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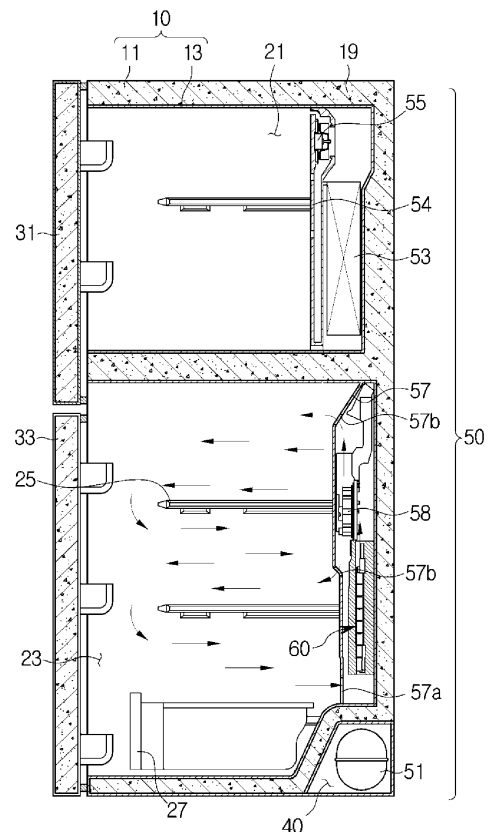
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(54) **REFRIGERATOR AND HEAT EXCHANGER USED THEREIN**

(57) A refrigerator includes: a body; a storage compartment formed in the body; and a cold air generating unit installed in the storage compartment and including a heat exchanger for generating cold air, wherein the heat exchanger includes: a tube, which forms a heat-exchanging space and extends in one direction and in which a refrigerant flows; heat-exchanging fins disposed to be in contact with the tube in the heat-exchanging space; headers connected to one side and the other side of the tube, respectively; and a refrigerant pipe connected to the headers so that the refrigerant is introduced into/discharged from the tube, and a plurality of flow paths on which the refrigerant flows, are formed in the tube.

FIG. 2



Description

[0001] The present invention relates to a heat exchanger having an improved structure in which heat-exchanging efficiency can be improved, and a refrigerator including the same.

[0002] In general, a refrigerator supplies cold air generated in an evaporator to a storage compartment, maintains freshness of various food for a long time, and keeps food. The storage compartment of the refrigerator is divided into a refrigerator compartment, temperature of which is maintained at approximately 3°C and which keeps food refrigerated and a freezer compartment, temperature of which is maintained at approximately -20 °C and which keeps food in a freezer.

[0003] The refrigerator repeats a cooling cycle in which a refrigerant is compressed, condensed, expanded and evaporated using a compressor, a condenser, an expansion device, and the evaporator. In general, the evaporator is installed in the storage compartment, is heat-exchanged and generates the cold air in the storage compartment. In this way, since the evaporator is installed in the storage compartment, when the volume of the evaporator is large, a storage space is reduced, or the volume of an insulating material with which a space between an inner case and an outer case is filled, is reduced such that an energy loss occurs.

[0004] Therefore, it is an aspect of the present disclosure to provide a refrigerator having an improved structure in which heat-exchanging efficiency of an evaporator can be improved.

[0005] It is another aspect of the present disclosure to provide a refrigerator having an improved structure in which heat-exchanging efficiency can be improved even when the volume of an evaporator installed in a storage compartment is small.

[0006] Additional aspects of the disclosure will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the disclosure.

[0007] In accordance with one aspect of the present disclosure, a refrigerator includes: a body; a storage compartment formed in the body; and a cold air generating unit installed in the storage compartment and including a heat exchanger for generating cold air, wherein the heat exchanger may include: a tube, which forms a heat-exchanging space and extends in one direction and in which a refrigerant flows; heat-exchanging fins disposed to be in contact with the tube in the heat-exchanging space; headers connected to one side and the other side of the tube, respectively; and a refrigerant pipe connected to the headers so that the refrigerant is introduced into/discharged from the tube, and a plurality of flow paths on which the refrigerant flows, may be formed in the tube.

[0008] The tube may include a plurality of contact portions, which extend in contact with the heat-exchanging fins and are disposed to be parallel to one another, and a connection portion provided in a bent shape so as to

connect the plurality of contact portions.

[0009] The tube may be disposed to surround the heat-exchanging fins in contact with the heat-exchanging fins.

[0010] The headers may include a first header connected to an introduction refrigerant pipe through which the refrigerant is introduced into the tube, and a second header connected to a discharging refrigerant pipe through which the refrigerant is discharged from the tube, and a lower side of the tube may be coupled to the first header, and an upper side of the tube may be connected to the second header.

[0011] The heat-exchanging fins may include first inclined surfaces inclined upward in a first direction and second inclined surfaces that extend from the first inclined surfaces and are inclined downward in the first direction, and a plurality of first inclined surfaces and a plurality of second inclined surfaces are coupled to each other.

[0012] A plurality of grooves may be formed in the heat-exchanging fins.

[0013] The heat-exchanging fins may have a shape in which they are bent a plurality of times so as to be in contact with inner surfaces of the contact portions facing the heat-exchanging space.

[0014] The heat-exchanging fins may include: first heat-exchanging fins disposed at an upper portion of the heat-exchanging space; and second heat-exchanging fins disposed at lower portions of the first heat-exchanging fins, and the second heat-exchanging fins may be disposed to cross the first heat-exchanging fins when viewed from above.

[0015] The heat-exchanging fins may include: first heat-exchanging fins disposed at an upper portion of the heat-exchanging space; and second heat-exchanging fins disposed at lower portions of the first heat-exchanging fins, and a distance between portions in which the second heat-exchanging fins are bent, may be greater than a distance between portions in which the first heat-exchanging fins are bent.

[0016] In accordance with another aspect of the present disclosure, a heat exchanger includes: a tube in which a refrigerant is moved and which is bent a plurality of times and extends in one direction; heat-exchanging fins disposed to be surrounded by the tube and to be in contact with the tube; headers connected to one side and the other side of the tube, respectively; and a refrigerant pipe connected to the headers so that the refrigerant is introduced into/discharged from the tube, and the tube may include a plurality of contact portions, which extend in contact with the heat-exchanging fins and are disposed to be parallel to one another and a connection portion provided in a bent shape so as to connect the plurality of contact portions.

[0017] The tube may be provided as a multi-channel tube having a plurality of flow paths on which the refrigerant is moved.

[0018] The headers may include a first header connected to an introduction refrigerant pipe through which

the refrigerant is introduced into the tube, and a second header connected to a discharging refrigerant pipe through which the refrigerant is discharged from the tube, and a lower side of the tube may be coupled to the first header, and an upper side of the tube may be connected to the second header.

[0019] The heat-exchanging fins may include first inclined surfaces inclined upward in a first direction and second inclined surfaces that extend from the first inclined surfaces and are inclined downward in the first direction, and a plurality of first inclined surfaces and a plurality of second inclined surfaces may be coupled to each other.

[0020] A plurality of grooves may be formed in the first inclined surfaces and the second inclined surfaces of the heat-exchanging fins.

[0021] The heat-exchanging fins may have a shape in which they are bent a plurality of times so as to be in contact with inner surfaces of the contact portions facing a heat-exchanging space.

[0022] The heat-exchanging fins may include: first heat-exchanging fins disposed at an upper portion of the heat-exchanging space; and second heat-exchanging fins disposed at lower portions of the first heat-exchanging fins, and the second heat-exchanging fins may be disposed to cross the first heat-exchanging fins when viewed from above.

[0023] A distance between portions in which the second heat-exchanging fins are bent, may be greater than a distance between portions in which the first heat-exchanging fins are bent.

[0024] These and/or other aspects of the disclosure 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 perspective view illustrating an exterior of a refrigerator in accordance with an embodiment of the present disclosure;

FIG. 2 is a cross-sectional view illustrating a schematic configuration of the refrigerator illustrated in FIG. 1;

FIG. 3 is a perspective view illustrating a heat exchanger of the refrigerator of FIG. 2, in accordance with an embodiment of the present disclosure;

FIG. 4 is a top view of the heat exchanger illustrated in FIG. 3;

FIG. 5 is a partially-enlarged view illustrating a configuration of a tube of the heat exchanger of FIG. 3;

FIG. 6 is a view of heat-exchanging fins included in the heat exchanger of FIG. 3;

FIG. 7 is a view illustrating a movement direction of a refrigerant in the heat exchanger of FIG. 3;

FIG. 8 is a view illustrating a heat exchanger in accordance with another embodiment of the present disclosure; and

FIGS. 9 and 10 are views illustrating a movement direction of a refrigerant in the heat exchanger of

FIG. 8.

[0025] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0026] Hereinafter, exemplary embodiments of the present disclosure will be described in more detail with reference to the accompanying drawings.

[0027] FIG. 1 is a perspective view illustrating an exterior of a refrigerator in accordance with an embodiment of the present disclosure, and FIG. 2 is a cross-sectional view illustrating a schematic configuration of the refrigerator illustrated in FIG. 1.

[0028] Referring to FIGS. 1 and 2, a refrigerator 1 may include a body 10, a storage compartment 20, and a door 30.

[0029] The body 10 includes an outer case 11 and an inner case 13. The outer case 11 forms an exterior of the body 10. The outer case 11 may be formed of a metal material having excellent durability and an excellent aesthetic.

[0030] The inner case 13 is disposed at an inner surface of the outer case 11. The inner case 13 forms an exterior of the storage compartment 20. The inner case 13 may be injection-molded as a single body using a plastic material. A space between the inner case 13 and the outer case 11 may be filled with an insulating material 19 so as to prevent cold air in the storage compartment 20 from being discharged.

[0031] The storage compartment 20 is disposed so that a front side of the storage compartment 20 through which food is put into or taken out from the storage compartment 20, is opened. According to an embodiment, the storage compartment 20 may be partitioned off into a plurality of storage compartments 20 using a partition wall 17.

[0032] The storage compartment 20 may include a first storage compartment 21 and a second storage compartment 23. The first storage compartment 21 and the second storage compartment 23 may be partitioned off using the partition wall 17. As illustrated in FIG. 1, the first storage compartment 21 may be disposed on the partition wall 17, and the second storage compartment 23 may be disposed under the partition wall 17.

[0033] The storage compartment 20 may include a refrigerator compartment and a freezer compartment. According to the type of the refrigerator, the first storage compartment 21 may be provided as a freezer compartment, and the second storage compartment 23 may be provided as a refrigerator compartment. The refrigerator 1 according to an exemplary embodiment of the present disclosure may be provided as a top mounted freezer (TMF) type refrigerator in which the first storage compartment 21 provided as the freezer compartment is placed on the second storage compartment 23 provided as the refrigerator compartment. The freezer compartment may be maintained at approximately -20°C, and the refrigerator compartment may be maintained at ap-

proximately 30°C. The freezer compartment and the refrigerator compartment may be insulated from each other using the partition wall 17.

[0034] A shelf 25 may be disposed in the storage compartment 20. The shelf 25 is provided to support food stored in the storage compartment 20. A plurality of shelves 25 may be provided in each storage compartment 20. The plurality of shelves 25 may be provided to be attachable to/detachable from the storage compartment 20.

[0035] As illustrated in FIG. 2, a storage container 27 may be provided in the storage compartment 20. The storage container 27 may be provided in the form of a box. The storage container 27 may be provided in such a way that food can be stored in a sealed internal space of the storage container 27.

[0036] The storage compartment 20 is opened/closed by the door 30. The door 30 is rotatably coupled to the body 10 so as to open/close the opened front side of the storage compartment 20. The first storage compartment 21 and the second storage compartment 23 are opened/closed by a first door 31 and a second door 33 that are rotatably coupled to the body 10.

[0037] A door guard 35 may be disposed in the door 30 so as to accommodate food in a rear side of the door guard 35. A plurality of door guards 35 may be provided.

[0038] The refrigerator 1 may further include a machine compartment 40. The machine compartment 40 may be formed in a lower portion of the body 10. In detail, the machine compartment 40 may be formed in rear of the body 10, and a space in which a partial configuration of a cold air generating unit 50 is disposed, may be provided in the machine compartment 40.

[0039] The refrigerator 1 may further include the cold air generating unit 50.

[0040] The cold air generating unit 50 may include a compressor 51, a condenser (not shown), an expansion valve (not shown), and evaporators 53 and 60. A freezing cycle of the cold air generating unit 50 may be driven when a refrigerant is circulated along the compressor 51, the condenser (not shown), the expansion valve (not shown), and the evaporators 53 and 60 and is compressed, condensed, expanded and evaporated.

[0041] The refrigerant is compressed at a high temperature under a high pressure and then is moved to the condenser. The high-temperature and high-pressure refrigerant is condensed by the condenser into a liquid state. The pressure and temperature of the refrigerant in the condensed liquid state are lowered at the expansion valve. The expansion valve may be provided as a capillary tube. The low-temperature low-pressure refrigerant that passes through the expansion valve is evaporated by the evaporators 53 and 60 due to heat taken away from an ambient air and is heat-exchanged with a surrounding gas. Thus, gas around the evaporators 53 and 60 is cooled and thus, cold air is generated. The fully-evaporated refrigerant is supplied to the compressor 51 again such that the freezing cycle is circulated. The

above-described freezing cycle is circulated such that the cold air is continuously generated in the storage compartments 21 and 23.

[0042] The compressor 51 and the condenser may be installed in the machine compartment 40. The evaporators 53 and 60 may be installed in the storage compartment 20. The evaporators 53 and 60 may be separately installed in the first storage compartment 21 and the second storage compartment 23. In FIG. 2, for convenience of explanation, the general evaporator 53 is installed in the first storage compartment 21, and the evaporator 60 according to an exemplary embodiment of the present disclosure is installed in the second storage compartment 23. Unlike this, the evaporator 60 according to an exemplary embodiment of the present disclosure may also be installed in the first storage compartment 21 and the second storage compartment 23, respectively.

[0043] As illustrated in FIG. 2, the cold air generating unit 50 may further include a first evaporator cover 54 and a first blower fan 55 installed in the first storage compartment 21. The first evaporator cover 54 may be installed in front of the evaporator 53 installed in the first storage compartment 21 and may separate the first storage compartment 21 into a storage space and a space in which the evaporator 53 is disposed. The first blower fan 55 may be installed in the first evaporator cover 54 at an upper portion of the evaporator 53 and may circulate the cold air generated in the evaporator 53 in the first storage compartment 21.

[0044] The evaporator 60 according to an exemplary embodiment of the present disclosure may be installed in the second storage compartment 23. Hereinafter, for convenience, an evaporator according to an exemplary embodiment of the present disclosure will be written as a heat exchanger 60 and will be described.

[0045] The cold air generating unit 50 may further include a second evaporator cover 57 and a second blower fan 58 installed in the second storage compartment 23. The second evaporator cover 57 may be installed in front of the heat exchanger 60 installed in the second storage compartment 23. The second evaporator cover 57 may separate the second storage compartment 23 into a storage space and a space in which the heat exchanger 60 is disposed. Since the heat exchanger 60 may be formed to have a smaller volume than that of the general evaporator 53, the second evaporator cover 57 may be provided to have a shape in which a portion of the second evaporator cover 57 facing the heat exchanger 60 is bent rearward. An air introduction portion 57a may be formed in a lower portion of the second evaporator cover 57. Also, a plurality of cold air discharging portions 57b may be formed in the second evaporator cover 57. The plurality of cold air discharging portions 57b may be formed at different heights. The second blower fan 58 may be disposed in rear of the second evaporator cover 57. The second blower fan 58 may move the cold air generated in the heat exchanger 60 forward through the cold air discharging portions 57b. The second blower fan 58 may

be disposed at an upper portion of the heat exchanger 60, as illustrated in FIG. 2. Unlike this, the second blower fan 58 may also be disposed at a lower portion of the heat exchanger 60.

[0046] Hereinafter, the heat exchanger 60 according to an exemplary embodiment of the present disclosure will be described in detail.

[0047] FIG. 3 is a perspective view illustrating a heat exchanger of the refrigerator of FIG. 2, in accordance with an embodiment of the present disclosure, and FIG. 4 is a top view of the heat exchanger illustrated in FIG. 3, and FIG. 5 is a partially-enlarged view illustrating a configuration of a tube of the heat exchanger of FIG. 3, and FIG. 6 is a view of heat-exchanging fins included in the heat exchanger of FIG. 3.

[0048] Referring to FIGS. 2 through 6, the heat exchanger 60 may include a tube 61, heat-exchanging fins 63, and headers 65.

[0049] The tube 61 may be disposed in such a way that the refrigerant may flow in the tube 61 and may be heat-exchanged with an external air. As illustrated in FIG. 5, the tube 61 may include a plurality of flow paths 61a through which the refrigerant is moved. A plurality of channels 61a on which the refrigerant may be moved, may be formed in the tube 61. The tube 61 may include a material having high thermal conductivity so that heat-exchanging between the refrigerant moving in the tube 61 and the external air can be easily performed. The tube 61 may include an aluminum material.

[0050] The tube 61 may be disposed to be bent a plurality of times and to extend in one direction. The tube 61 may extend in one direction while forming a heat-exchanging space 61b. The tube 61 may be disposed to surround the heat-exchanging fins 63 in contact with the heat-exchanging fins 63.

[0051] The tube 61 may include a plurality of contact portions 61c, which extend in contact with the heat-exchanging fins 63 and are disposed to be parallel to one another, and a connection portion 61d provided in a bent shape so as to connect the plurality of contact portions 61c. The contact portions 61c may be provided to have a shape of a flat plate that extends in one direction. As illustrated in FIG. 3, the contact portions 61c may be disposed to be parallel to one another.

[0052] The heat-exchanging fins 63 may be disposed to be in contact with the tube 61 so as to transfer heat to the tube 61. The heat-exchanging fins 63 may be disposed to be surrounded by the tube 61 and to be in contact with the tube 61. The heat-exchanging fins 63 may be disposed to be in contact with the tube 61 in the heat-exchanging space 61b.

[0053] The heat-exchanging fins 63 may be provided to have a shape in which they are bent a plurality of times. As illustrated in FIG. 6, the heat-exchanging fins 63 may include first inclined surfaces 63d inclined upward in a first direction and second inclined surfaces 63e that extend from the first inclined surfaces 63d and are inclined downward in the first direction. Here, the first direction is

defined as a direction in which the heat-exchanging fins 63 extend along the contact portions 61c of the tube 61. The heat-exchanging fins 63 may be provided in a zigzag shape in which a plurality of first inclined surfaces 63d and a plurality of second inclined surfaces 63e are coupled to each other. Unlike this, the heat-exchanging fins 63 may be formed to have various shapes so as to increase the area that contacts the external air. The heat-exchanging fins 63 may be installed in such a way that portions in which the first inclined surfaces 63d and the second inclined surfaces 63e are connected to each other and are bent, are in contact with inner surfaces of the contact portions 61c and heat-exchanging between the refrigerant and the external air occurs.

[0054] As illustrated in FIG. 6, a plurality of grooves 63c may be formed in the heat-exchanging fins 63. The plurality of grooves 63c may be formed in the first inclined surfaces 63d and the second inclined surfaces 63e of the heat-exchanging fins 63, respectively, so that the area of the heat-exchanging fins 63 that contact the air can be increased. The grooves 63c may be provided to have various shapes so that the contact area between the heat-exchanging fins 63 and the air can be increased.

[0055] As illustrated in FIG. 5, the heat-exchanging fins 63 may include first heat-exchanging fins 63a and second heat-exchanging fins 63b. The first heat-exchanging fins 63a may be disposed at upper portions of the second heat-exchanging fins 63b of the heat exchanger 60. The first heat-exchanging fins 63a and the second heat-exchanging fins 63b may be disposed to cross one another when viewed from above. The first heat-exchanging fins 63a and the second heat-exchanging fins 63b may be provided to have the same shape and to cross each other. Unlike this, the first heat-exchanging fins 63a and the second heat-exchanging fins 63b may be provided to have different shapes. Although not shown, the second heat-exchanging fins 63b disposed at the lower portion of the heat exchanger 60 may be formed in such a way that a distance between portions in which the first inclined surfaces 63d and the second inclined surfaces 63e are bent, is greater than a distance between portions in which the first heat-exchanging fins 63a are bent. Thus, defrosting water generated in the heat exchanger 60 is moved downward and is frozen so that the heat-exchanging space 61b may be prevented from being closed.

[0056] The headers 65 may be connected to one side and the other side of the tube 61, respectively. The headers 65 may include a first header 65a connected to one side of the tube 61 disposed at the lower portion of the heat exchanger 60 and a second header 65b connected to one side of the tube 61 disposed at the upper portion of the heat exchanger 60.

[0057] The first header 65a may be connected to an introduction refrigerant pipe 71 through which the refrigerant is introduced into the tube 61. The first header 65a may be connected to the introduction refrigerant pipe 71 and the tube 61, respectively, so that the refrigerant introduced from the introduction refrigerant pipe 71 can be

moved to the tube 61.

[0058] The second header 65b may be connected to a discharging refrigerant pipe 72 through which the refrigerant is discharged from the tube 61. The second header 65b may be connected to the tube 61 and the discharging refrigerant pipe 72, respectively, so that the refrigerant discharged from the tube 61 can be moved to the discharging refrigerant pipe 72.

[0059] As described above, the heat exchanger 60 may be configured so that one tube 61 extends from the first header 65a to the second header 65b and the refrigerant is moved in the same movement direction. Hereinafter, movement of the refrigerant in the heat exchanger 60 will be described.

[0060] FIG. 7 is a view illustrating a movement direction of a refrigerant in the heat exchanger of FIG. 3.

[0061] Referring to FIG. 7, the refrigerant may pass through the first header 65a from the introduction refrigerant pipe 71 and may be moved to the tube 61. After a liquid or gaseous refrigerant is introduced into the tube 61, is moved along the tube 61 and is evaporated due to heat taken away from the external air, the refrigerant in a gaseous state may be moved to the discharging refrigerant pipe 72. Since the tube 61 to which the refrigerant is moved and the heat-exchanging fins 63 that contact the tube 61 are formed of materials having excellent thermal conductivity, cold air may be generated in the heat exchanger 60 when heat is transferred to the refrigerant by contacting with the external air. The evaporated refrigerant may be moved along the tube 61 and may be moved to the discharging refrigerant pipe 72 through the second header 65b. The refrigerant may be moved from the lower portion of the heat exchanger 60 to the upper portion thereof in a state in which the heat exchanger 60 is installed in the storage compartment 20 and may be heat-exchanged with air.

[0062] The heat exchanger 60 according to an exemplary embodiment of the present disclosure may improve heat-exchanging efficiency owing to the above-described configuration. Thus, in order to generate the same heat-exchanging efficiency, the volume of the heat exchanger 60 can be reduced.

[0063] Hereinafter, the present disclosure provides a heat exchanger according to another embodiment of the present disclosure.

[0064] FIG. 8 is a view illustrating a heat exchanger in accordance with another embodiment of the present disclosure, and FIGS. 9 and 10 are views illustrating a movement direction of a refrigerant in the heat exchanger of FIG. 8.

[0065] Referring to FIGS. 8 through 10, a heat exchanger 80 may include a tube 81, heat-exchanging fins 83, headers 85, an introduction refrigerant pipe 71, and a discharging refrigerant pipe 72. The heat exchanger 80 illustrated in FIGS. 8 through 10 has a different configuration of the tube 81 and the headers 85 compared to that of the heat exchanger 60 of FIG. 3, and the remaining configuration of the heat exchanger 80 is the

same as that of the heat exchanger 60. Hereinafter, only the different configuration of the heat exchanger 80 from that of the heat exchanger 60 of FIG. 3 will be described, and a description of the same configuration will be omitted.

[0066] The tube 81 may be disposed in such a way that the refrigerant flows in the tube 81 and is heat-exchanged with the external air. The tube 81 may include a material having high thermal conductivity so that the refrigerant flowing in the tube 81 may be easily heat-exchanged with the external air. The tube 81 may include an aluminum material. Although not shown, a plurality of channels on which the refrigerant may be moved, may be formed in the tube 81.

[0067] A plurality of tubes 81 may be provided and may be installed to be parallel to one another. The plurality of tubes 81 may be configured to connect a first header 85a and a second header 85b. As illustrated in FIG. 10, the tubes 81 may include a first tube 81a and a second tube 81b installed to be spaced a predetermined distance apart from the first tube 81a. The first tube 81a and the second tube 81b may form a heat transfer space 81c. The heat-exchanging fins 83 may be disposed in the heat transfer space 81c. The plurality of tubes 81 including the first tube 81a and the second tube 81b may be disposed in a position in which the tubes 81 overlap each other, when viewed from above. The plurality of tubes 81 of the heat exchanger 80 may be provided as separate flow paths.

[0068] The first header 85a and the second header 85b may be formed in a cylindrical shape so that the plurality of tubes 81 may be connected to the first header 85a and the second header 85b, respectively. The first header 85a and the second header 85b may be disposed to be parallel to each other.

[0069] As illustrated in FIGS. 9 and 10, in the heat exchanger 80, the refrigerant may pass through the first header 85a from the introduction refrigerant pipe 71 and may be moved to the tubes 81. After a liquid or gaseous refrigerant is introduced into the tubes 81, is moved along the tubes 81 and is evaporated due to heat taken away from the external air, the refrigerant in a gaseous state may be moved to the discharging refrigerant pipe 72. Since the tubes 81 to which the refrigerant is moved and the heat-exchanging fins 83 that contact the tubes 81 are formed of materials having excellent thermal conductivity, cold air may be generated in the heat exchanger 80 when heat is transferred to the refrigerant by contacting with the external air. The evaporated refrigerant may be moved along the tubes 81 and may be moved to the discharging refrigerant pipe 72 through the second header 85b.

[0070] As described above, in a refrigerator according to the one or more of the above exemplary embodiments, cooling efficiency of the refrigerator can be improved. In addition, owing to an improved structure of a heat exchanger used as an evaporator, heat-exchanging efficiency can be improved even when the volume of the

evaporator is small.

[0071] The above detailed description is just for the purpose of illustrating the present invention as defined by the claims. Embodiments can be used in various different combinations, changes, and environments. 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 these embodiments without departing from the principles of the invention, the scope of which is defined in the claims.

Claims

1. A refrigerator comprising:

a storage compartment; and
a cold air generating unit installed in the storage compartment and comprising a heat exchanger to generate cold air, the heat exchanger comprising:

a tube forming a heat-exchanging space and having therein a plurality of flow paths in which a refrigerant flows,
heat-exchanging fins in contact with the tube in the heat-exchanging space, headers connected to one side and another side of the tube, respectively, and
a refrigerant pipe connected to the headers to introduce the refrigerant into the tube or discharge the refrigerant from the tube.

2. The refrigerator of claim 1, wherein the tube comprises a plurality of contact portions, which extend in contact with the heat-exchanging fins and are disposed to be parallel to one another, and a connection portion provided in a bent shape so as to connect the plurality of contact portions.

3. The refrigerator of claim 1 or 2, wherein the tube surrounds the heat-exchanging fins in contact with the tube.

4. The refrigerator of claim 1, 2 or 3, wherein the headers comprise a first header connected to an introduction refrigerant pipe through which the refrigerant is introduced into the tube, and a second header connected to a discharging refrigerant pipe through which the refrigerant is discharged from the tube,
a lower side of the tube is coupled to the first header, and
an upper side of the tube is connected to the second header.

5. The refrigerator of any one of the preceding claims,

wherein

the heat-exchanging fins comprise first inclined surfaces inclined upward in a first direction and second inclined surfaces that extend from the first inclined surfaces and are inclined downward in the first direction, and
a plurality of first inclined surfaces and a plurality of second inclined surfaces are coupled to each other.

6. The refrigerator of any one of the preceding claims, wherein a plurality of grooves are formed in the heat-exchanging fins.

7. The refrigerator of any one of the preceding claims, wherein the heat-exchanging fins have a shape in which they are bent a plurality of times at sections of the heat-exchanging fins in contact with inner surfaces of the contact portions facing the heat-exchanging space.

8. The refrigerator of claim 7, wherein the heat-exchanging fins comprise:

first heat-exchanging fins disposed at an upper portion of the heat-exchanging space; and
second heat-exchanging fins disposed at a lower portion of the first heat-exchanging fins, and the second heat-exchanging fins are disposed to cross the first heat-exchanging fins when viewed from above.

9. The refrigerator of claim 7, wherein the heat-exchanging fins comprise:

first heat-exchanging fins disposed at an upper portion of the heat-exchanging space; and
second heat-exchanging fins disposed at a lower portion of the first heat-exchanging fins, wherein a distance between portions in which the second heat-exchanging fins are bent, is greater than a distance between portions in which the first heat-exchanging fins are bent.

10. A heat exchanger comprising:

a tube in which a refrigerant is moved and which is bent a plurality of times;
heat-exchanging fins surrounded by the tube and in contact with the tube;
headers connected to one side and another side of the tube, respectively; and
a refrigerant pipe connected to the headers to introduce the refrigerant into the tube or discharge the refrigerant from the tube,
the tube comprising a plurality of contact portions, which extend in contact with the heat-exchanging fins and are disposed to be parallel to one another, and a connection portion provided

in a bent shape so as to connect the plurality of contact portions.

11. The heat exchanger of claim 10, wherein the tube is provided as a multi-channel tube having a plurality of flow paths on which the refrigerant is moved. 5
12. The heat exchanger of claim 10 or 11, wherein the headers comprise a first header connected to an introduction refrigerant pipe through which the refrigerant is introduced into the tube, and a second header connected to a discharging refrigerant pipe through which the refrigerant is discharged from the tube, 10
a lower side of the tube is coupled to the first header, 15
and
an upper side of the tube is connected to the second header.
13. The heat exchanger of claim 10, 11 or 12, wherein the heat-exchanging fins comprise first inclined surfaces inclined upward in a first direction and second inclined surfaces that extend from the first inclined surfaces and are inclined downward in the first direction, and 20
a plurality of first inclined surfaces and a plurality of second inclined surfaces are coupled to each other. 25
14. The heat exchanger of claim 13, wherein a plurality of grooves are formed in the first inclined surfaces and the second inclined surfaces of the heat-exchanging fins. 30
15. The heat exchanger of any one of claims 10 to 14, wherein the heat-exchanging fins have a shape in which they are bent a plurality of times so as to be in contact with inner surfaces of the contact portions facing a heat-exchanging space. 35

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FIG. 1

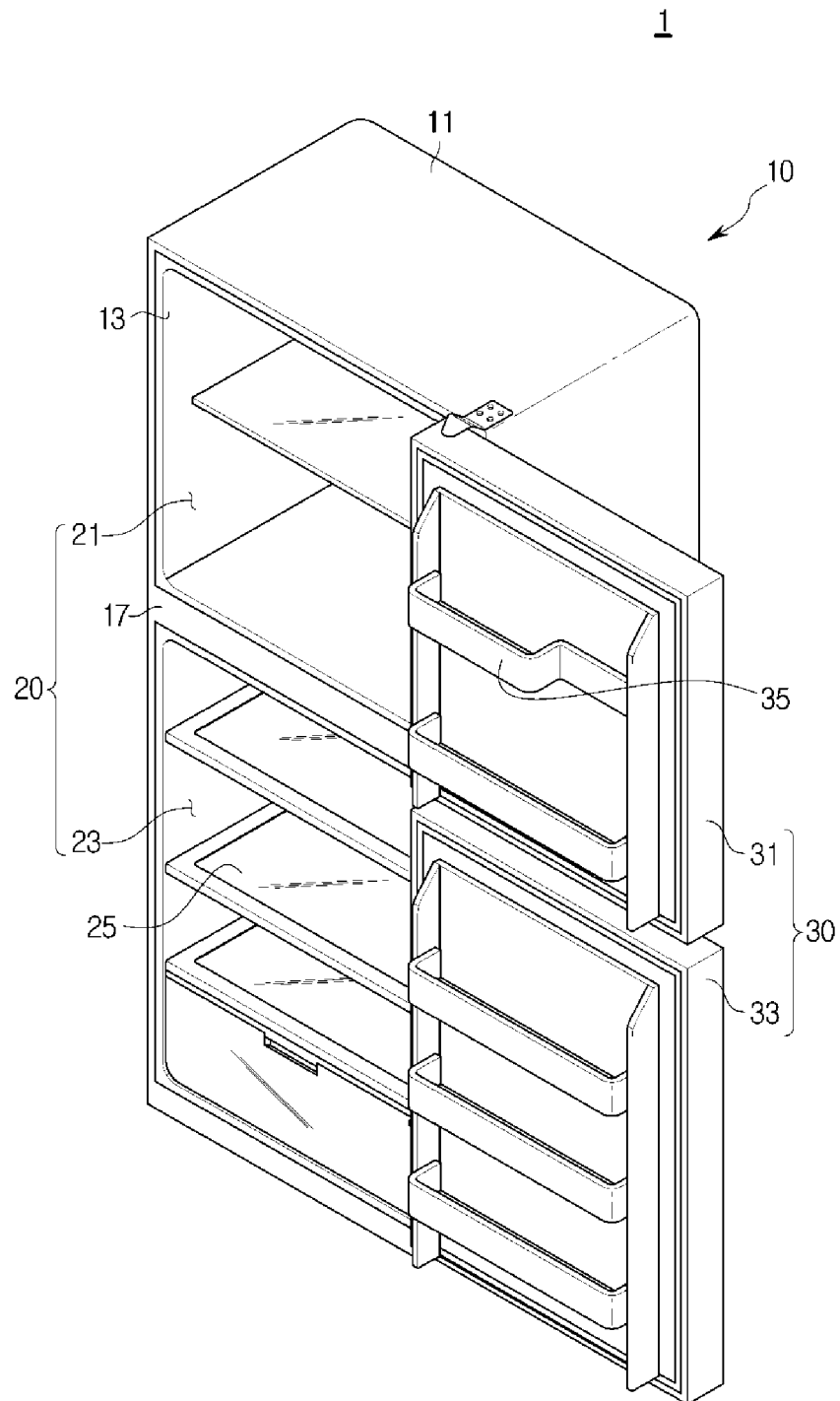


FIG. 2

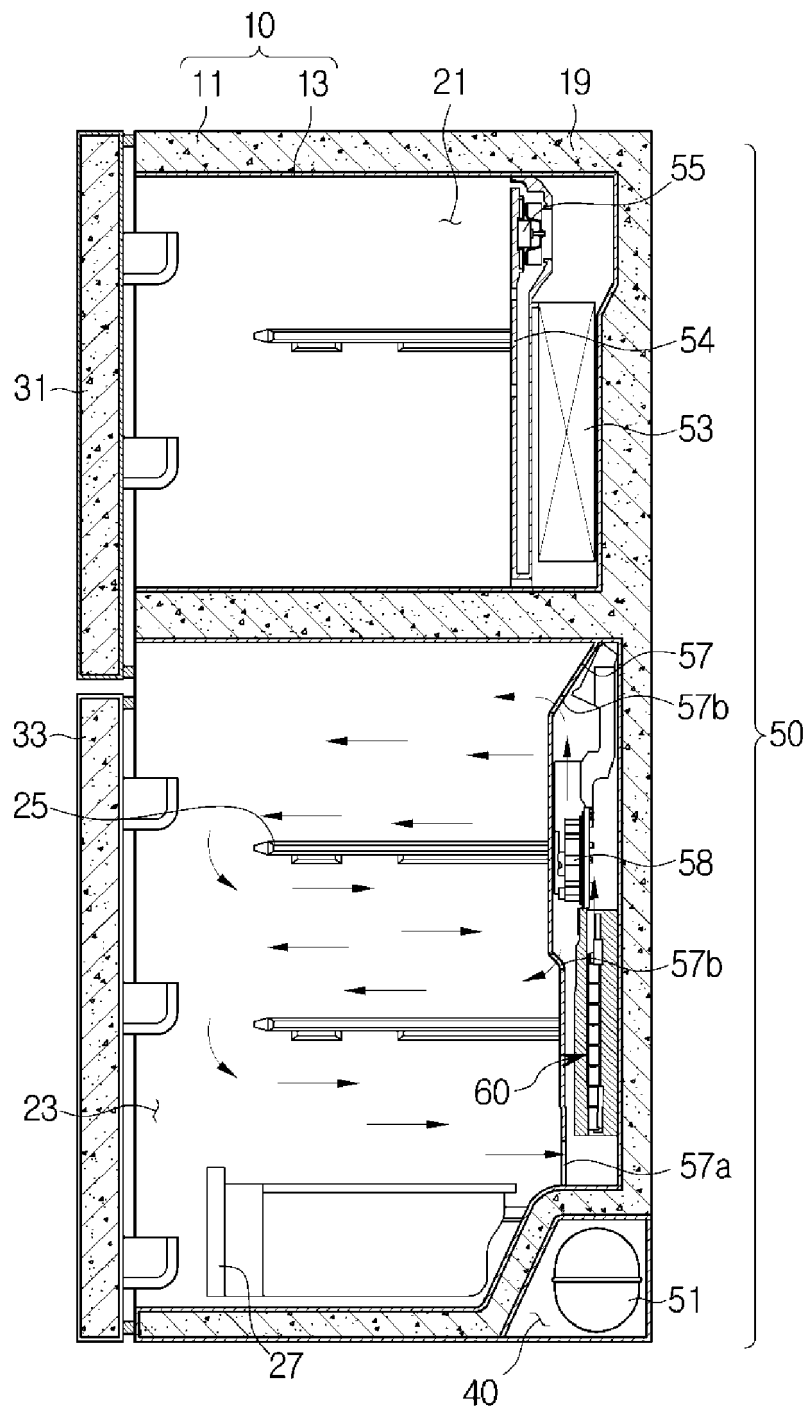


FIG. 3

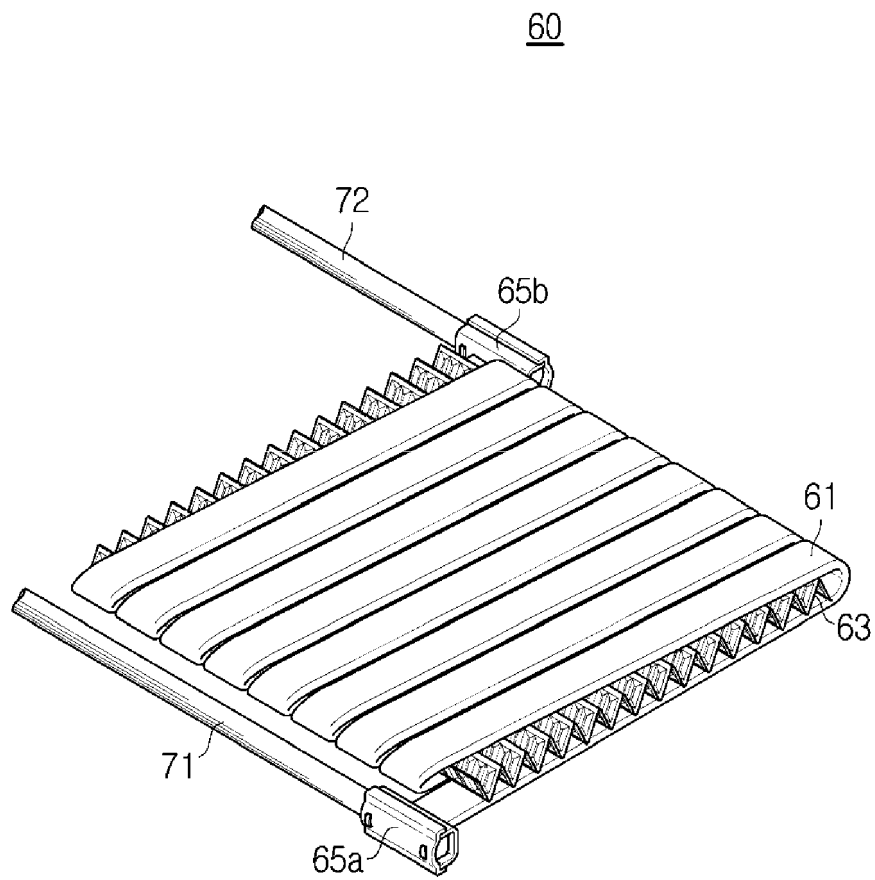


FIG. 4

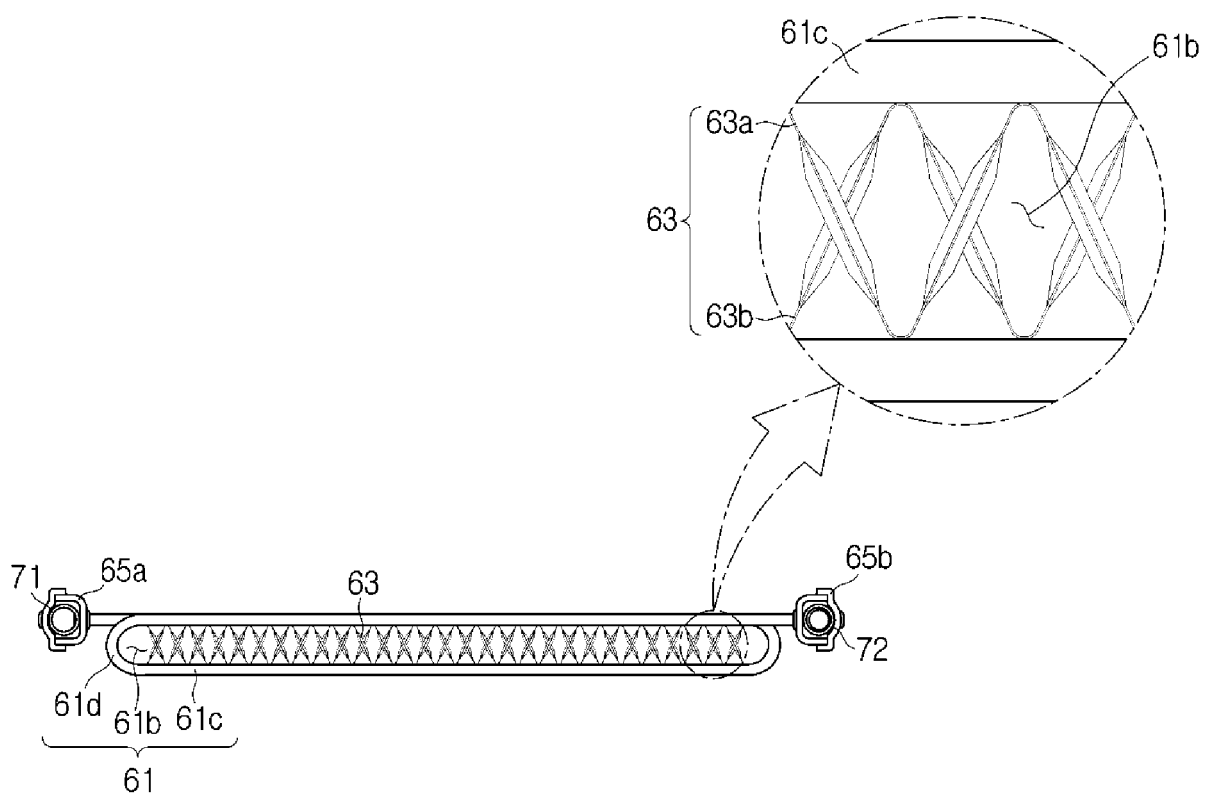


FIG. 5

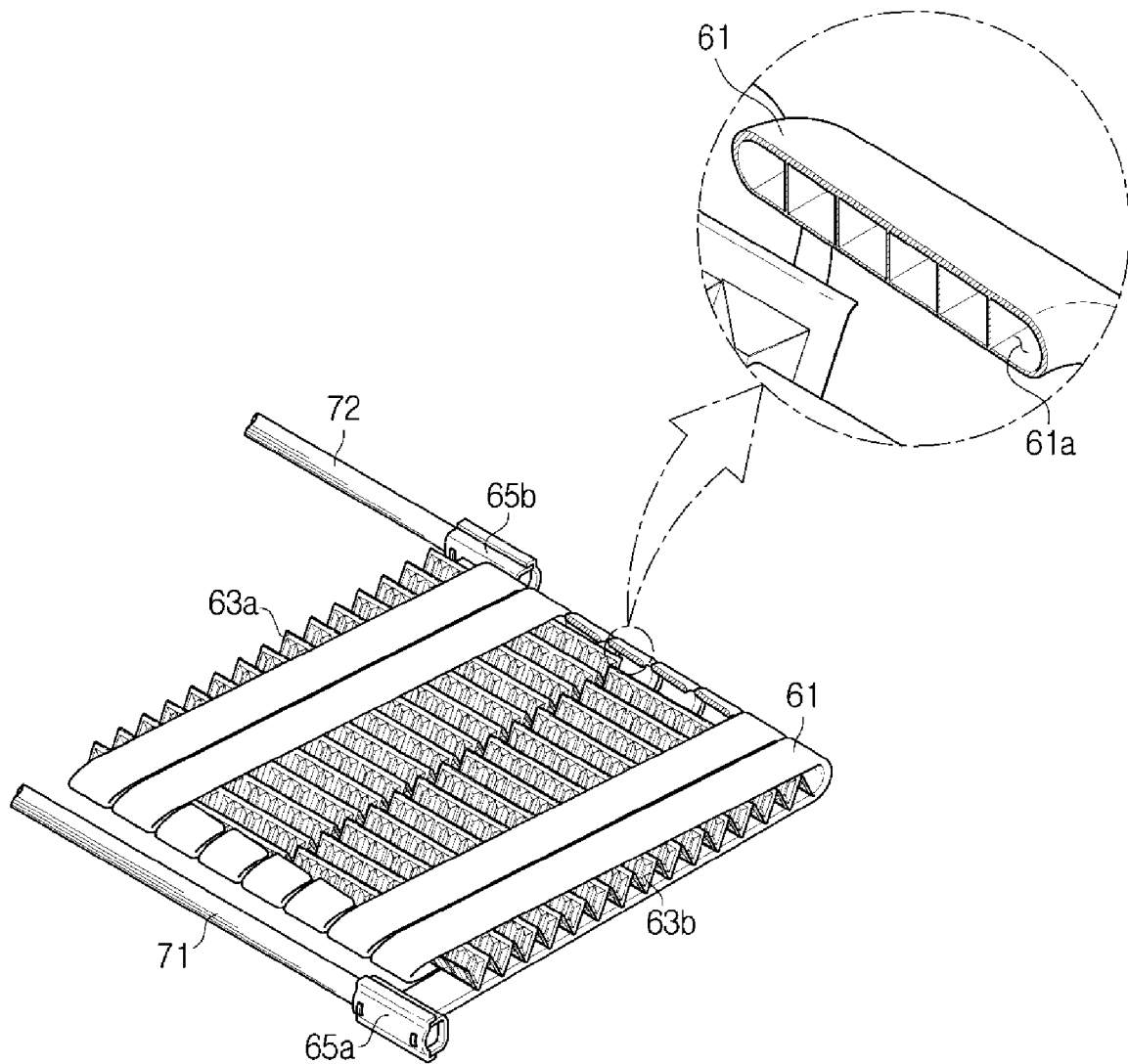


FIG. 6

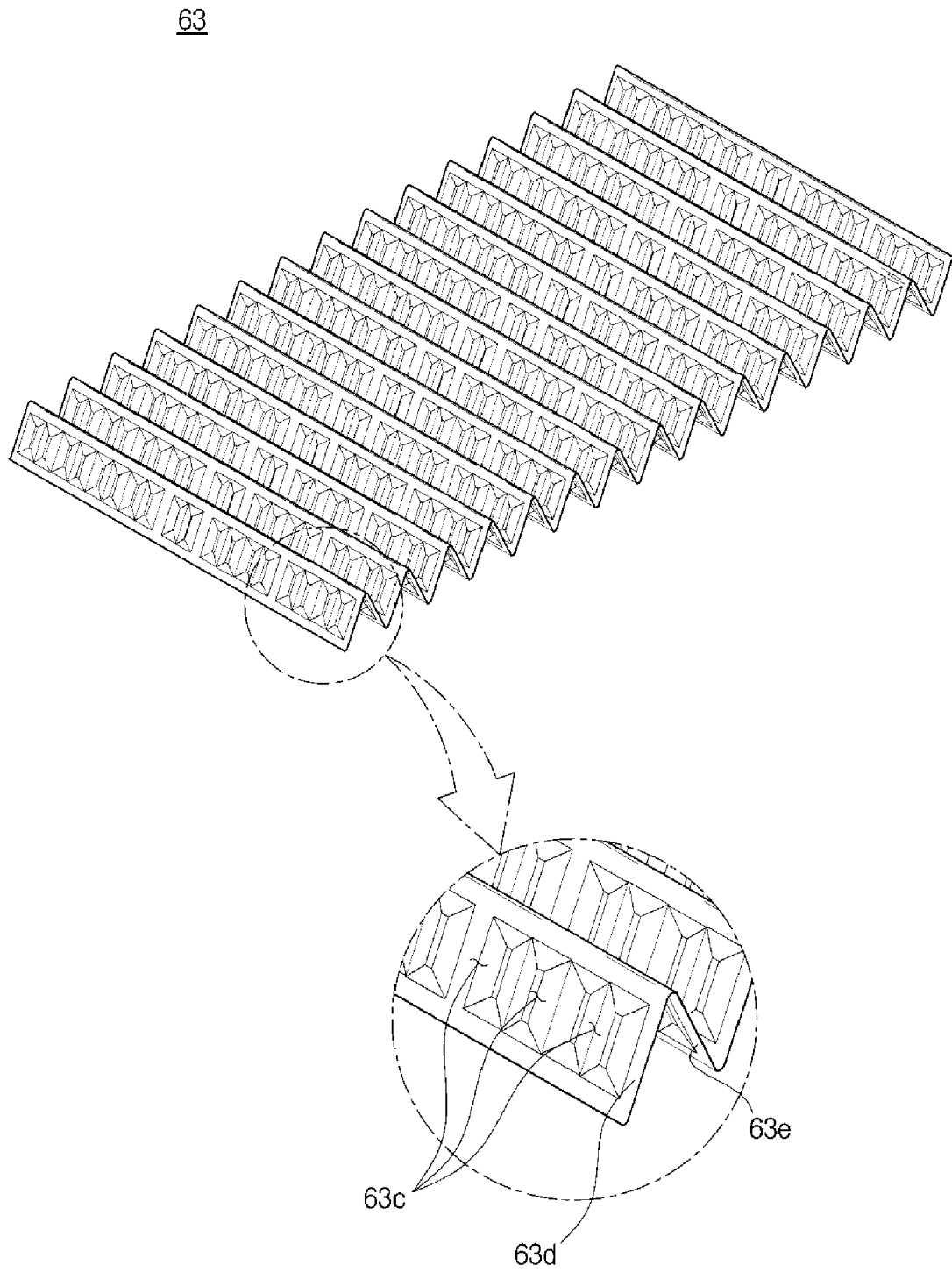


FIG. 7

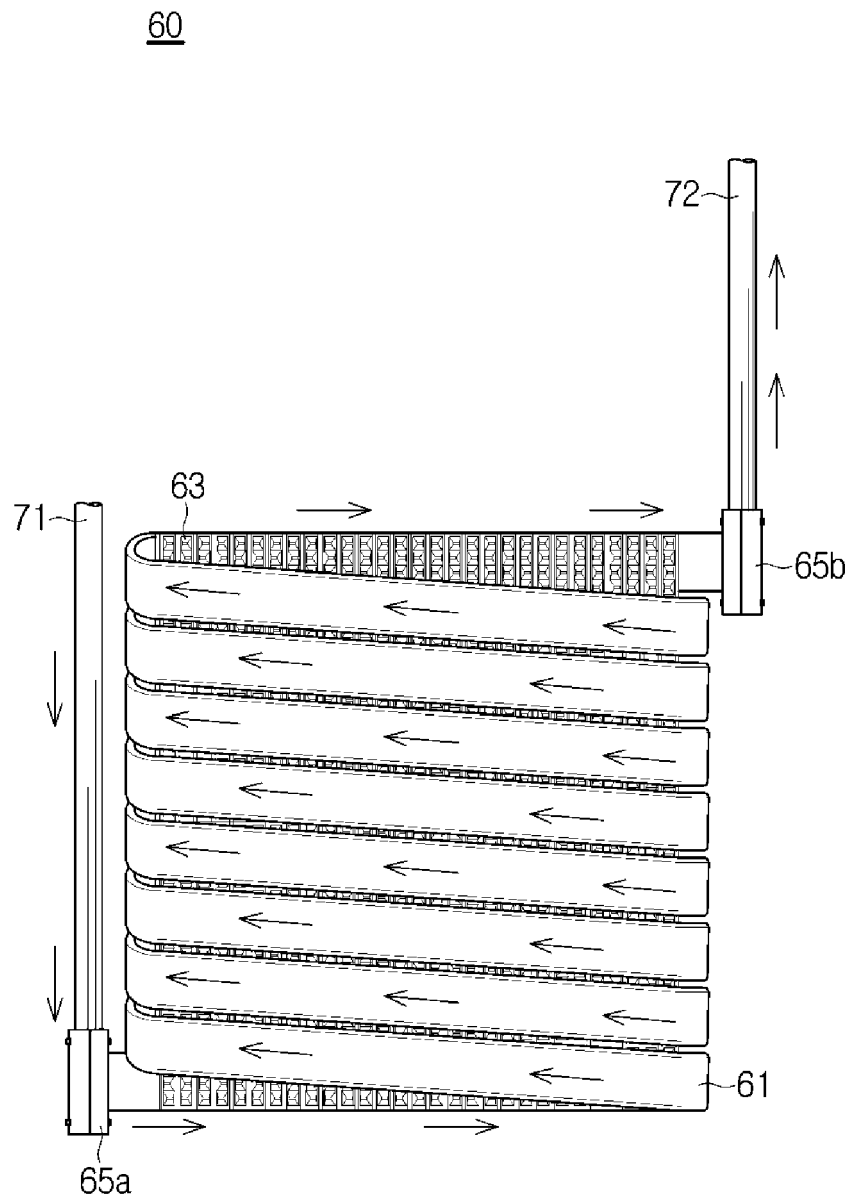


FIG. 8

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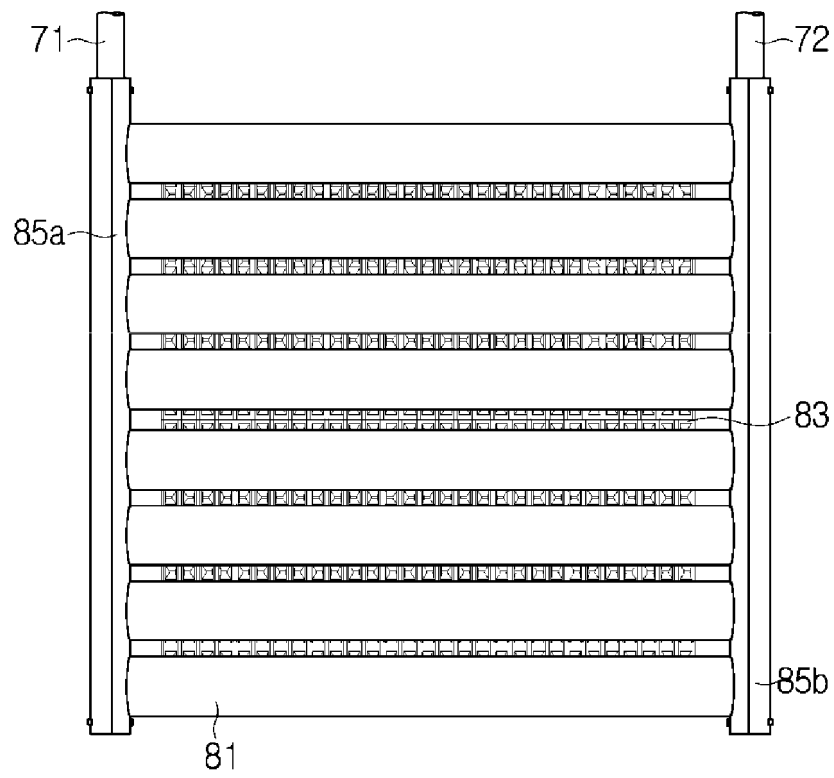


FIG. 9

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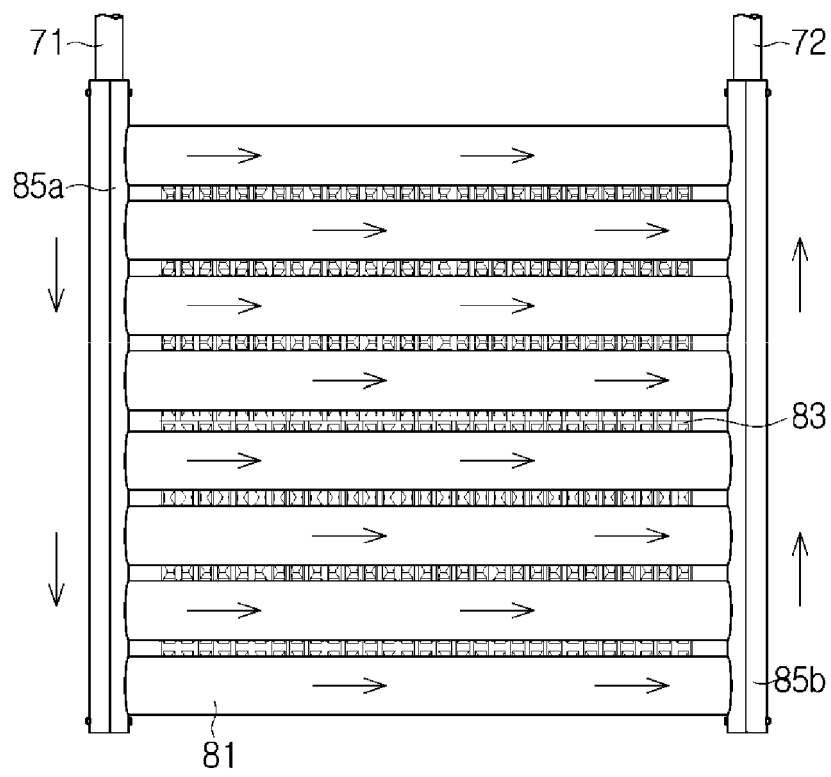
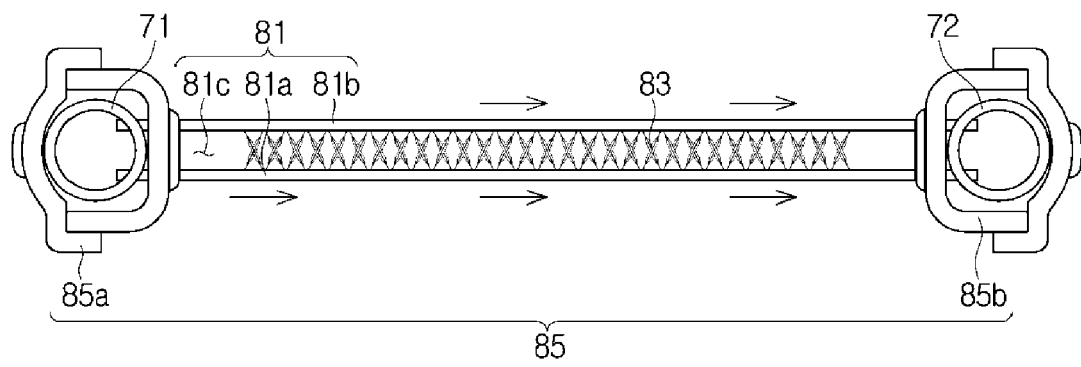


FIG. 10





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Place of search The Hague		Date of completion of the search 22 July 2016	Examiner Kuljis, Bruno
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