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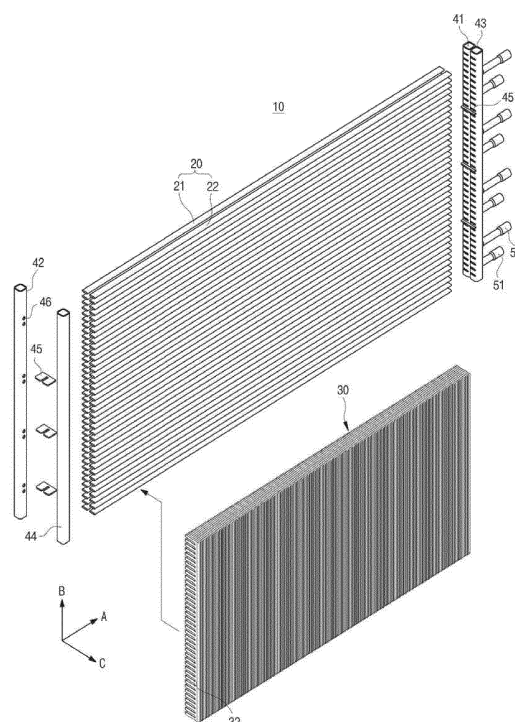
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(54) **HEAT EXCHANGER AND AIR CONDITIONER HAVING SAME**

(57) The present invention relates to a heat exchanger which additionally has a bead structure to be folded in a predetermined shape, and an air conditioner having the same. The heat exchanger includes a plurality of refrigerant tubes which respectively extend in a first direction, and are disposed to be spaced apart from each other in a second direction; and a fin array which is fitted to the plurality of refrigerant tubes in a third direction, wherein the fin array includes a plurality of insertion grooves which are disposed to be spaced apart in the second direction, such that the plurality of refrigerant tubes are inserted, a plurality of folding parts which are bent so that the plurality of insertion grooves are disposed at one side of the fin array, and a plurality of heat exchange fins which are divided by the plurality of insertion grooves and the plurality of folding parts. The strength can be reinforced by including the bead, and thus the fin array can be folded in the predetermined shape.

[Fig. 3]



Description

[Technical Field]

[0001] The present invention relates to a heat exchanger and an air conditioner having the same, and more particularly, to a heat exchanger which is capable of being folded in a predetermined shape, and an air conditioner having the same.

[Background Art]

[0002] Generally, an air conditioner is an apparatus which controls temperature, humidity, atmosphere, distribution or the like proper for human activity using a refrigeration cycle, and also removes dust or the like contained in air. Main elements forming the refrigeration cycle includes a compressor, a condenser, an evaporator, an expansion valve, a fan and so on.

[0003] The condenser and the evaporator are provided in the form of a heat exchanger which provides conditioned air through heat exchange between a refrigerant and the air. The heat exchanger includes a plurality of refrigerant tubes which are arranged to be spaced apart from each other, a header which is coupled to both ends of the plurality of refrigerant tubes, and a plurality of heat exchange fins which are coupled to between the plurality of refrigerant tubes so as to increase a contact area with an outside.

[0004] Conventional heat exchange fins are provided to extend in a lengthwise direction and also to be fitted to each of the refrigerant tubes. In such a type of heat exchange fins, it takes a long time for an assembling process, and it is also difficult to manufacture the heat exchange fins. Therefore, a fin array in which the heat exchange fins are manufactured in one plate type, folded in a predetermined shape, and then coupled to each of the refrigerant tubes may be used.

[0005] However, in a process in which the fin array is folded, there is a problem that, instead of a portion thereof to be folded, a weak portion having a low strength is folded. Also, in the case of the fin array which is fitted to one side of each of the refrigerant tubes, a gap between the heat exchange fins may not be maintained, and thus performance of the heat exchanger may be lowered.

[0006] Also, due to the header which is formed to extend in one direction, there is another problem that it is difficult to apply the heat exchanger including the plurality of refrigerant tubes and the header to an indoor unit of a wall-mounted air conditioner.

[Disclosure]

[Technical Problem]

[0007] The present invention is directed to providing a heat exchanger including a fin array which is bent in a predetermined shape, and an air conditioner having the

same.

[0008] Also, the present invention is directed to providing a heat exchanger which is capable of maintaining a gap between the folded fin arrays, and an air conditioner having the same.

[Technical Solution]

[0009] One aspect of the present invention provides a heat exchanger including a plurality of refrigerant tubes which respectively extend in a first direction, and are disposed to be spaced apart from each other in a second direction; and a fin array which is fitted to the plurality of refrigerant tubes in a third direction, wherein the fin array includes a plurality of insertion grooves which are disposed to be spaced apart in the second direction, such that the plurality of refrigerant tubes are inserted, a plurality of folding parts which are bent so that the plurality of insertion grooves are disposed at one side of the fin array, and a plurality of heat exchange fins which are divided by the plurality of insertion grooves and the plurality of folding parts.

[0010] Each of the heat exchange fins may include one pair of contact surfaces which face each other to form the plurality of insertion grooves, and one pair of connection surfaces which face each other to be connected to the plurality of folding parts.

[0011] The pair of connection surfaces may include a first connection surface which is disposed to be spaced apart from each of the heat exchange fins adjacent to each other in the second direction, and a second connection surface which is disposed to be connected to each of the heat exchange fins adjacent to each other in the second direction.

[0012] Each of the plurality of folding parts may include a first folding part which is disposed to connect the first connection surface of each of the heat exchange fins in the first direction, and a second folding part which is disposed to connect the second connection surface of each of the heat exchange fins in the first direction.

[0013] The pair of contact surfaces may include a burring part which increases a contact area with each of the plurality of refrigerant tubes.

[0014] The second connection surface may include a moisture guide groove which is formed in the second direction to discharge moisture generated during a heat exchange process.

[0015] Each of the heat exchange fins may include at least one bead which is disposed so that a plurality of folding parts are bent in a predetermined shape, and the at least one bead may be formed to protrude in the first direction.

[0016] Each of the heat exchange fins may include a plurality of louvers to change a path of air which exchanges heat while passing through the heat exchanger.

[0017] The plurality of louvers may include a first louver which is inclined from the third direction to one side, and a second louver which is inclined from the third direction

to the other side.

[0018] Each of the heat exchange fins may include at least one bead which is disposed so that a plurality of folding parts are bent in a predetermined shape, and the at least one bead may be located outside the plurality of louvers.

[0019] Each of the heat exchange fins may include a gap maintaining member which protrudes in the first direction of each of the heat exchange fins so as to be spaced apart from each other in the first direction and to be disposed at the plurality of refrigerant tubes.

[0020] The gap maintaining member may include a plurality of slits which are respectively formed to have a protuberated part at one side thereof, and each of the slits may be disposed so that the protuberated part of one slit is in contact with the protuberated part of another slit which is located at at least one heat exchange fin located adjacent in the first direction.

[0021] The gap maintaining member may include at least one tab which protrudes from one surface of each of the heat exchange fins.

[0022] The plurality of refrigerant tubes may include a first refrigerant tube and a second refrigerant tube which are located in parallel with each other in the third direction, and a plurality of first refrigerant tubes and a plurality of second refrigerant tubes may be disposed to be spaced apart from each other in the second direction.

[0023] The heat exchanger may include one pair of first headers which are coupled to both ends of the first refrigerant tube, and one pair of second headers which are coupled to both ends of the second refrigerant tube, and one side of each of the pair of first headers and the pair of second headers may include at least one through-hole so that a refrigerant passes through the first refrigerant tube and the second refrigerant tube.

[0024] Another aspect of the present invention provides a heat exchanger including a plurality of refrigerant tubes which has a path formed therein so that a refrigerant flows therethrough, and are stacked upward, and a fin array which is fitted to one side of the plurality of refrigerant tubes to be in contact with the plurality of refrigerant tubes, wherein the fin array includes a plurality of folding parts which are bent along a predetermined bending line, and at least one bead which is disposed adjacent to the plurality of folding parts and provided so that the plurality of folding parts are bent along the predetermined bending line.

[0025] The at least one bead may be formed by performing a pressing from one surface of the fin array toward the other surface thereof.

[0026] The heat exchanger may include the plurality of refrigerant tubes, and a header which is coupled to the plurality of refrigerant tubes and formed to extend from a first end to a second end, and the header may include at least one bending part which is bent in a direction which becomes close to the first end and the second end.

[0027] The at least one bending part may include a cutting surface which cuts at least a part of the header.

[0028] The at least one bending part may include a support part which connects at least a part of the header, such that parts of the header which are separated by the cutting surface are connected to each other.

[0029] The heat exchanger may include a fin array which is fitted to the plurality of refrigerant tubes, and the fin array may include at least one notch corresponding to the at least one bending part.

[0030] The at least one notch may be provided in a shape in which at least a part of the fin array is removed, and the fin array may be bent in a direction that an area of the at least one notch becomes smaller.

[0031] The heat exchanger may include a fin array having a moisture guide groove which is formed to discharge moisture generated during a heat exchange process, and, as the header is bent, the fin array may be bent so that the moisture guide groove continues.

[0032] Still another aspect of the present invention provides a heat exchanger including a casing installed at a wall surface; and a heat exchanger disposed inside the casing to be bent, wherein the heat exchanger includes a plurality of refrigerant tubes, a header which is coupled to the plurality of refrigerant tubes, and at least one bending part which is provided to bend the header in one direction.

[0033] The at least one bending part may include a cutting surface which cuts at least a part of the header.

[0034] The heat exchanger may include a fin array which is fitted to the plurality of refrigerant tubes, and the fin array may be bent along with the header.

[Advantageous Effects]

[0035] The strength can be reinforced by including the bead, and thus the fin array can be folded in the predetermined shape.

[0036] Also, since the fin array includes the gap maintaining member, ventilation and drainage can be smoothly performed, and thus the heat exchanger having high performance can be provided.

[Description of Drawings]

[0037]

FIG. 1 is a view illustrating an air conditioner according to one embodiment of the present invention.

FIG. 2 is a view illustrating a heat exchanger according to one embodiment of the present invention.

FIG. 3 is a view illustrating a state in which the heat exchanger according to one embodiment of the present invention is disassembled.

FIG. 4 is a view illustrating a state in which a fin array of the heat exchanger according to one embodiment of the present invention is folded.

FIG. 5 is a view illustrating the fin array of the heat exchanger according to one embodiment of the present invention.

FIG. 6 is a view illustrating the fin array of the heat exchanger along with refrigerant tubes according to one embodiment of the present invention.

FIG. 7 is a cross-sectional view of the fin array of the heat exchanger according to one embodiment of the present invention.

FIG. 8 is a view illustrating a fin array of a heat exchanger according to another embodiment of the present invention.

FIG. 9 is a cross-sectional view of the fin array of FIG. 8.

FIG. 10 is a view illustrating an air conditioner according to still another embodiment of the present invention.

FIG. 11 is a view illustrating a state in which a heat exchanger according to still another embodiment of the present invention is disassembled.

FIG. 12 is a view illustrating a header of the heat exchanger according to still another embodiment of the present invention.

FIG. 13 is a view illustrating a fin array of the heat exchanger according to still another embodiment of the present invention.

[Modes of the Invention]

[0038] Hereinafter, exemplary embodiments of the present invention will be described in detail.

[0039] A refrigeration cycle forming an air conditioner includes a compressor, a condenser, an expansion valve, and an evaporator. In the refrigeration cycle, a series of processes including compression, condensation, expansion and evaporation are circulated, and thus conditioned air which exchanges heat with a refrigerant may be provided.

[0040] The compressor compresses a refrigerant gas to a high temperature and high pressure state, and then discharges it, and the discharged refrigerant gas is introduced into the condenser. The condenser condenses the compressed refrigerant to a liquid phase, and releases heat to therearound through a condensing process.

[0041] The expansion valve expands the condensed liquid refrigerant in the high temperature and high pressure state to a liquid refrigerant in a low pressure state. The evaporator evaporates the refrigerant expanded in the expansion valve, and then returns the refrigerant gas in a low temperature and low pressure state to the compressor. The evaporator may achieve a refrigeration effect by exchanging heat with an object to be refrigerated using evaporative latent heat. The air conditioner may control a temperature in an indoor space through such a cycle.

[0042] An outdoor unit of the air conditioner is a portion of the refrigeration cycle which includes the compressor and an outdoor heat exchanger. An indoor unit of the air conditioner includes an indoor heat exchanger, and the expansion valve may be provided at one of the indoor unit and the outdoor unit. Each of the indoor heat ex-

changer and the outdoor heat exchanger serves as the condenser or the evaporator. When the indoor heat exchanger serves as the condenser, the air conditioner functions as a heater, and when the indoor heat exchanger serves as the evaporator, the air conditioner functions as the air conditioner.

[0043] FIG. 1 is a view illustrating an air conditioner according to one embodiment of the present invention. In FIG. 1, the air conditioner including the indoor heat exchanger is illustrated. Hereinafter, for convenience of explanation, the indoor heat exchanger is referred to as a heat exchanger, and an indoor air conditioner is referred to as an air conditioner. Also, FIG. 1 illustrates a schematic structure of the heat exchanger.

[0044] The air conditioner includes a casing 1, a fan 3 which is disposed inside the casing 1, and a heat exchanger 10. The casing 1 includes a suction port 2a and a discharge port 2b, and the suction port 2a and the discharge port 2b may be formed at one side and the other side thereof, respectively.

[0045] Also, the air conditioner may include a suction duct 5 which is connected to the suction port 2a so as to suction air in a space to be air-conditioned, and a discharge duct 7 which is connected to the discharge port 2b so as to discharge the air into the space to be air-conditioned. That is, the air conditioner may be a duct type air conditioner which is installed at a ceiling.

[0046] According to an operation of the fan 3, the air suctioned into the suction duct 5 is introduced into the casing 1 through the suction port 2a, discharged to the discharge duct 7 through the discharge port 2b, and thus forcibly circulated. The air which is forcibly circulated between the space to be air-conditioned and the casing 1 may pass through the heat exchanger 10, may exchange heat with a refrigerant, and thus may be conditioned.

[0047] The heat exchanger 10 may include a refrigerant tube 20 through which the refrigerant flows, and a fin array 30 which is fitted to the refrigerant tube 20. The heat exchanger 10 may be installed to be inclined at a predetermined angle with respect to a floor surface. The fin array 30 may be fitted to the refrigerant tube 20 from a lower side thereof toward an upper side thereof.

[0048] While the refrigerant and the air which have a temperature difference therebetween exchange heat with each other, moisture may be generated. To discharge the moisture to an outside of the heat exchanger 10, one side of the fin array 30 may include a moisture guide groove 32. The fin array 30 may be fitted to the refrigerant tube 20 so that the moisture guide groove 32 is located at a lower portion thereof.

[0049] Hereinafter, a shape and a configuration of the heat exchanger 10 will be described in detail.

[0050] FIG. 2 is a view illustrating the heat exchanger 10 according to one embodiment of the present invention, and FIG. 3 is a view illustrating a state in which the heat exchanger 10 according to one embodiment of the present invention is disassembled.

[0051] As described above, the heat exchanger 10 in-

cludes the refrigerant tube 20 and the fin array 30. Also, the heat exchanger 10 may include headers 41, 42, 43 and 44 which are coupled to both ends of the refrigerant tube 20.

[0052] The refrigerant tube 20 may be formed in a flat plate shape which extends in a first direction A. A path 24 (FIG. 6) through which the refrigerant flows may be provided inside the refrigerant tube 20. The path may be divided by a partition wall 23 (FIG. 6).

[0053] The refrigerant tube 20 may extend in the first direction A, and may be horizontally disposed in two or more rows. For example, the refrigerant tube 20 may include a first refrigerant tube 21 and a second refrigerant tube 22 which are horizontally disposed in a third direction C. A plurality of first refrigerant tubes 21 and a plurality of second refrigerant tubes 22 may be disposed to be spaced apart from each other in a second direction B. The first refrigerant tubes 21 and the second refrigerant tubes 22 may be spaced apart from each other at regular intervals, and may be stacked in the second direction B.

[0054] The headers 41, 42, 43 and 44 may extend in the second direction B, and may be coupled to one end of each of the refrigerant tubes 21 and 22. Each of the headers 41, 42, 43 and 44 may be formed in a pipe shape having partition walls 45 which are spaced apart at a predetermined interval therein. Each of the headers 41, 42, 43 and 44 of the present invention is divided into four spaces by three partition walls 45. The number of partition walls 45 and the number of divided spaces may be changed according to a design.

[0055] The headers 41, 42, 43 and 44 may include one pair of first headers 41 and 42 which are coupled to both ends of the first refrigerant tubes 21, and one pair of second headers 43 and 44 which are coupled to both ends of the second refrigerant tubes 22. For convenience of explanation, the headers which are located left in FIGS. 2 and 3 are referred to as a first left header 42 and a second left header 44, and the headers which are located right are referred to as a first right header 41 and a second right header 43. One surface of the first left header 42 may be coupled to one surface of the second left header 44, and one surface of the first right header 41 may be coupled to one surface of the second right header 43.

[0056] A first pipe 51 and a second pipe 52 may be connected to the first right header 41 and the second right header 43, respectively. The first pipe 51 and the second pipe 52 may be connected to each of the spaces formed by the partition walls 45. As illustrated in FIGS. 2 and 3, four first pipes 51 and four second pipes 52 are spaced apart from each other at regular intervals, and coupled to the first right header 41 and the second right header 43, respectively.

[0057] The first left header 42 and the second left header 44 may include at least one through-hole 46 formed at the surfaces thereof which are coupled to each other. At least one through-hole 46 may be provided at each of the spaces formed by the partition walls 45. The refrigerant may pass through the first left header 42 and the

second left header 44 via the through-hole 46.

[0058] The case in which the refrigerant is introduced into the first pipe 51 will be described. The refrigerant is distributed to the four first pipes 51, and then introduced into the first right header 41. The refrigerant exchanges heat while being moved along the first refrigerant tube 21 from the first right header 41, and then reaches the first left header 42. The refrigerant introduced into the first left header 42 is moved to the second left header 44 through the through-hole 46, exchanges heat while being moved along the second refrigerant tube 22, is introduced into the second right header 43, and then discharged to the second pipe 52. When the refrigerant is introduced through the second pipe 52, the refrigerant passes, in turn, through the second refrigerant tube 22 and the first refrigerant tube 21, and is discharged to the first pipe 51.

[0059] The refrigerant is condensed or evaporated while flowing through such a path, and absorbs heat from therearound or releases heat to therearound. In order for the refrigerant to efficiently release or absorb heat, the fin array 30 may be coupled to the refrigerant tube 20.

[0060] The fin array 30 may be formed of one plate which extends in the first direction A and the second direction B. The fin array 30 is cross-bonded to an outer surface of the refrigerant tube 20, and serves to increase a heat exchange area between the refrigerant tube 20 and the air passing through the heat exchanger 10.

[0061] The fin array 30 may be fitted to one side of each of the plurality of refrigerant tubes 20 so as to be in contact with each of the plurality of refrigerant tubes 20. That is, the fin array 30 may be fitted to the refrigerant tubes 20 in the third direction C.

[0062] FIG. 4 is a view illustrating a state in which the fin array 30 of the heat exchanger 10 according to one embodiment of the present invention is folded, and FIG. 5 is a view illustrating the fin array 30 of the heat exchanger 10 according to one embodiment of the present invention.

[0063] The fin array 30 may include a plurality of insertion grooves 60, a plurality of folding parts 70, and a plurality of heat exchange fins 80 which are formed by the plurality of insertion grooves 60 and the plurality of folding parts 70. As illustrated in FIG. 5, the fin array 30 may be provided in the plate shape which extends in the first direction A and the second direction B.

[0064] The plurality of insertion grooves 60 may be arranged to be spaced apart from each other in the second direction B, such that the plurality of refrigerant tubes 20 are inserted. Each of the insertion grooves 60 may be provided to accommodate all of the first refrigerant tube 21 and the second refrigerant tube 22.

[0065] The plurality of folding parts 70 may be bent so that the plurality of insertion grooves 60 are disposed at one side of the fin array 30. The plurality of folding parts 70 may be bent in a predetermined direction, and the fin array 30 may be provided in a predetermined shape. As illustrated in FIG. 4, the plate-shaped fin array 30 is folded

zigzag at a predetermined interval, and may be provided in a shape illustrated in FIGS. 2 and 3.

[0066] Each of the plurality of folding parts 70 may include a first folding part 71 which is bent toward one side, and a second folding part 74 which is bent toward the other side. In the plate-shaped fin array 30, the first folding part 71 and the second folding part 74 may be alternately arranged so that the fin array 30 is folded zigzag.

[0067] The first folding part 71 and the second folding part 74 may be formed by bending lines 72, 73, 75 and 76. In FIG. 5, each of the bending lines 72, 73, 75 and 76 are illustrated in dotted line.

[0068] That is, the first folding part 71 is a small area portion of the fin array 30 which is located between one pair of first bending lines 72 and 73. Also, the second folding part 74 is another small area portion of the fin array 30 which is located between one pair of second bending lines 74 and 75. As illustrated in FIG. 5, in the fin array 30, the heat exchange fin 80, the first folding part 71, the heat exchange fin 80 and the second folding part 74 are repeatedly arranged in the first direction A.

[0069] The first folding part 71 may be formed by the pair of first bending lines 72 and 73 located at both sides thereof. That is, the heat exchange fin 80 and the first folding part 71 may be divided based on the first bending lines 72 and 73. As illustrated in FIG. 5, each of the first folding parts 71 may be disposed to be spaced apart in the second direction B. The insertion groove 60 is provided between the first folding parts 71 which are adjacent to each other in the second direction B. That is, the first folding part 71 and the insertion groove 60 are repeatedly disposed in the second direction B.

[0070] The second folding part 74 may be formed by the pair of second bending lines 75 and 76 located at both sides thereof. That is, the heat exchange fin 80 and the second folding part 74 may be divided based on the second bending lines 75 and 76. As illustrated in FIG. 5, each of the second folding parts 74 may be disposed to be spaced apart in the second direction B.

[0071] However, in the second folding part 74 unlike the first folding part 71, one side of the heat exchange fin 80 including a cutting line 78 is located between the second folding parts 74 which are adjacent to each other in the second direction B. More specifically, one pair of cutting parts 77 may be provided at both sides of each of the second folding parts 74.

[0072] The cutting part 77 may be connected to another cutting part 77 adjacent in the second direction B through the cutting line 78. That is, the cutting line 78, the cutting part 77, the second folding part 74 and the cutting part 77 may be repeatedly arranged in the second direction B.

[0073] The plate-shaped fin array 30 is punched in a predetermined shape by a pressing, and thus provided in a shape illustrated in FIG. 5, and then may be folded in a predetermined direction as illustrated in FIG. 4 through a toothed gear located at each of both surfaces of the fin array 30. The fin array 30 which is folded through

the toothed gear may be pressed from one side, and then may be provided in a shape of FIGS. 2 and 3.

[0074] At this point, instead of the bending lines 72, 73, 75 and 76, a weak portion having a low strength may be folded, and thus the fin array 30 may not be bent in the predetermined shape. Therefore, the fin array 30 may include at least one bead 90 which is disposed so that the plurality of folding parts 70 are bent in the predetermined shape. A shape of the fin array 30 including the bead 90 will be described below.

[0075] The plurality of heat exchange fins 80 may be arranged in the first direction A and the second direction B. The first folding parts 71 may be located at one side of each of the heat exchange fins 80 in the first direction A, and the second folding parts 74 may be located at the other side thereof. One side of the heat exchange fin 80 at which the first folding part 71 is located may be spaced apart from another heat exchange fin 80 located adjacent in the second direction B. The other side of the heat exchange fin 80 at which the second folding part 74 is located may be connected to another heat exchange fin 80 located adjacent in the second direction B.

[0076] As described above, the moisture guide groove 32 may be provided at one side of the fin array 30. The moisture guide groove 32 may be provided at one side of the heat exchange fin 80 at which the second folding part 74 is located, and may extend in the second direction B. Therefore, the moisture generated during a heat exchange process may flow along the moisture guide groove 32 in a direction of gravity, and may be discharged to an outside of the heat exchanger 10.

[0077] FIG. 6 is a view illustrating the fin array 30 of the heat exchanger 10 along with the refrigerant tubes 21 and 22 according to one embodiment of the present invention, and FIG. 7 is a cross-sectional view of the fin array 30 of the heat exchanger 10 according to one embodiment of the present invention.

[0078] Each of the heat exchange fins 80 may include a contact surface 82 which forms the insertion groove 60, and connection surfaces 87 and 88 which are provided to be connected to each of the folding parts 70. Also, each of the heat exchange fins 80 may include a plurality of louvers 84 and 86.

[0079] As illustrated in FIG. 6, the contact surface 82 is one surface of the heat exchange fin 80 which is in contact with the refrigerant tube 20 when the fin array 30 is fitted to the refrigerant tube 20. The contact surface 82 may be in contact with the refrigerant tube 20, and may increase heat exchange efficiency.

[0080] At this point, the contact surface 82 may include a burring part 83 for increasing a contact area with the refrigerant tube 20. The burring part 83 may be bent in a direction corresponding to the refrigerant tube 20, and thus may increase the contact area between the heat exchange fin 80 and the refrigerant tube 20. Also, the burring part 83 may reinforce strength of the heat exchange fin 80, and thus may be bent in the predetermined shape when the fin array 30 is folded.

[0081] The connection surfaces 87 and 88 may include a first connection surface 87 which is connected to the first folding part 71, and a second connection surface 88 which is connected to the second folding part 74. As described above, one side of the heat exchange fin 80 at which the first folding part 71 is located is referred to as the first connection surface 87, and the other side of the heat exchange fin 80 at which the second folding part 74 is located is referred to as the second connection surface 88.

[0082] Therefore, the first connection surface 87 may be disposed to be spaced apart from another first connection surface 87 adjacent in the second direction B, and the second connection surface 88 may be disposed to be connected to another second connection surface 88 adjacent in the second direction B. That is, the second connection surface 88 may be formed to extend in the second direction B.

[0083] The plurality of louvers 84 and 86 may be installed to change a path of air which exchanges heat while passing through the heat exchanger 10. The plurality of louvers 84 and 86 may include a first louver 84 which is inclined from the third direction C toward one side, and a second louver 86 which is inclined from the third direction C toward the other side. For convenience of explanation, the louver adjacent to the first connection surface 87 is referred to as the first louver 84, and the louver adjacent to the second connection surface 88 is referred to as the second louver 86.

[0084] As illustrated in FIG. 7, a case in which the air passes through the heat exchanger 10 from the first connection surface 87 toward the second connection surface 88 will be described. The air introduced toward the first connection surface 87 passes through the first louver 84, and the path thereof is changed to one side of the third direction C. The path of the air passed through a plurality of first louvers 84 arranged in the third direction C is changed by the second louver 86 which is inclined from the third direction C toward the other side thereof. That is, the air passes through the heat exchanger 10 through a curved path, and thus the contact area between the air and the heat exchanger 10 may be increased, and the heat exchange efficiency may be enhanced.

[0085] As described above, the fin array 30 may include at least one bead 90 to reinforce the strength upon a folding operation. In the case of the second folding part 74, the second folding part 74 has a relatively high strength due to the second connection surface 88 which extends in the second direction B, and thus can be folded in the predetermined shape. However, in the case of the first folding part 71, since the first connection surface 87 is disposed to be spaced apart in the second direction B, and the first folding part 71 has a relatively low strength, it may not be folded in the predetermined shape.

[0086] Therefore, the bead 90 may be located adjacent to the first folding part 71, and thus the strength may be reinforced when the first folding part 71 is folded. That is, the bead 90 may be provided at the first connection

surface 87, and may be disposed outside the first louver 84.

[0087] The bead 90 may be formed to protrude in the first direction A, and thus to reinforce the strength upon the folding operation. Also, the bead 90 may be formed by a pressing which is performed from one surface of the fin array 30 toward the other surface thereof. Due to the bead 90, the strength of the first connection surface 87 is reinforced, and thus the fin array 30 may be folded along the first bending lines 72 and 73 in the predetermined shape.

[0088] To increase the heat exchange efficiency, each of the heat exchange fins 80 should be spaced apart in the first direction A, and then should be disposed at the plurality of refrigerant tubes 20. As described above, the fin array 30 is folded and then stacked by an external pressure applied from one side thereof. The external pressure may be applied from the first direction A, and may serve to stack each of the heat exchange fins 80. Therefore, each of the heat exchange fins 80 may include a gap maintaining member by which the heat exchange fins 80 are spaced part from each other in the first direction A.

[0089] The gap maintaining member may be provided to protrude from the heat exchange fins 80 in the first direction A. At this point, the gap maintaining member may be formed at at least only some of the heat exchange fins 80.

[0090] FIG. 8 is a view illustrating a fin array 30a of a heat exchanger according to another embodiment of the present invention, and FIG. 9 is a cross-sectional view of the fin array 30a of FIG. 8.

[0091] The descriptions which have been described with reference to FIGS. 1 to 7 will be quoted along with a description which will be described below. Also, the fin array 30a may include a moisture guide groove 32a, an insertion groove 60a, folding parts 70a, 71a and 74a, bending lines 72a, 73a, 75a and 76a, a cutting part 77a, a cutting line 78a, a heat exchange fin 80a, a contact surface 82a, a burring part 83a, louvers 84a and 86a, connection surfaces 87a and 88a and a bead 90a.

[0092] A gap maintaining member may include a plurality of slits 92 which are formed to have protuberated parts 94. The slits 92 may be formed outside the louvers 84a and 86a of each of the heat exchange fins 80a, respectively. That is, the slits 92 may be formed at places at which the above-described bead 90a and a part of the louvers 84a and 86a are formed. Also, the slits 92 may be formed at only some of the heat exchange fins 80a, and then the bead 90a may be formed at the remaining parts. Also, the slits 92 may be formed at only the first connection surface 87a.

[0093] As illustrated in FIG. 18, the slit 92 is formed at one heat exchange fin 80a, and the bead 90a is formed at another heat exchange fin 80a which is adjacent in the second direction B. At this point, the first folding part 71a is located between the heat exchange fins 80a at which the beads 90a are formed, and a space between the heat

exchange fins 80a at which the slits 92 are formed may be cut.

[0094] Since the first folding part 71a may serve as resistance against a flow of air passing through a heat exchanger 10a, it is preferable that the first folding part 71a is installed minimally. Accordingly, the first folding part 71a may not be provided at the heat exchange fin 10a having the slit 92 such that a gap between the heat exchange fins 80a may be maintained. As illustrated in FIG. 9, there is not the first folding part 71a in a cross section of the heat exchange fin 80a having the slit 92.

[0095] Each of the slits 92 may be disposed so that the protuberated part 94 of one slit 92 is in contact with the protuberated part 94 of another slit 92 which is located at at least one heat exchange fin 80a located adjacent in the first direction A. That is, as illustrated in FIG. 9, the slits 92 may be formed so that the protuberated parts 94 of the slits 92 are in contact with each other when the fin array 30a is folded.

[0096] Also, the gap maintaining member may include at least one tab (not shown) which protrudes corresponding to a gap between the heat exchange fins 80a which are spaced apart in the first direction A. The tab (not shown) may be provided to protrude from one surface of the heat exchange fin 80 toward one side.

[0097] As illustrated in FIGS. 1 to 9, the first direction A, the second direction B and the third direction C may be provided vertically to each other, but are not limited thereto.

[0098] FIG. 10 is a view illustrating an air conditioner according to still another embodiment of the present invention. FIG. 10 illustrates an indoor air conditioner including an indoor heat exchanger. Hereinafter, for convenience of explanation, the indoor heat exchanger is referred to as a heat exchanger, and the indoor air conditioner is referred to as an air conditioner. Also, FIG. 10 illustrates a schematic structure of the heat exchanger.

[0099] The air conditioner includes a casing 101, and a heat exchanger 110 which is disposed inside the casing 101. The casing 101 includes a suction port 102a and a discharge port 102b, and a fan 103 may be disposed inside the casing 101. A blade 105 may be provided at the discharge port 102b to control a direction of discharged air. Also, the casing 101 may include a rear surface panel 104 which is installed at a wall surface. That is, the air conditioner may be a wall-mounted air conditioner which is fixed to the wall surface.

[0100] The heat exchanger 110 may include a plurality of refrigerant tubes 120, and headers 141 and 142 (FIG. 2) which are coupled to the plurality of refrigerant tubes 120. The heat exchanger 10 may be bent and installed inside the casing 101. FIG. 10 illustrates a state in which the heat exchanger 110 is bent once and then installed. However, this is just an example, and the heat exchanger 110 may be bent several times and then installed.

[0101] Also, the heat exchanger 110 may include a fin array 130 which is fitted to the plurality of refrigerant tubes 120. The fin array 130 may be configured with one folding

fin, a plurality of fins, or various other types.

[0102] To discharge moisture generated during a heat exchange process, the fin array 130 may include a moisture guide groove 132. To accommodate the moisture which flows along the moisture guide groove 132, a drainage tray 106 may be provided inside the casing 101 to be adjacent to one end of the moisture guide groove 132.

[0103] Hereinafter, detailed shape and configuration of the heat exchanger 110 will be described. FIG. 11 is a view illustrating a state in which the heat exchanger 110 according to still another embodiment of the present invention is disassembled. Herein, the fin array 130 is omitted.

[0104] The refrigerant tube 120 may be formed in a flat plate shape which extends in one direction. A path (not shown) through which a refrigerant may flow is provided inside the refrigerant tube 120. The path (not shown) may be divided into a plurality of parts by a partition wall (not shown). The refrigerant tube 120 may be horizontally disposed in two or more rows. As illustrated in FIG. 11, the refrigerant tube 120 may include a first refrigerant tube 121 and a second refrigerant tube 122 which are horizontally disposed. A plurality of first refrigerant tubes 121 and a plurality of second refrigerant tubes 122 may be arranged to be spaced apart from each other.

[0105] The headers 141 and 142 may include a right header 141 and a left header 142 which are coupled to both ends of the refrigerant tube 120. One pair of right headers 141 and one pair of left headers 142 may be provided to be coupled to the first refrigerant tube 121 and the second refrigerant tube 122, respectively.

[0106] Each of the headers 141 and 142 may be formed in a pipe shape having one pair of partition walls 145 which are spaced apart at a predetermined interval therein. An inside of each of the pair of headers 141 and 142 is divided into two spaces by the pair of partition walls 145. The number of the pair of partition walls 145 and the number of divided spaces may be changed according to a design.

[0107] A first pipe 151 and a second pipe 152 may be connected to one pair of right headers 141, respectively. The first pipe 151 and the second pipe 152 may be connected to the spaces formed by the pair of partition walls 145, respectively. As illustrated in FIG. 11, two first pipes 151 and two second pipes 152 may be respectively coupled to the right headers 141 so as to be spaced apart from each other at predetermined intervals.

[0108] One pair of left headers 142 may include at least one through-hole 146 formed at each of surfaces thereof which are coupled to each other. At least one through-hole 146 may be provided at each of the spaces formed by the pair of partition walls 145. The refrigerant may pass through the pair of left headers 142 via the through-hole 146.

[0109] Each of the headers 141 and 142 may be formed to extend from a first end 143 to a second end 144, and thus to be coupled to the plurality of first refrigerant tubes 121 and the plurality of second refrigerant

tubes 122 spaced apart from each other, respectively. A plate shield 147 may be provided at the first end 143 and the second end 144 so that the refrigerant is prevented from flowing to an outside of the headers 141 and 142. The plate shield 147 may be formed in the same shape as that of the partition wall 145.

[0110] Also, each of the headers 141 and 142 may include at least one bending part 160 which is bent in a direction which becomes close to the first end 143 and the second end 144. That is, at least one bending part 160 may be provided to bend each of the headers 141 and 142 in one direction.

[0111] FIG. 12 is a view illustrating the header 142 of the heat exchanger 110 according to still another embodiment of the present invention. FIG. 12 illustrates a bent left header 142, and the right header 141 may also be bent in the same shape. Hereinafter, for convenience of explanation, the left header 142 may be referred to as a header.

[0112] The header 142 may include a plurality of coupling holes 153 which are coupled to the plurality of refrigerant tubes 120. One pair of partition walls 145 may be coupled to the header 142 in parallel with the plurality of coupling holes 153. At least one bending part 160 may be located between the pair of partition walls 145.

[0113] At least one bending part 160 may include a cutting surface 161 which cuts at least a part of the header 142. Also, the at least one bending part 160 may include a support part 162 which connects at least a part of the header 142. That is, one side of the header 142 which is separated by the cutting surface 161 may be connected by the support part 162.

[0114] The cutting surface 161 may be formed in parallel with the plurality of refrigerant tubes 120. As illustrated in FIG. 12, the refrigerant tube 120 may be omitted on an extension line of the cutting surface 161. A depth and a direction of the cutting surface 161 may be changed according to a design.

[0115] FIG. 13 is a view illustrating the fin array 130 of the heat exchanger 110 according to still another embodiment of the present invention.

[0116] Since the cutting surface 161 is provided to be horizontal with the refrigerant tubes 120 or provided between the refrigerant tubes 120, the refrigerant tubes 120 may not be bent along the bent header 142. However, the fin array 130 fitted to the refrigerant tubes 120 may be bent along with the header 142.

[0117] The fin array 130 may include a plurality of insertion grooves 170 in which the refrigerant tubes 120 are inserted. A plurality of louvers 184 and 186 may be provided at each of heat exchange fins 180 which form the fin array 130. The plurality of louvers 184 and 186 may be disposed to change a path of air which exchanges heat while passing through the heat exchanger 110. The plurality of louvers 184 and 186 may include a first louver 184 and a second louver 186 which are inclined in different directions from each other.

[0118] Also, the fin array 130 may include at least one

notch 190 corresponding to at least one bending part 160. For explanation, two notches 190 which are provided at an interval corresponding to three heat exchange fins 180 are illustrated.

[0119] The notch 190 may be provided in a shape in which at least a part of the fin array 130 is removed. As illustrated in FIG. 4, the notch 190 may be provided at one side of the fin array 130 to be dug in a V shape. However, this is just an example, and a shape of the notch 190 may be variously provided.

[0120] The fin array 130 may be bent in a direction that an area of at least one notch 190 becomes smaller. That is, as the header 142 is bent, the fin array 130 may be bent.

[0121] As described above, the moisture guide groove 132 may be provided at one side of the fin array 130. As the header 142 is bent, the fin array 130 may be bent so that the moisture guide groove 132 continues. Therefore, even in the bent heat exchanger 110, condensate water may reach the drainage tray 106 along the moisture guide groove 132.

[0122] A process in which the heat exchanger 110 is installed at the casing 101 will be described briefly. The heat exchanger 110 which is not bent may be disposed at the casing 101, and then may be fixed to the casing 101 while bending the bending part 160. At this point, the header 142 which is bent by the support part 162 may be connected and easily installed. Since each part of the header 142 is fixed to the casing 101, the heat exchanger 110 may be fixed to the casing 101 even though the support part 162 is cut after an installation operation.

[0123] Also, with reference to the accompanying drawings, the air conditioner, the heat exchanger and the heat exchange fin have been described mainly with particular shapes. However, the shapes can be modified and changed variously.

Claims

1. A heat exchanger comprising:

a plurality of refrigerant tubes which respectively extend in a first direction, and are disposed to be spaced apart from each other in a second direction; and
a fin array which is coupled to the plurality of refrigerant tubes,

wherein the fin array comprises a plurality of heat exchange fins which are disposed to be in contact with each of the refrigerant tubes; a folding part which connects the heat exchange fins adjacent in the first direction; and an insertion groove in which at least two refrigerant tubes arranged in a third direction are inserted.

2. The heat exchanger of claim 1, wherein each of the

heat exchange fins comprises one pair of contact surfaces which face each other to form the insertion groove, and one pair of connection surfaces which face each other to be connected to the folding part.

3. The heat exchanger of claim 2, wherein the pair of connection surfaces comprise a first connection surface which is disposed to be spaced apart from each of the heat exchange fins adjacent to each other in the second direction, and a second connection surface which is disposed to be connected to each of the heat exchange fins adjacent to each other in the second direction.
4. The heat exchanger of claim 3, wherein the folding part comprises a first folding part which is disposed to connect the first connection surface in the first direction, and a second folding part which is disposed to connect the second connection surface in the first direction.
5. The heat exchanger of claim 2, wherein the pair of contact surfaces comprise a burring part which increases a contact area with each of the refrigerant tubes.
6. The heat exchanger of claim 3, wherein the second connection surface comprises a moisture guide groove which is formed in the second direction to discharge moisture generated during a heat exchange process.
7. The heat exchanger of claim 1, wherein each of the heat exchange fins comprises at least one bead which is disposed so that a plurality of folding parts are bent in a predetermined shape, and the at least one bead is formed to protrude in the first direction.
8. The heat exchanger of claim 1, wherein each of the heat exchange fins comprises a plurality of louvers to change a path of air which exchanges heat while passing through the heat exchanger.
9. The heat exchanger of claim 8, wherein the plurality of louvers comprise a first louver which is inclined from the third direction to one side, and a second louver which is inclined from the third direction to the other side.
10. The heat exchanger of claim 8, wherein each of the heat exchange fins comprises at least one bead which is disposed so that a plurality of folding parts are bent in a predetermined shape, and the at least one bead is located outside the plurality of louvers.
11. The heat exchanger of claim 1, wherein each of the heat exchange fins comprises a gap maintaining member which protrudes in the first direction of each

of the heat exchange fins so as to be spaced apart from each other in the first direction and to be disposed at the plurality of refrigerant tubes.

12. The heat exchanger of claim 11, wherein the gap maintaining member comprises a plurality of slits which are respectively formed to have a protuberated part at one side thereof, and each of the slits is disposed so that the protuberated part of one slit is in contact with the protuberated part of another slit which is located at at least one heat exchange fin located adjacent in the first direction.
13. The heat exchanger of claim 11, wherein the gap maintaining member comprises at least one tab which protrudes from one surface of each of the heat exchange fins.
14. The heat exchanger of claim 1, wherein at least two refrigerant tubes which are arranged in the third direction comprise a first refrigerant tube and a second refrigerant tube which are located in parallel with each other in the third direction.
15. The heat exchanger of claim 14, comprising one pair of first headers which are coupled to both ends of the first refrigerant tube, and one pair of second headers which are coupled to both ends of the second refrigerant tube, wherein one side of each of the pair of first headers and the pair of second headers comprises at least one through-hole so that a refrigerant passes through the first refrigerant tube and the second refrigerant tube.
16. An air conditioner which comprises a casing, and a heat exchanger disposed inside the casing, wherein the heat exchanger comprises refrigerant tubes which respectively extend in a first direction, and are disposed to be spaced apart from each other in a second direction; and a fin array which is bent in a predetermined shape and coupled to each of the refrigerant tubes, and of which at least a part has a plurality of heat exchange fins connected in the second direction and a moisture guide groove extending along the plurality of heat exchange fins in the second direction.
17. The air conditioner of claim 16, wherein the fin array and each of the refrigerant tubes are coupled to each other so that the moisture guide groove is located at one side of each of the refrigerant tubes.
18. The air conditioner of claim 16, wherein the heat exchanger is installed inside the casing to have a predetermined slope, and the fin is disposed so that the moisture guide groove is located thereunder.

19. A heat exchanger comprising:

along with the header.

each of refrigerant tubes; and
a header coupled to each of the refrigerant tubes
and formed to extend from a first end to a second
end, 5

wherein the header comprises at least one bending
part which is bent in a direction which becomes close
to the first end and the second end. 10

20. The heat exchanger of claim 19, wherein the at least
one bending part comprises a cutting surface which
cuts at least a part of the header. 15

21. The heat exchanger of claim 20, wherein the at least
one bending part comprises a support part which
connects at least a part of the header, such that parts
of the header which are separated by the cutting sur-
face are connected to each other. 20

22. The heat exchanger of claim 19, comprising a fin
array which is fitted to each of the refrigerant tubes,
wherein the fin array comprises at least one notch
corresponding to the at least one bending part. 25

23. The heat exchanger of claim 22, wherein the at least
one notch is provided in a shape in which at least a
part of the fin array is removed, and the fin array is
bent in a direction that an area of the at least one
notch becomes smaller. 30

24. The heat exchanger of claim 19, comprising a fin
array having a moisture guide groove which is
formed to discharge moisture generated during a
heat exchange process, 35
wherein, as the header is bent, the fin array is bent
so that the moisture guide groove continues.

25. An air conditioner comprising: 40

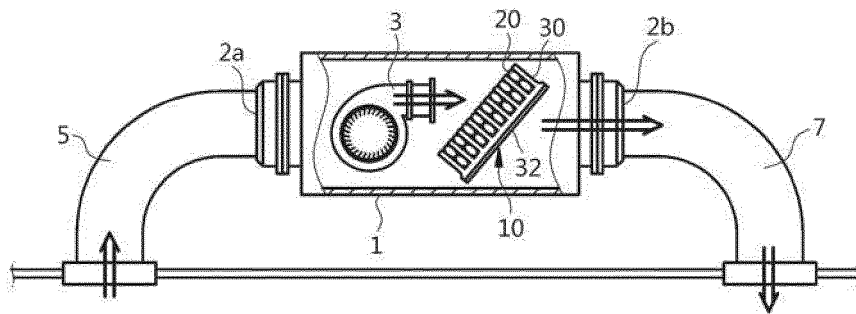
a casing installed at a wall surface; and
a heat exchanger disposed inside the casing to
be bent, 45

wherein the heat exchanger comprises a plurality of
refrigerant tubes, a header which is coupled to the
plurality of refrigerant tubes, and at least one bending
part which is provided to bend the header in one
direction. 50

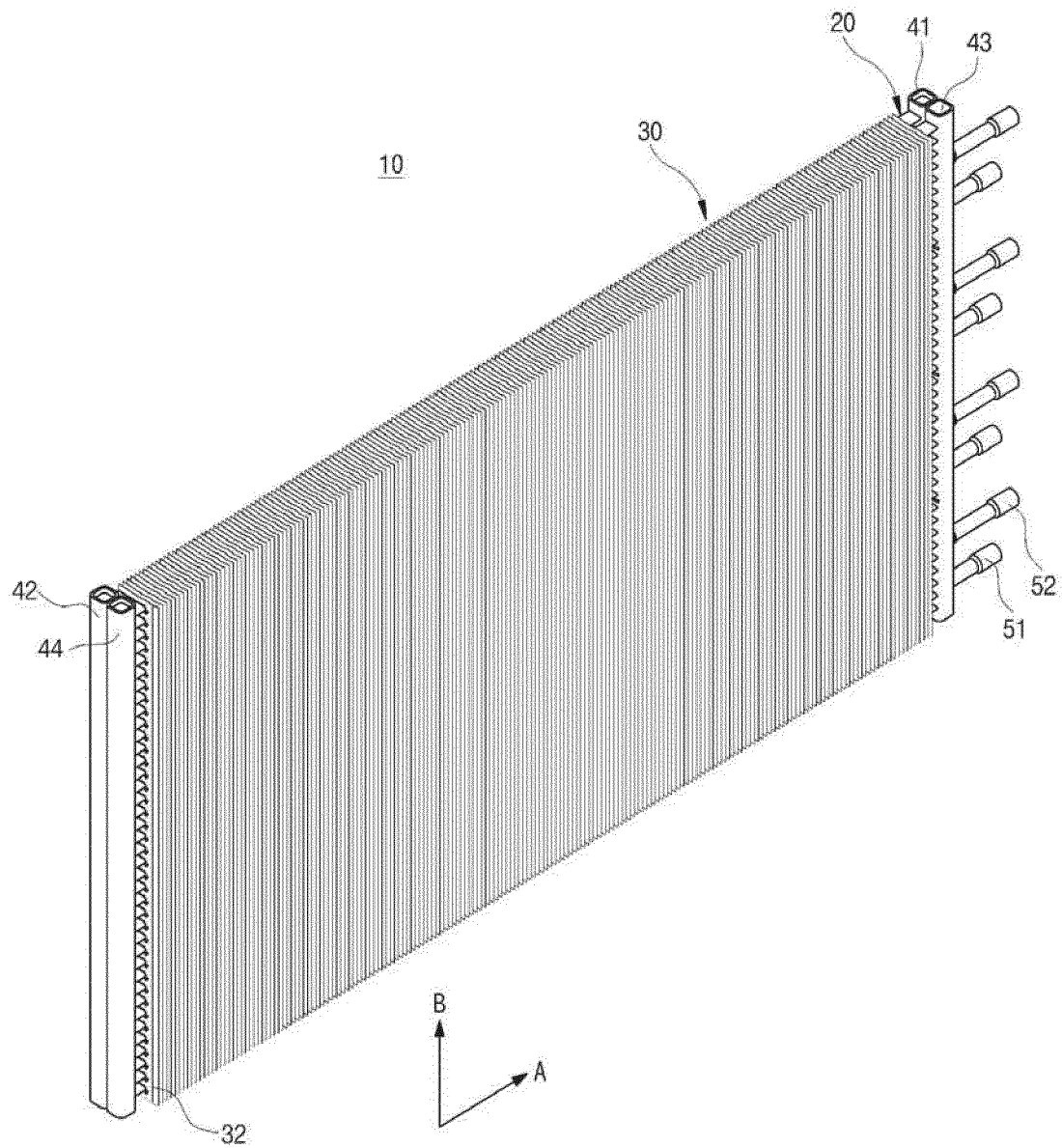
26. The air conditioner of claim 25, wherein the at least
one bending part comprises a cutting surface which
cuts at least a part of the header. 55

27. The air conditioner of claim 25, wherein the heat ex-
changer comprises a fin array which is fitted to the
plurality of refrigerant tubes, and the fin array is bent

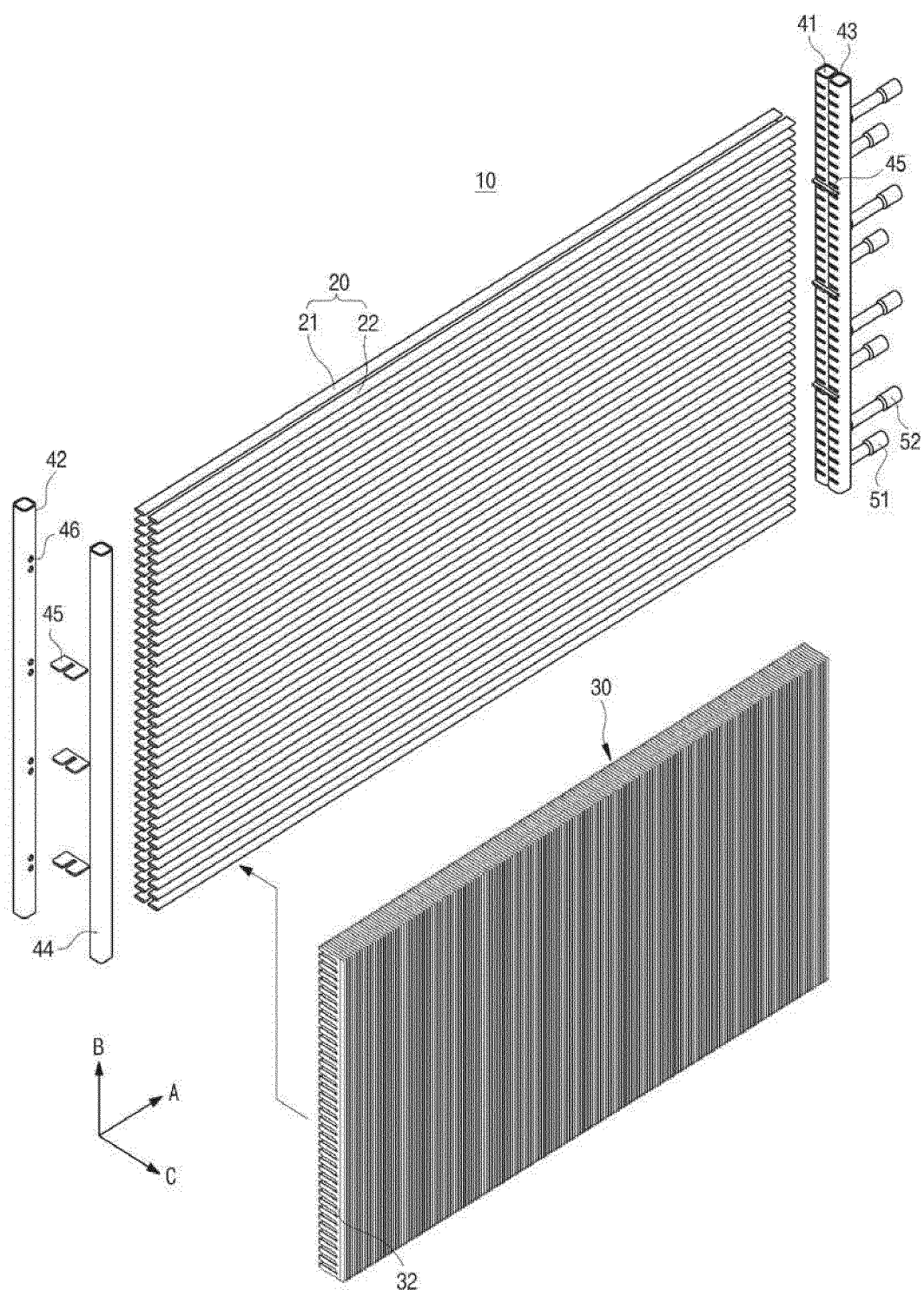
[Fig. 1]



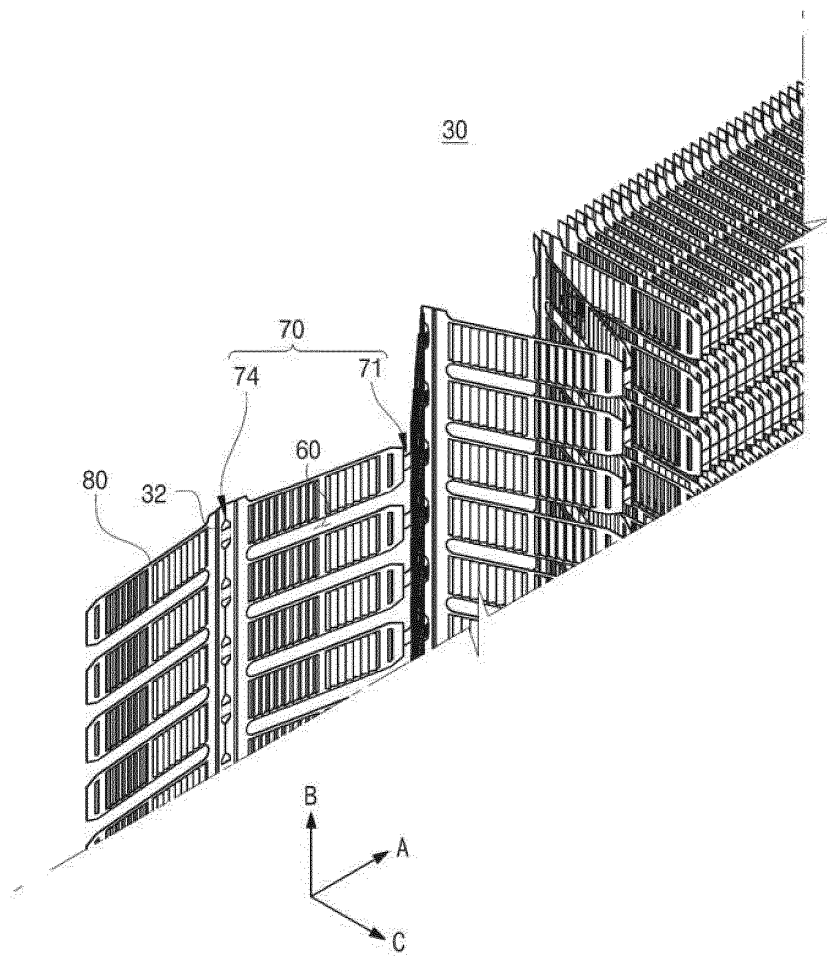
[Fig. 2]



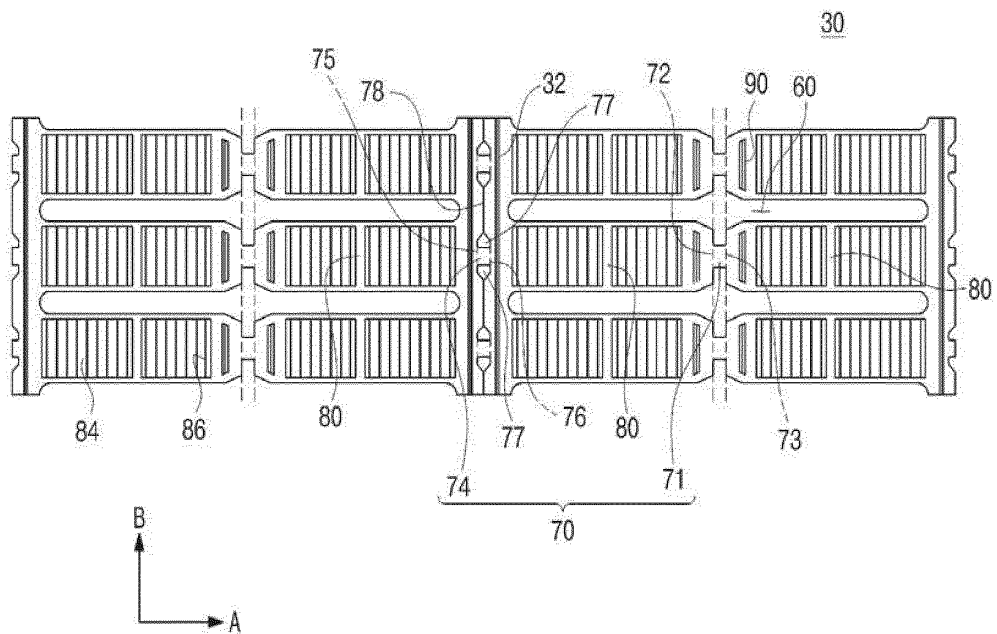
[Fig. 3]



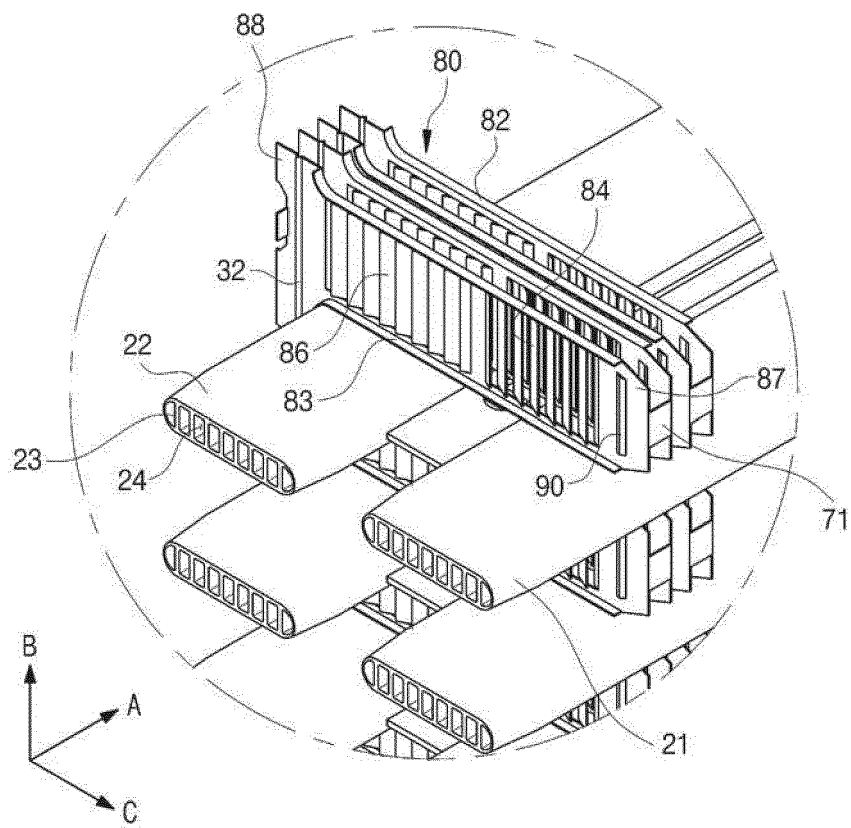
[Fig. 4]



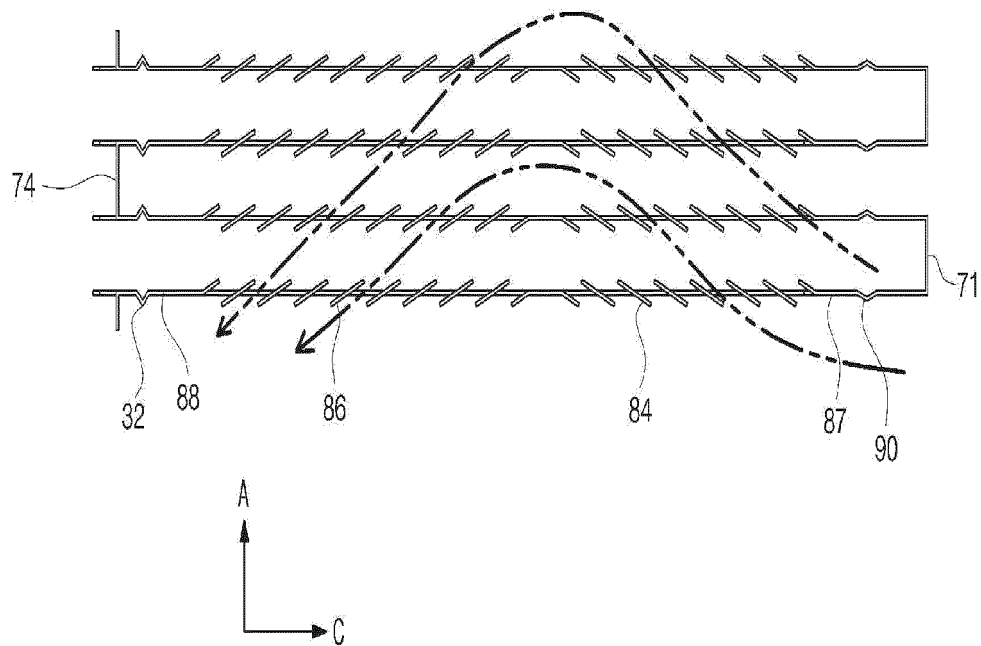
[Fig. 5]



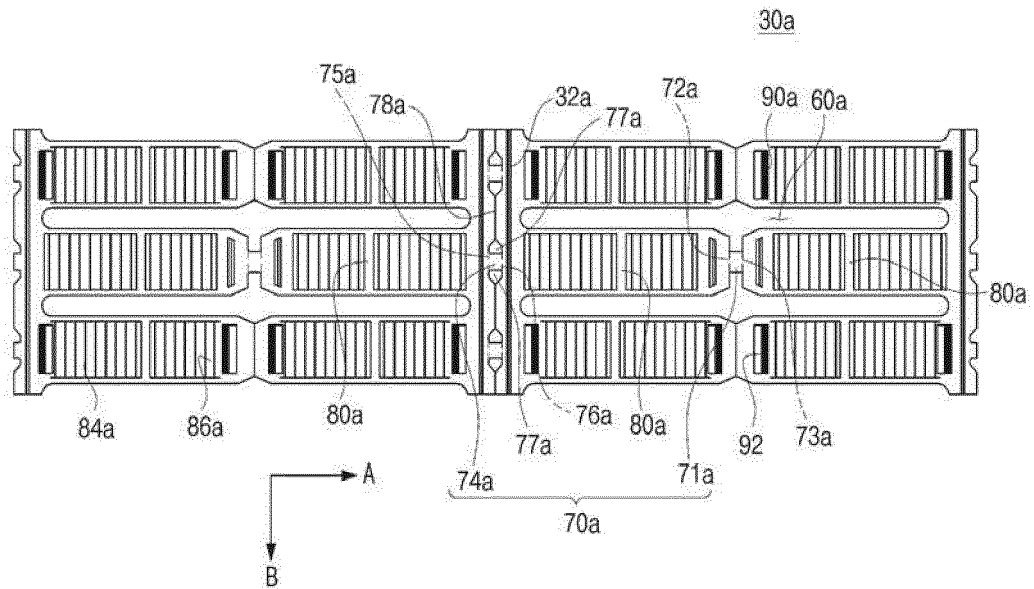
[Fig. 6]



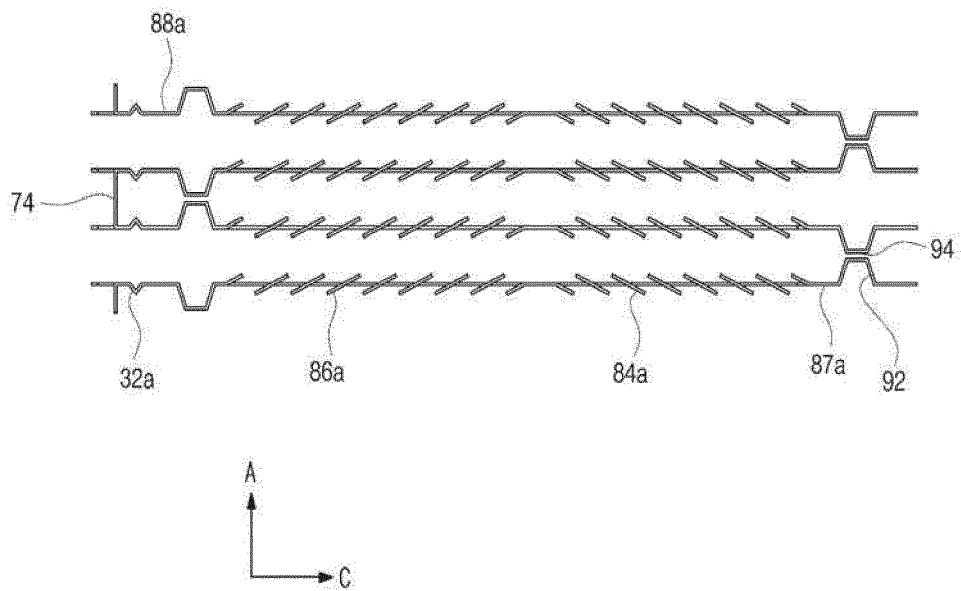
[Fig. 7]



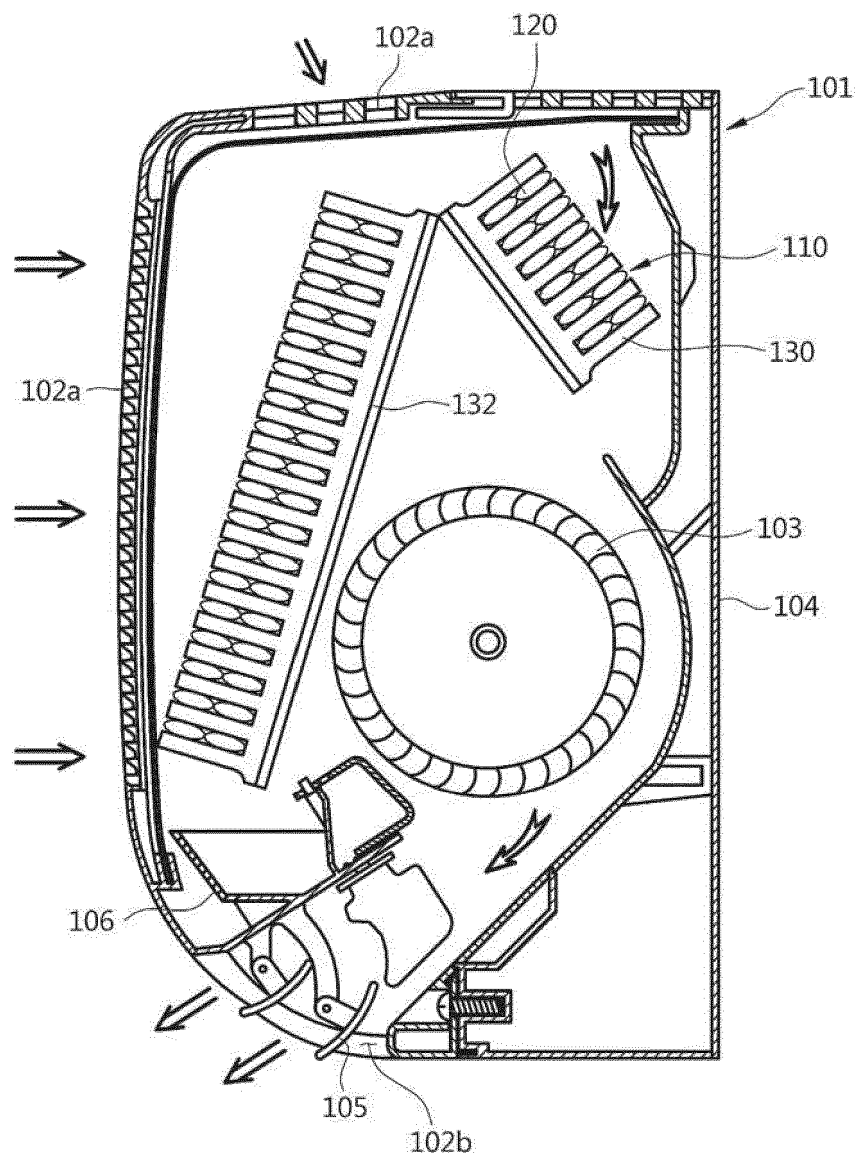
[Fig. 8]



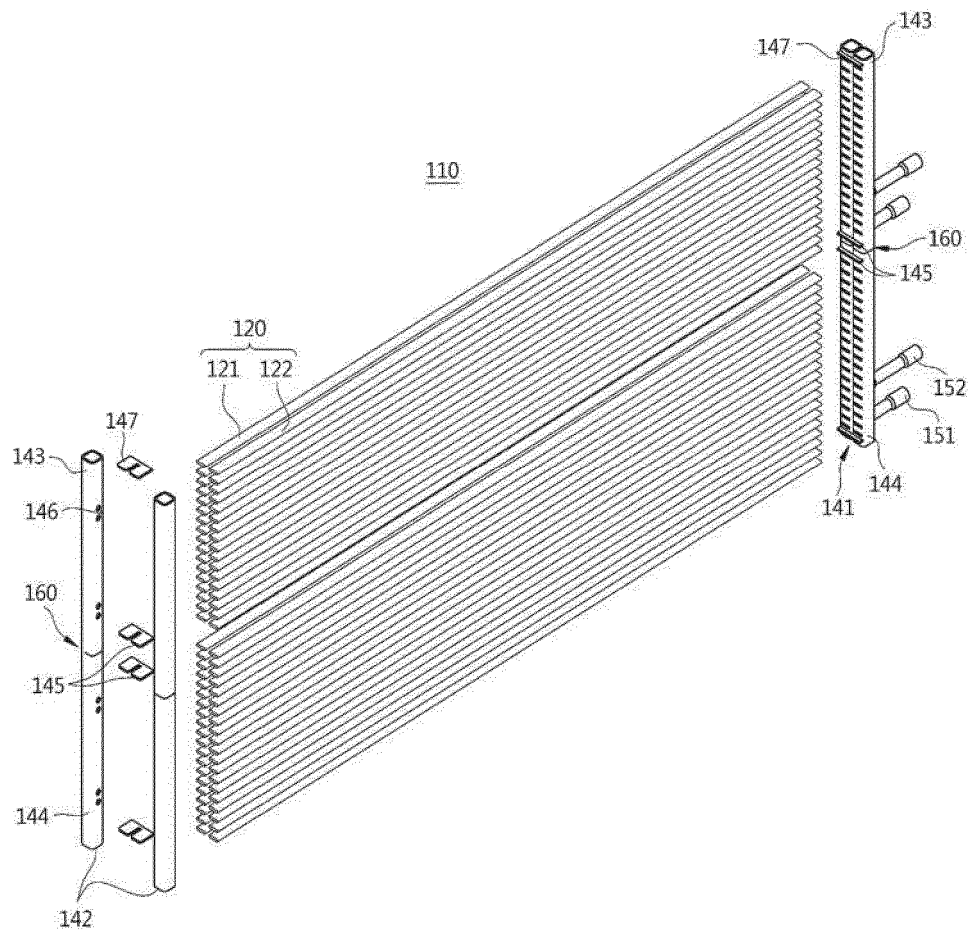
[Fig. 9]



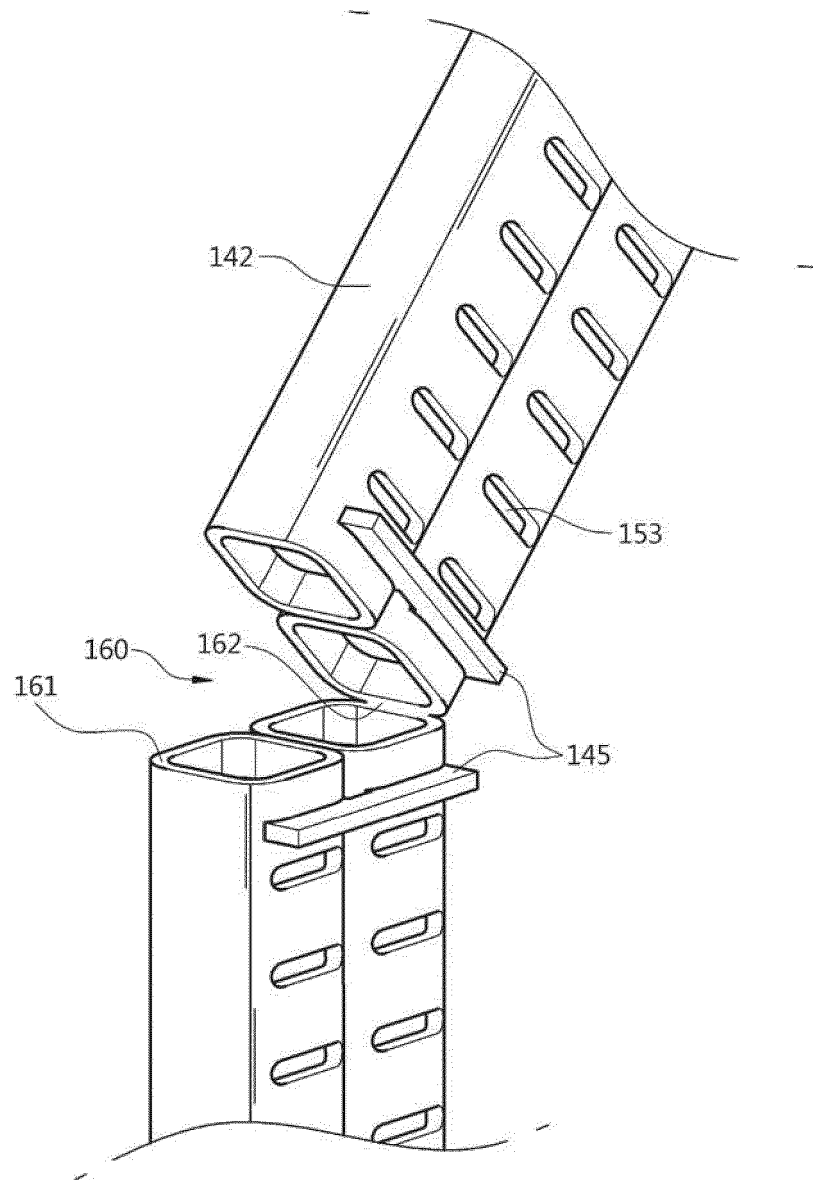
[Fig. 10]



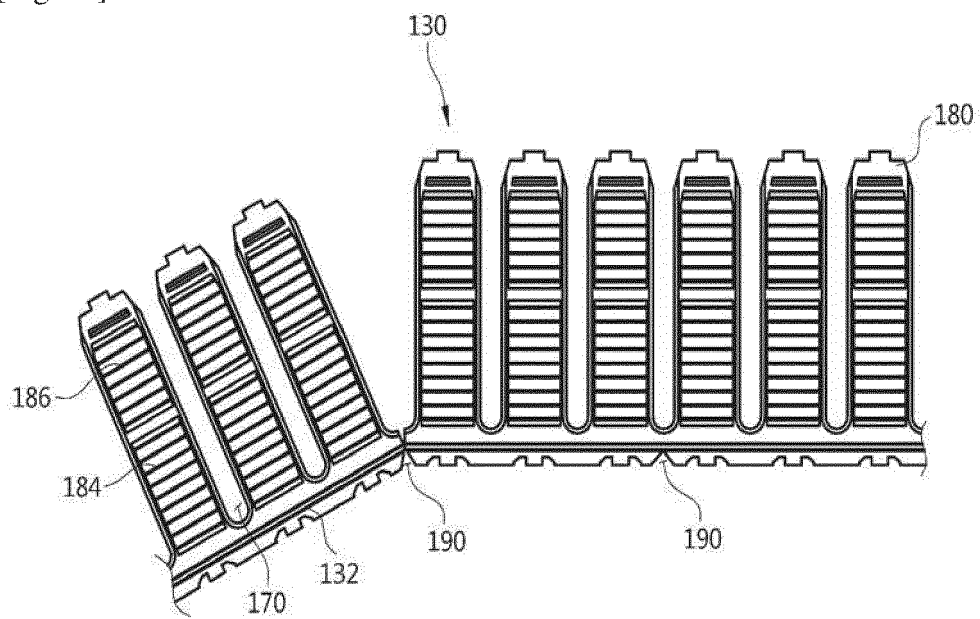
[Fig. 11]



[Fig. 12]



[Fig. 13]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2014/012709

A. CLASSIFICATION OF SUBJECT MATTER

F28F 1/10(2006.01)i, F28F 9/013(2006.01)i, F28F 9/02(2006.01)i, F24F 13/30(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F28F 1/10; F24F 1/00; F28D 1/053; F28F 9/02; F28F 1/32; B21D 53/08; F28F 1/30; F28F 9/013; F24F 13/30

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: coolant, array, heat exchange, heat exchange pin, folding, connection, burring, bead, bending, louver, uplift, slit, header, casing, air conditioner and notch

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2004-205124 A (TOYO RADIATOR CO., LTD.) 22 July 2004 See paragraphs [0008]-[0020]; claim 3 and figures 1-4, 8.	1-5,8-9,14-15
Y		6-7,10-13,16-24
A		25-27
Y	KR 10-2013-0099254 A (DAIKIN INDUSTRIES, LTD.) 05 September 2013 See paragraphs [0025], [0084]; and figure 9.	6,11-13,16-18,24
Y	JP 2013-217586 A (PANASONIC CORP.) 24 October 2013 See paragraph [0019]; and figure 1.	7,10
Y	JP 2010-223551 A (DAIKIN IND., LTD.) 07 October 2010 See paragraphs [0024]-[0029], [0038]-[0039]; and figures 1-4.	16-18,25-27
Y	JP 07-127988 A (TOSHIBA CORP.) 19 May 1995 See paragraphs [0005]-[0007], [0012]-[0013]; and figures 1, 4, 7.	19-27

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

26 FEBRUARY 2015 (26.02.2015)

Date of mailing of the international search report

26 FEBRUARY 2015 (26.02.2015)

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Authorized officer

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

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