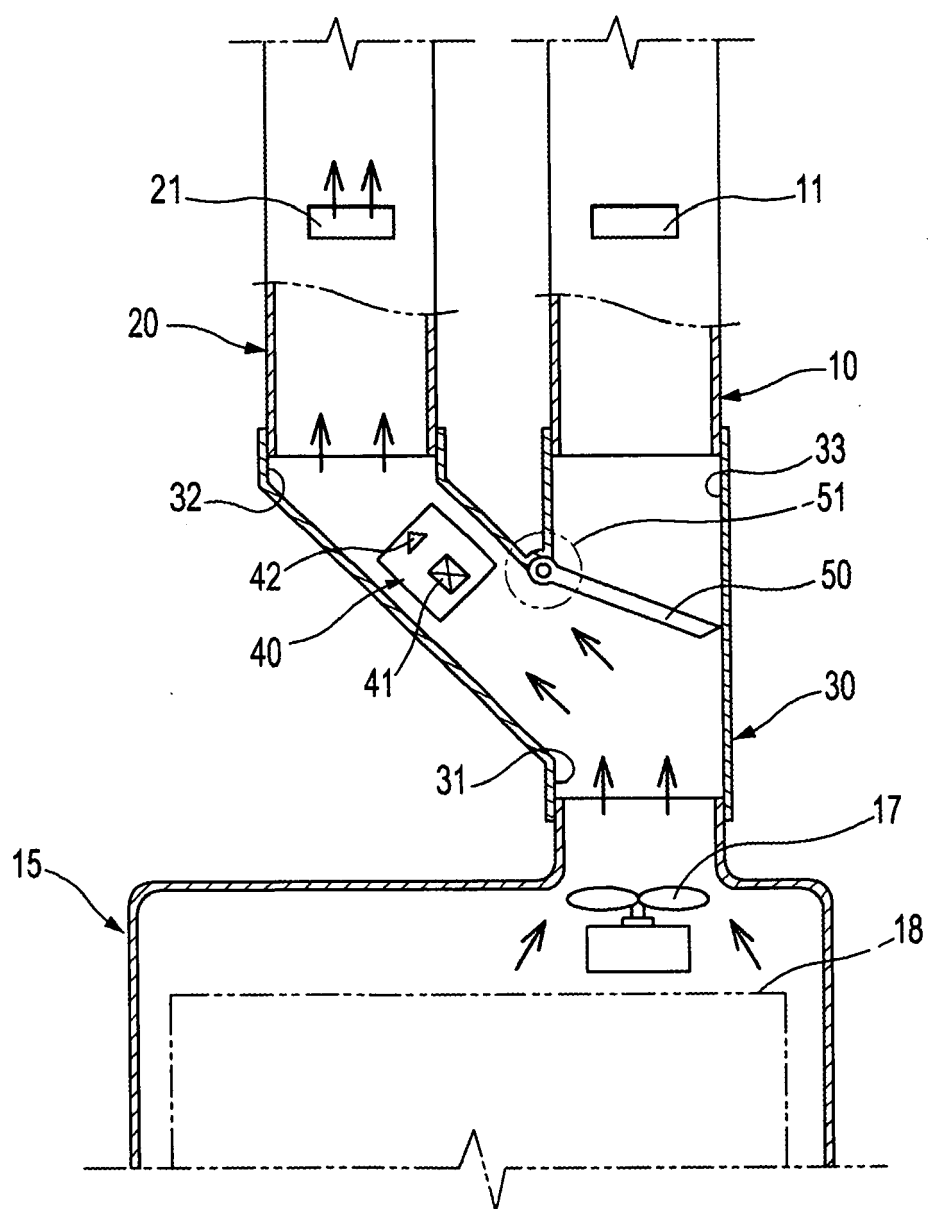


Fig.11

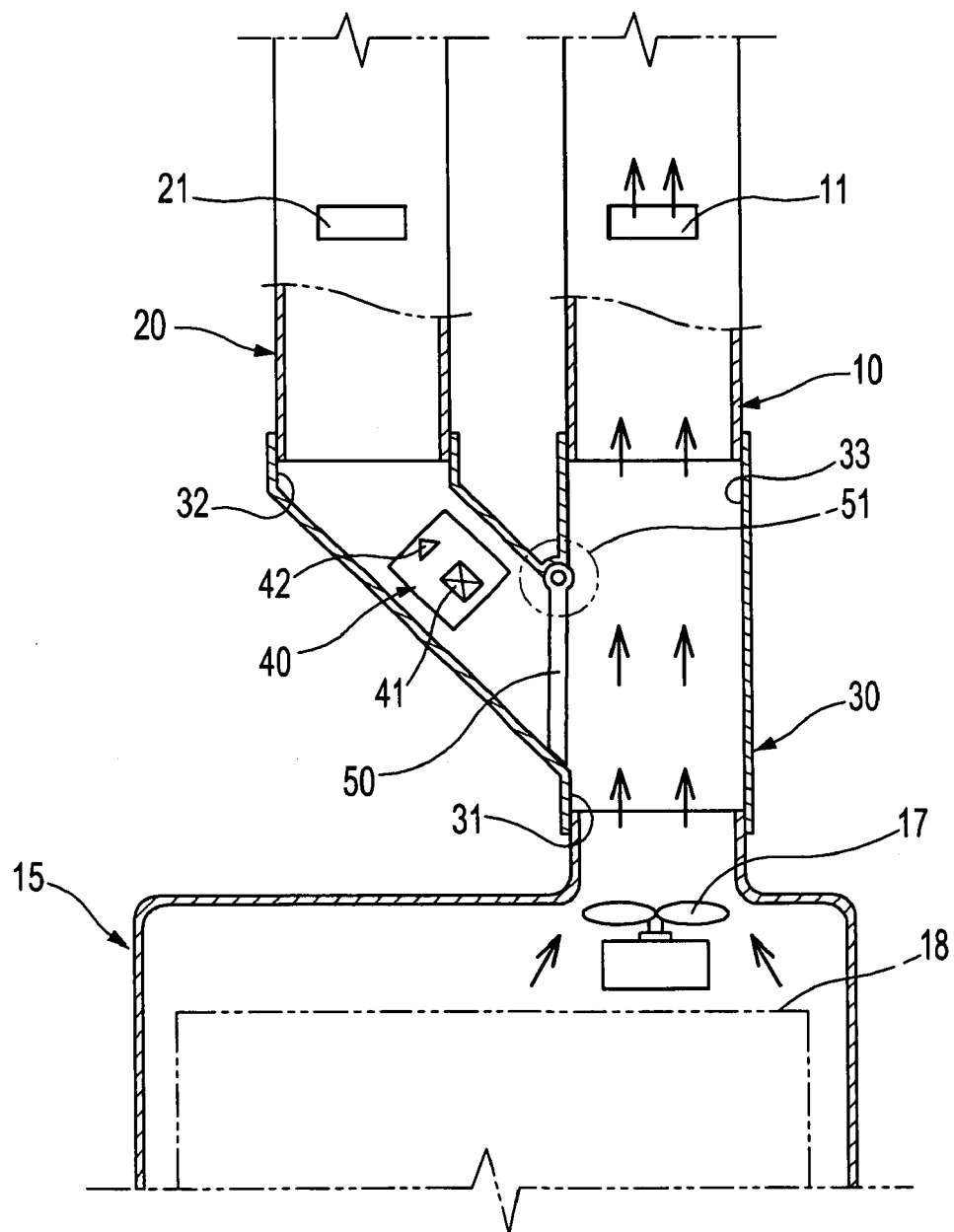


Fig.12

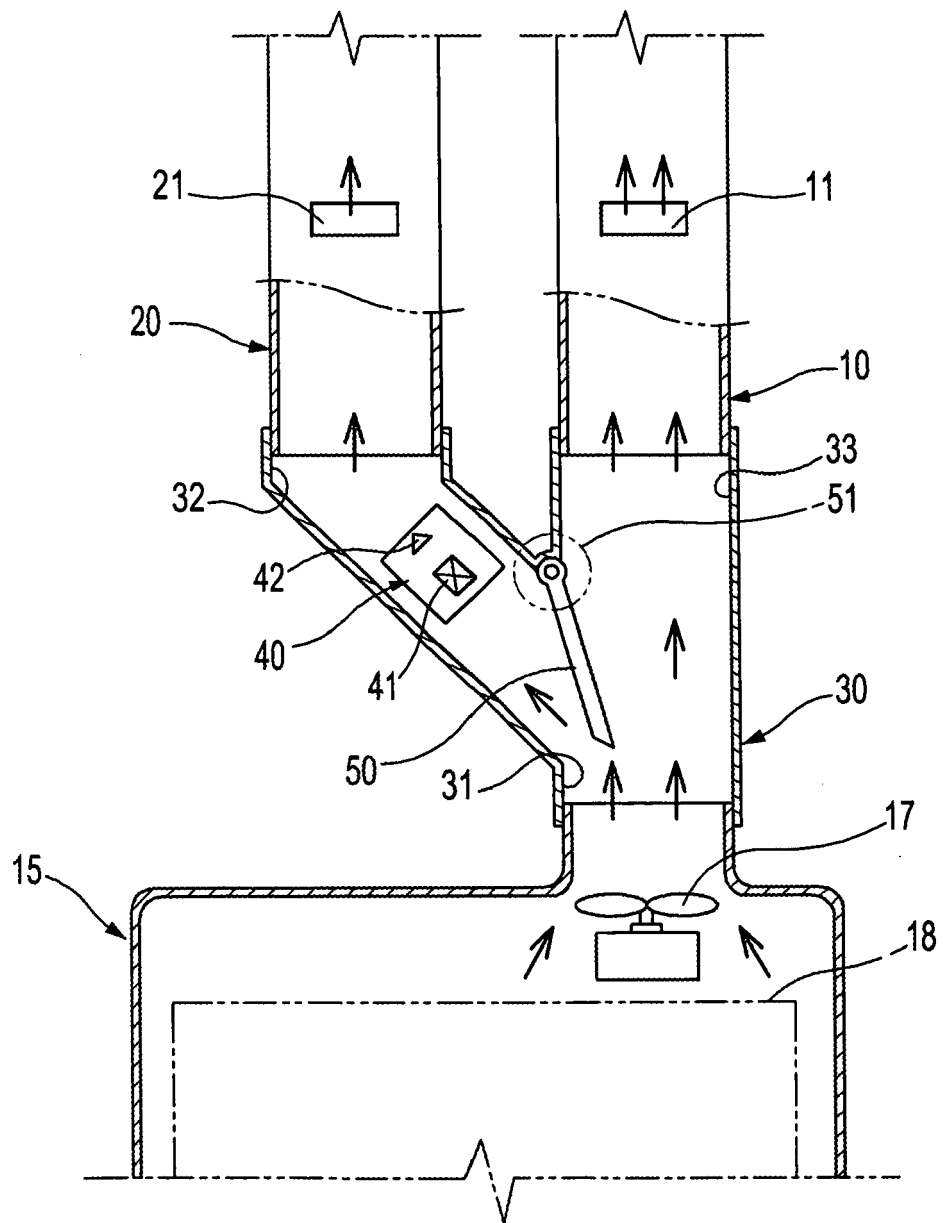
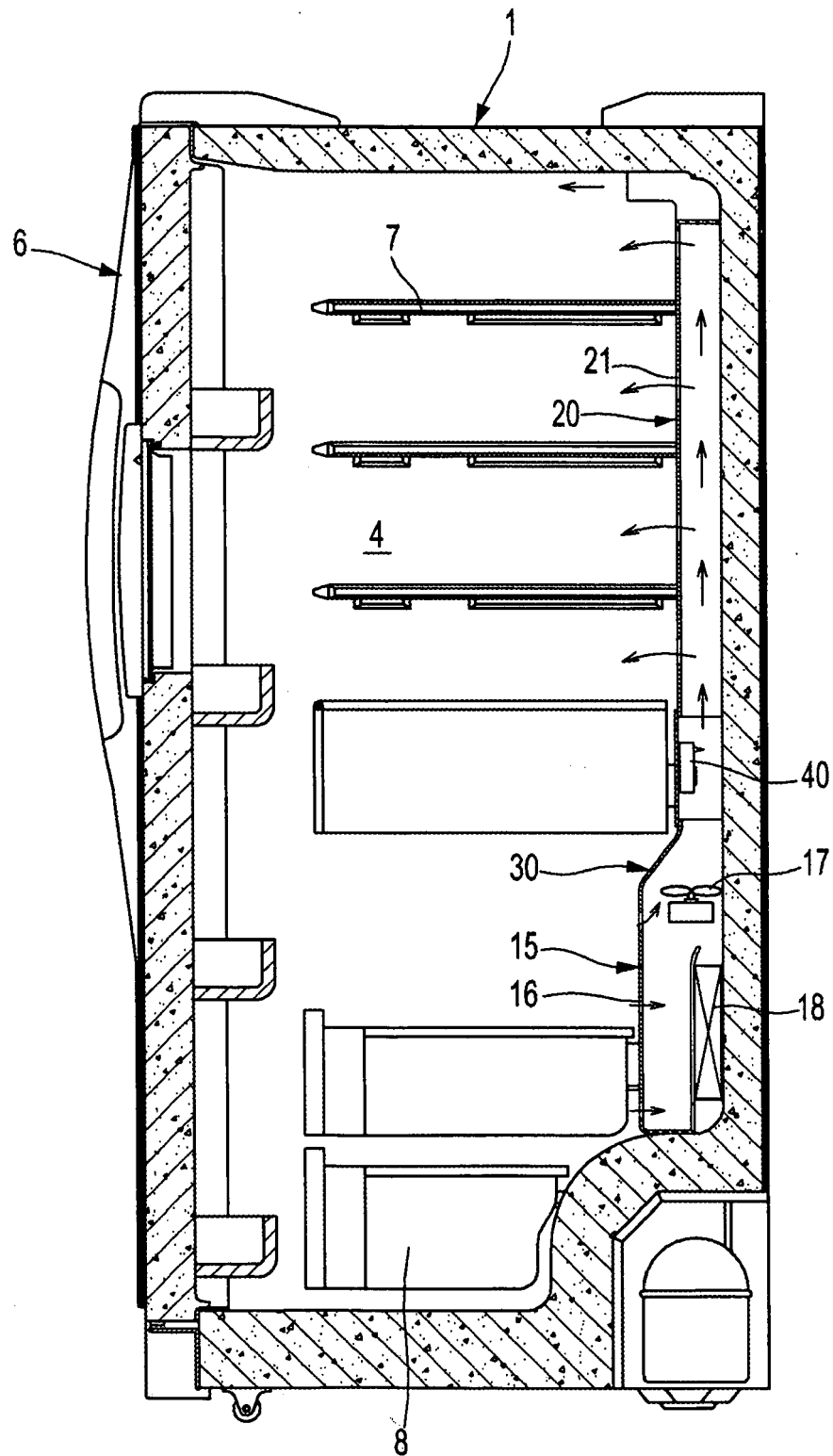


Fig.13



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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