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(11)

EP 1 439 365 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
21.07.2004 Bulletin 2004/30

(51) Int Cl.7: **F28F 9/02**

(21) Application number: **03024821.5**

(22) Date of filing: **31.10.2003**

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

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(30) Priority: **15.01.2003 KR 2003002700**

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(54) **Heat exchanger**

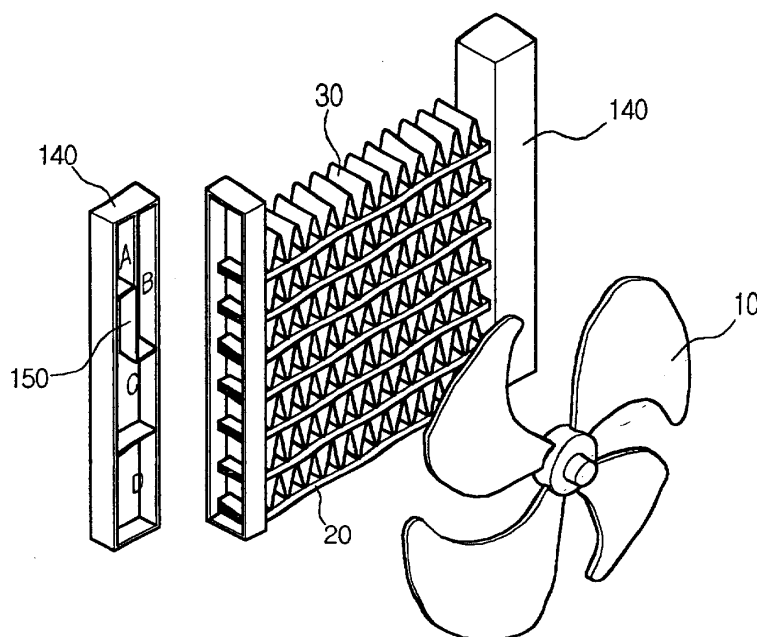
(57) Disclosed herein is a heat exchanger in which a header in the heat exchanger is made of a material of plastic so that a regulator plate to define a passage of pipe can be formed freely. Also, not only a passage between pipes but also a passage between fine tubes in the same pipe can be formed. Accordingly, formation of a passage to accomplish maximal heat exchange efficiency is possible.

In addition, the heat exchange performance is im-

proved by forming a more number of fine tubes having a less small diameter, compared to the pipes of the material of aluminum, using the pipes of the material of plastic.

The heat exchanger according to the present invention constructed as above can accomplish the improvement of heat exchange performance by the maximum of 30% over the heat exchanger of the material of aluminum.

Fig.2



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to a heat exchanger, and more particularly to a heat exchanger, which improves an efficiency of heat exchange by optimizing shapes of a pipe and a header and forming a passage of coolant between fine tubes constituting the pipe.

2. Description of the Related Art

[0002] Nowadays, a demand for air conditioners has been steadily increased due to an improvement of a standard of living, and accordingly the air conditioners that have been conventionally used in a large-scaled unit are being widely diffused into households.

[0003] In general, these air conditioners achieve an air conditioning through a compression step of converting low temperature-low pressure gas coolant into high temperature-high pressure gas coolant, a condensation step of converting the high temperature-high-pressure gas coolant into intermediate temperature-high-pressure liquid coolant, an expansion step of converting the intermediate temperature-high pressure liquid coolant into low temperature-low pressure liquid coolant, and an evaporation step of converting the low temperature-low pressure liquid coolant into low temperature-low pressure gas coolant.

[0004] Considering detailed devices performing these steps, the compression step, the condensation step, the expansion step, and the evaporation steps are performed in a compressor, a condenser, an expansion valve, and an evaporator, respectively.

[0005] At this time, whether an air conditioner is a cooler or heater depends on indoor or outdoor installation positions of the condenser and the evaporator of the devices. If the condenser is located in the indoor, the air conditioner is the heater. If the evaporator is located in the indoor, the air conditioner is the cooler.

[0006] The condenser and the evaporator are generally comprised of a heat exchanger. The heat exchanger is an apparatus for directly or indirectly contacting two kinds of fluid having different temperatures each other such that heat is exchanged.

[0007] Specially, the heat exchanger is comprised of pipes in a zigzag form for heat exchange, pins located between the zigzag-formed pipes for increasing an efficiency of heat exchange, and a fan for supplying air for the zigzag-formed pipes. By the way, when a small air conditioner is required such as in a household, a small heat exchanger with a material of aluminum is used. In this case, considering the material of aluminum, the heat exchanger with a different structure is used.

[0008] More particularly, the heat exchanger with the

material of aluminum includes a fan for producing a flow of air, pipes in a plate bar shape for a passage of water, a header located at both ends of the pipes for forming a passage of water between the pipes, and a regulator plate inserted into the header for regulating the passage in the header.

[0009] Here, as the header, a cylindrical or semi-cylindrical shape header is generally used. The cylindrical header is manufactured in such a manner that pipe insertion holes are formed at a constant interval and then the pipes are inserted and assembled into the pipe insertion holes. The semi-cylindrical header, which is separated into insertion portions into which the pipes are inserted and cover portions for covering the insertion portion, is manufactured in such a manner that the pipes are inserted into the pipe insertion holes formed on the insertion portions and then are engaged with the cover portion.

[0010] FIG. 1 shows a structure of a conventional heat exchanger. Referring to FIG. 1, as described earlier, the conventional heat exchanger includes a fan 10 for producing a flow of air by a force of rotation; a plurality of pipes 20 layered vertically by an appropriate number in which heat is exchanged due to the flow of air produced by the fan 10; a plurality of pins 30 formed by a plate folded repeatedly in order to increase the efficiency of heat exchange and adhered closely to the pipes 20 between the pipes; a header 40 located at both ends of the pipes 20 for forming a passage of water between the pipes; and a regulator plate 50 inserted into the header 40 for regulating the passage in the header.

[0011] The heat exchanger constructed as above accomplishes a heat exchange while the air produced by the fan 10 passes through the pipes provided with the pins. Particularly, an efficient heat exchange can be accomplished by inserting the regulator plate 50 into an appropriate position inside the header so that a coolant passage is formed in a vertical direction.

[0012] However, such an approach has a problem that the efficiency of heat exchange is not sufficient.

SUMMARY OF THE INVENTION

[0013] Accordingly, the present invention has been made keeping in mind the above problem occurring in the prior art, and an object of the present invention is to provide a heat exchanger which is capable of accomplishing a more efficient heat exchange by forming a coolant passage between fine tubes constituting the pipes as well as between the pipes, as compared to the conventional approach by which the coolant passage is formed only between the pipes.

[0014] In order to accomplish the above object, the present invention provides a heat exchanger comprising a plurality of pipes, each including a plurality of fine tubes; and a header to enable formation of a passage between fine tubes in the same pipe as well as between the pipes.

[0015] Preferably, each of said plurality of pipes is made of a plastic material so that a plurality of fine tubes can be formed.

[0016] Preferably, said header is made of a plastic material so that a regulator plate inside said header can be freely formed. Accordingly, it is possible to facilitate formation of a passage between fine tubes in the same pipe as well as between the pipes due to a free construction of the regulator plate into the header. Accordingly, there provides a benefit of an increase in an efficiency of heat exchange.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a diagram showing a structure of a conventional heat exchanger;

FIG. 2 is a schematic diagram showing a heat exchanger according to a preferred embodiment of the present invention;

FIG. 3 is a schematic diagram showing a heat exchanger according to another preferred embodiment of the present invention; and

FIG. 4 is a state diagram showing a comparison in heat exchange performance between a heat exchanger using a header and pipes of a plastic material according to the present invention and a conventional heat exchanger using a header and pipes of an aluminum material.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0019] FIG. 2 is a schematic diagram showing a heat exchanger according to a preferred embodiment of the present invention.

[0020] Referring to FIG. 2, the heat exchanger according to the preferred embodiment includes a fan 10 for producing a flow of air by a force of rotation; a plurality of pipes 20 layered vertically by an appropriate number in which heat is exchanged due to the flow of air produced by the fan 10; a plurality of pins 130 formed by a plate folded repeatedly in order to increase the efficiency of heat exchange and adhered closely to the pipes 20 between the pipes; a header 140 located at both ends of the pipes 20 for forming a passage between the fine tubes in the same pipe as well as between the pipes 20; and a regulator plate 150 inserted into the header 140 for regulating the passage in the header.

[0021] More particularly, each of the pipes 20 is re-

ferred to as a micro-tube assuming a shape of rectangular parallelepiped and is comprised of a plurality of fine tubes. The number of fine tubes is typically 9 or 10. The reason for such a division of the fine tubes is that a partition for increasing durability is formed in the middle of pipe since aluminum is frail. Like this, the pipes 20 of the material of aluminum is suitable to a small heat exchanger since a heat exchange efficiency is high and a less space is required, compared to a heat exchanger using typical copper pipes.

[0022] On the other hand, pins 30 of the material of aluminum are adhered between the pipes 20 in order to increase the heat exchange efficiency more.

[0023] The header 140 is a member adhered to both ends of a group of pipes 20 which are multi-layered for forming a passage between the pipes by properly constructing the regulator plate 150 in a middle portion inside the header 140.

[0024] In this embodiment, the regulator plate 150 can be freely constructed by manufacturing the header 140 employing a material of plastic through a plastic heat-melting.

[0025] Conventionally, since the header used the same material of aluminum as the pipe and so the regulator plate was mounted such that only a passage between the pipes could be defined due to a problem of welding between metals, formation of a passage could not be optimized. However, in this embodiment, since the regulator plate of the material of plastic is constructed, an optimal passage formation is possible.

[0026] Referring to FIG. 2, it can be seen that the header is partitioned into A, B, C and D by the regulator plate. Namely, in this embodiment, the regulator plate mounted in only a horizontal direction in the past is also mounted in a vertical direction to enable formation of a passage with a precise capacity.

[0027] In this embodiment, it can be seen that the passage is configured such that the coolant is flown in order of A, B, C and D, and, during this procedure, is flown into passages formed by fine tubes in the same pipe.

[0028] FIG. 3 is a schematic diagram showing a heat exchanger according to another preferred embodiment of the present invention.

[0029] Referring to FIG. 3, the heat exchanger according to the another preferred embodiment includes a fan 10 for producing a flow of air by a force of rotation; a plurality of pipes 120, each including a plurality of fine tubes, layered vertically by an appropriate number in which heat is exchanged due to the flow of air produced by the fan 10; a header 140 located at both ends of the pipes 120 for forming a passage between the fine tubes in the same pipe as well as between the pipes 120; and a regulator plate 150 inserted into the header 140 for regulating the passage in the header.

[0030] Here, it can be seen that the header 140 is the same as the header of FIG. 2, but the pipes 120 are changed differently from the pipes of FIG. 2.

[0031] In this embodiment, the pipes 120 made of the

material of plastic are different in structure from conventional aluminum pipes, considering the material of plastic.

[0032] First, there is no pin in this embodiment. The reason for this is that the provision of a pin of material of plastic has no meaning due to a low heat transfer capability of the material of plastic while pins of material of aluminum can transfer heat to pipes to which the pins are adhered due to a high heat transfer capability of the material of aluminum.

[0033] Next, diameters of the fine tubes of the material of plastic are very smaller than those of the fine tubes of the material of aluminum. Accordingly, a number of fine tubes constitute one pipe.

[0034] Among the coolant occupying a heat resistance of 13%, a pipe wall occupying a heat resistance of 7%, and air occupying a heat resistance of 80% when the whole of heat resistance is assumed as 100%, the pipes of the material of plastic constructed as above place an important point on increase of an efficiency of heat exchange accomplished in the air, while an efficiency of heat exchanger accomplished in the pipe wall is somewhat abandoned. This is because diameters of the fine tubes of the material of plastic are very smaller than those of the fine tubes of the material of aluminum, and accordingly more fine tubes can be formed in equal width, compared to the fine tubes of the material of aluminum.

[0035] Therefore, the entire heat exchange efficiency is increased, and can be more increased by using the header 140 of the material of plastic described in FIG. 2.

[0036] FIG. 4 is a state diagram showing a comparison in heat exchange performance between the heat exchanger using the header and pipes of the plastic material described as above and the conventional heat exchanger using the header and pipes of the aluminum material. It can be seen from the state diagram that a heat exchange performance is improved by about 20-30% in an interval of a typically applied air flow 0.5-0.8.

[0037] A unit in the left of the state diagram represents a total heat transfer coefficient. The multiplication of the total heat transfer coefficient and a temperature difference is a heat capacity, i.e., a heat exchange capacity. The temperature difference means a difference between a temperature of coolant introduced into the heat exchanger and a temperature of coolant for cooling air.

[0038] As described above, according to the present invention, the header in the heat exchanger is made of the material of plastic so that the regulator plate to define a passage of pipe can be formed freely. Also, not only a passage between the pipes but also a passage between the fine tubes in the same pipe can be formed. Accordingly, formation of a passage to accomplish maximal heat exchange efficiency is possible.

[0039] In addition, the heat exchange performance is improved by forming a more number of fine tubes having a less small diameter, compared to the pipes of the ma-

terial of aluminum, using the pipes of the material of plastic.

[0040] The heat exchanger according to the present invention constructed as above can accomplish the improvement of heat exchange performance by the maximum of 30% over the heat exchanger of the material of aluminum.

[0041] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

1. A heat exchanger comprising:

a fan for producing a flow of air by a force of rotation;
a plurality of pipes, each including a plurality of fine tubes, layered vertically by an appropriate number in which heat is exchanged due to the flow of air produced by said fan;
a plurality of pins formed by a plate folded repeatedly in order to increase an efficiency of heat exchange and adhered closely to said plurality of pipes between said plurality of pipes;
at least one header located at both ends of said plurality of pipes for forming a passage between said plurality of fine tubes in the same pipe as well as between said plurality of pipes; and
a regulator plate inserted into said at least one header for regulating the passage said at least one header.

2. The heat exchanger according to claim 1, wherein each of said plurality of pipes is made of a plastic material.

3. The heat exchanger according to claim 1, wherein each of said plurality of pins is made of an aluminum material.

4. The heat exchanger according to claim 1, wherein said at least one header is made of a plastic material.

5. The heat exchanger according to claim 1, wherein said at least one header includes a regulator plate mounted in not only a horizontal direction but also a vertical direction to enable formation of a passage with a precise capacity.

6. The heat exchanger comprising:

a fan for producing a flow of air by a force of rotation;
a plurality of pipes, each including a plurality of fine tubes, layered vertically by an appropriate number in which heat is exchanged due to the flow of air produced by said fan ;
at least one header located at both ends of said plurality of pipes for forming a passage between said plurality of fine tubes in the same pipe as well as between said plurality of pipes; and
a regulator plate inserted into said at least one header for regulating the passage in said at least one header.

7. The heat exchanger according to claim 6, wherein each of said plurality of pipes is made of a plastic material.

8. The heat exchanger according to claim 6, wherein said at least one header is made of a plastic material.

9. The heat exchanger according to claim 6, wherein said at least one header includes a regulator plate mounted in not only a horizontal direction but also a vertical direction to enable formation of a passage with a precise capacity.

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Fig.1
Related Art

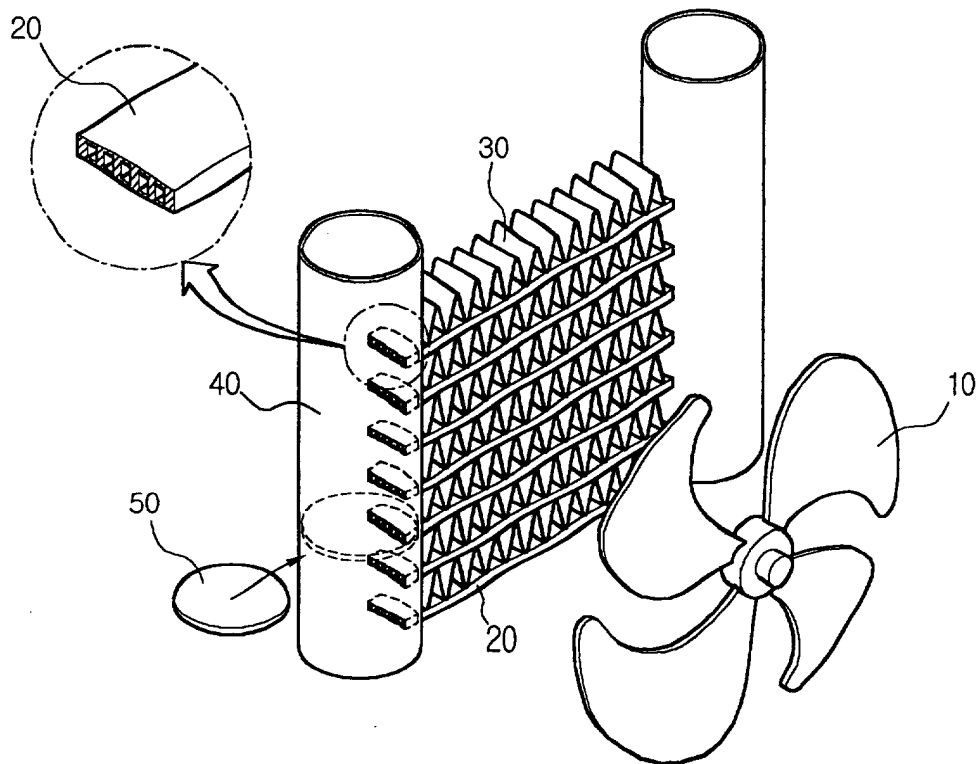


Fig.2

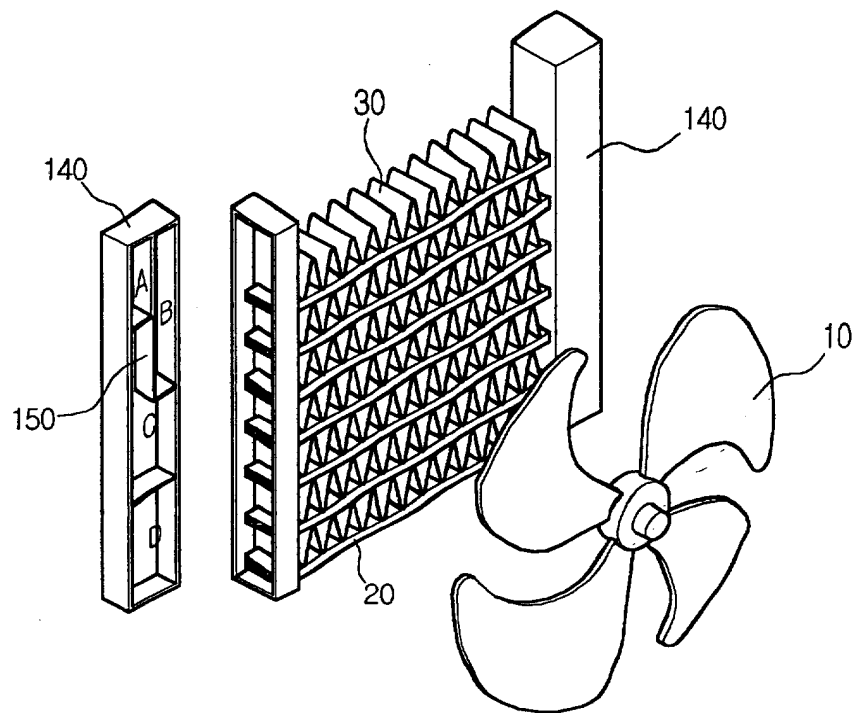


Fig.3

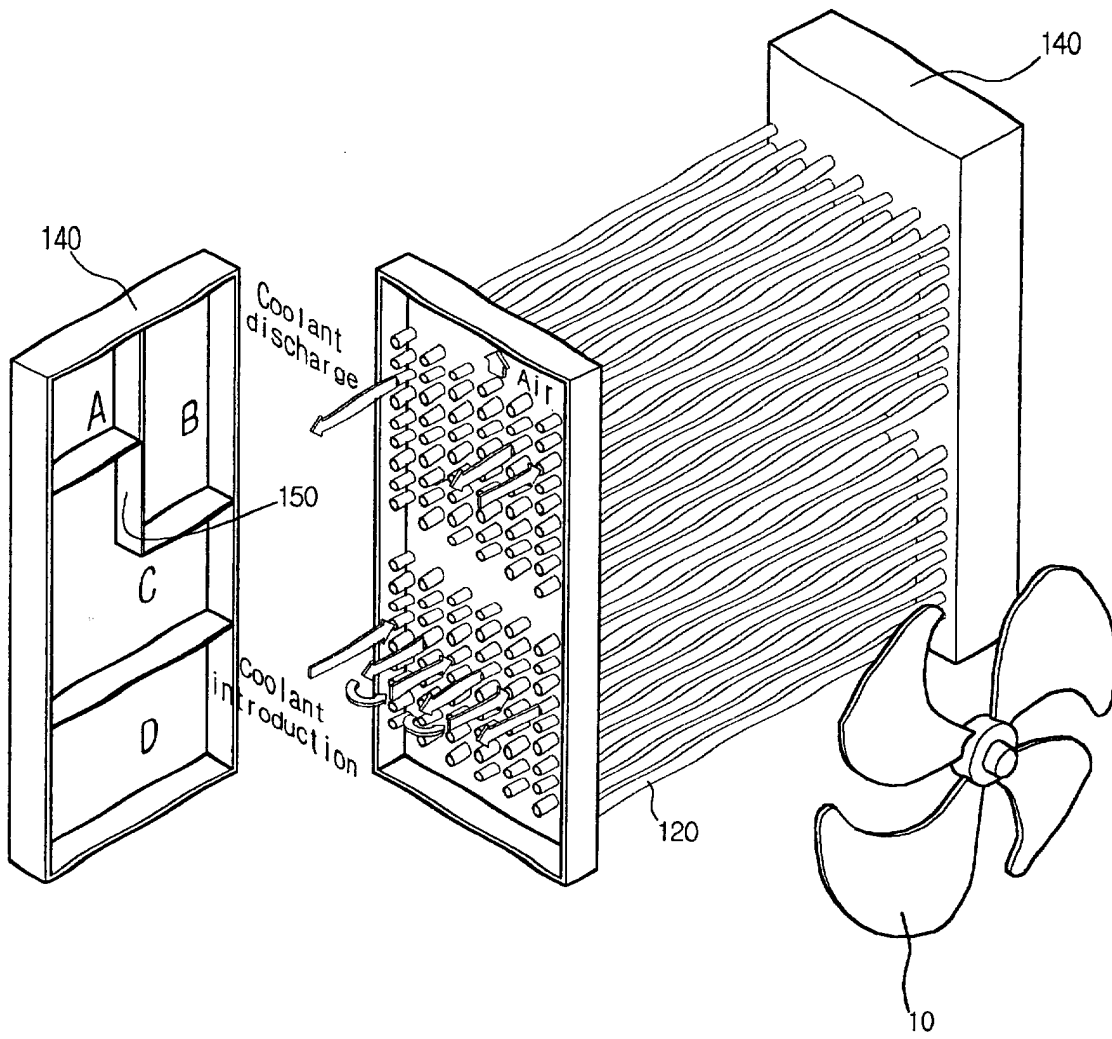
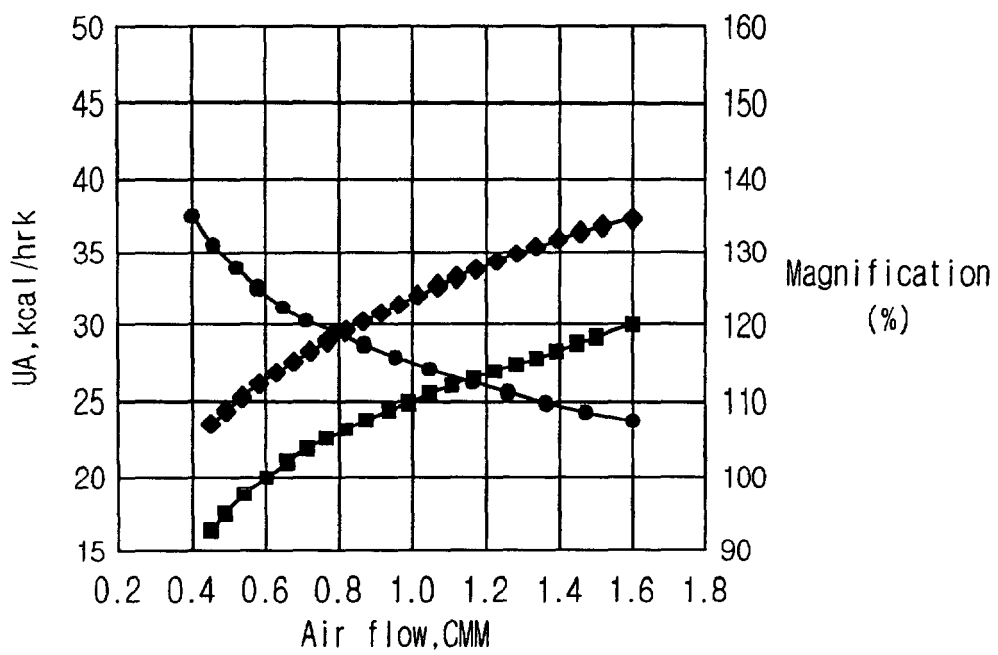


Fig.4



- Conventional heat exchange performance
- Magnification of performance in contrast to conventional performance
- ◆ Heat exchange performance of the present invention