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(54) **MICROCHANNEL HEAT EXCHANGER GROUP AND AIR CONDITIONING SYSTEM HAVING SAME**

(57) A microchannel heat exchanger group (100) and an air conditioning system (200) having the same are provided. The microchannel heat exchanger group (100) includes a plurality of fins (10) and a plurality of rows of first flat tubes (21) and a plurality of rows of second flat tubes (31); the microchannel heat exchanger group (100) at least includes a first heat exchanger (20) and a second heat exchanger (30); the first heat exchanger (20) and the second heat exchanger (30) are independent of each other; the first heat exchanger (20) includes the first flat tubes (21); the second heat exchanger (30) includes the second flat tubes (31); insertion slots include first insertion slots (111) and second insertion slots (112); the first flat tubes (21) are inserted into the first insertion slots (111); and the second flat tubes (31) are inserted into the second insertion slots (112). The air conditioning system (200) includes the microchannel heat exchanger group (100).

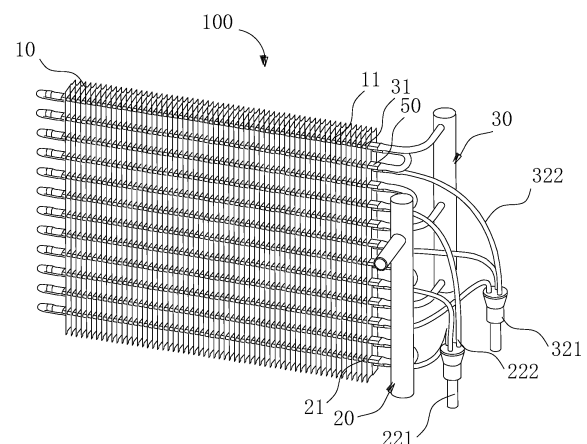


FIG. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Chinese patent application No. 202221085342.4, filed on April 29, 2022, and titled "MICROCHANNEL HEAT EXCHANGER GROUP AND AIR CONDITIONING SYSTEM HAVING SAME", the content of which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] The present application relates to the field of refrigeration, in particular, to a microchannel heat exchanger group and an air conditioning system having the same.

BACKGROUND

[0003] Microchannel heat exchanger groups belong to a class of compact, lightweight and highly efficient heat exchangers designed to meet the needs of industrial development.

[0004] In the related art, a refrigeration system usually needs a set of microchannel heat exchanger corresponding to the refrigeration system, which makes the heat exchange of the fins in the microchannel heat exchanger cannot be fully utilized, and thus reduces the heat exchange efficiency of the microchannel heat exchanger.

SUMMARY

[0005] A microchannel heat exchanger group capable of improving the thermal efficiency of the microchannel heat exchanger group and an air conditioning system including the same are provided on the basis of embodiments of the present application.

[0006] In order to solve the technical problems above, the present application provides a following technical solution.

[0007] A microchannel heat exchanger group, including a plurality of fins, wherein the plurality of fins are arranged in a plurality of rows, and each of the plurality of fins are provided with insertion slots; wherein the microchannel heat exchanger group further at least includes a first heat exchanger and a second heat exchanger, the first heat exchanger includes a plurality of first flat tubes, the second heat exchanger includes a plurality of second flat tubes, the plurality of first flat tubes and the plurality of second flat tubes are arranged in a plurality of layers along a length direction of each of the plurality of fins, the plurality of first flat tubes and the plurality of second flat tubes are arranged in a plurality of rows along a width direction of each of the plurality of fins; the insertion slots include a first insertion slot and a second insertion slot, the plurality of first flat tubes are inserted into the first insertion slot, the plurality of second flat tubes

are inserted into the second insertion slot, and the plurality of first flat tubes are separated from the plurality of second flat tubes.

[0008] It could be understood that in the present application, since the microchannel heat exchanger group further includes a first heat exchanger and a second heat exchanger independent of each other, when one of the first heat exchanger and the second heat exchanger is out of work, the other one of the first heat exchanger and the second heat exchanger can make full use of the heat exchange area of the plurality of fins to exchange heat, thereby improving an energy efficiency of the microchannel heat exchanger group.

[0009] In some embodiments, the plurality of first flat tubes and the plurality of second flat tubes alternate with each other along the length direction of the plurality of fins.

[0010] It could be understood that since the plurality of first flat tubes and the plurality of second flat tubes alternate with each other, when one of the first heat exchanger and the second heat exchanger is out of work, the other one of the first heat exchanger and the second heat exchanger can further make full use of the heat exchange area of the plurality of fins to exchange heat, thereby improving an energy efficiency of the microchannel heat exchanger group.

[0011] In some embodiments, the first heat exchanger includes a first connector assembly and a second connector assembly, each of the plurality of first flat tubes, the first connector assembly and the second connector assembly are connected to and in communication with each other, a first circulation path is defined by a refrigerant flowing into one of the plurality of first flat tubes from the first connector assembly, and flowing out from the second connector assembly; and the second heat exchanger includes a third connector assembly and a fourth connector assembly, each of the plurality of second flat tubes, the third connector assembly and the fourth connector assembly are connected to and in communication with each other, a second circulation path is defined by the refrigerant flowing into one of the plurality of first flat tubes from the third connector assembly, and flowing out from the fourth connector assembly; wherein a group of the first circulation path and a group of the second circulation path and are isolated from one another, the number of the first circulation path in the group of the first circulation path is defined as M , the number of the second circulation path in the group of the second circulation path is defined as N , and both the number M of the first circulation path in the group of the first circulation path and the number N of the second circulation path in the group of the second circulation path are natural numbers equal to or greater than 1.

[0012] In some embodiments, the number M of the first circulation path in the group of the first circulation path and the number N of the second circulation path in the group of the second circulation path satisfy the following formula: $M = N$.

[0013] In some embodiments, the insertion slots are disposed at a same side of the plurality of fins, the insertion slots at adjacent rows of the plurality of fins alternate with each other; optionally wherein both sides of each of the plurality of fins are provided with the insertion slots, and the insertion slots disposed at both sides of each of the plurality of fins alternate with each other.

[0014] It could be understood that since the insertion slots are alternately disposed, the contact area between the plurality of first flat tubes, the plurality of second flat tubes and the plurality of fins are improved, thereby improving the heat exchange efficiency of the microchannel heat exchanger group.

[0015] In some embodiments, the first connector assembly includes a first distributor and a plurality of first capillary tubes being connected to and in communication with the first distributor, both ends of each of the plurality of first capillary tubes are connected to and in communication with the first distributor and corresponding one of the plurality of first flat tubes, respectively; and the third connector assembly includes a second distributor and a plurality of second capillary tubes being connected to and in communication with the second distributor, both ends of each of the plurality of second capillary tubes are connected to and in communication with the second distributor and corresponding one of the plurality of second flat tubes, respectively.

[0016] It could be understood that by providing the first distributor and the second distributor, the refrigerant flows into the plurality of first flat tubes and the plurality of second flat tubes after the refrigerant is evenly distributed by the first distributor and the second distributor, and the processing is simplified.

[0017] In some embodiments, the second connector assembly includes a first collecting tube and a plurality of first connecting tubes being connected to and in communication with the first collecting tube, both ends of each of the plurality of the first connecting tubes are connected to and in communication with the first collecting tube and corresponding one of the plurality of first flat tubes; and the fourth connector assembly includes a second collecting tube and a plurality of second connecting tubes being connected to and in communication with the second collecting tube, both ends of each of the plurality of the second connecting tubes are connected to and in communication with the second collecting tube and corresponding one of the plurality of second flat tubes.

[0018] It could be understood that by disposing the first collecting tube and the second collecting tube, it is convenient to collect the refrigerant in the first flat tube and the second flat tube.

[0019] In some embodiments, both the plurality of first flat tubes and the plurality of second flat tubes are arranged in a plurality of rows, the first heat exchanger includes a plurality of first bending tubes, the second heat exchanger comprises a plurality of second bending tubes, the first flat tubes arranged in adjacent rows of

the plurality of first flat tubes are connected to and in communication with each other via corresponding one of the plurality of first bending tubes, and the plurality of first bending tubes and the plurality of first flat tubes are separately arranged; and the second flat tubes arranged in adjacent rows of the plurality of second flat tubes are connected to and in communication with each other via corresponding one of the plurality of second bending tubes, and the plurality of second bending tubes and the plurality of second flat tubes are separately arranged.

[0020] It could be understood that since the microchannel heat exchanger group includes a plurality of first bending tubes and a plurality of second bending tubes, the refrigerant can make a turn, and deformation of the plurality of fins caused by bending of the plurality of fins can be avoided.

[0021] In some embodiments, the microchannel heat exchanger group further includes an adapter, the adapter is disposed between the plurality of first capillary tubes and the plurality of first flat tubes and between the plurality of second capillary tubes and the plurality of second flat tubes, and a tube orifice of the adapter opposite to the plurality of first flat tubes matches with a tube orifice of corresponding one of the plurality of first flat tube and another tube orifice of the adapter opposite the plurality of second flat tubes matches with a tube orifice of corresponding one of the plurality of second flat tube.

[0022] It could be understood that by disposing the adapter, it is convenient for matching and connection between the plurality of the capillary tubes and the plurality of the flat tubes.

[0023] The present application further provides the following technical solution. An air conditioning system is provided, which includes a microchannel heat exchanger group.

[0024] In comparison with related art, in the present application, since the microchannel heat exchanger group further includes a first heat exchanger and a second heat exchanger independent of each other, when one of the first heat exchanger and the second heat exchanger is out of work, the other one of the first heat exchanger and the second heat exchanger can make full use of the heat exchange area of the plurality of fins to exchange heat, thereby improving an energy efficiency of the microchannel heat exchanger group.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] In order to more clearly illustrate the technical solutions in the embodiments of the present application or in the conventional technology, the accompanying drawings to be used in the description of the embodiments or the conventional technology will be briefly described below. Obviously, the accompanying drawings in the following description are only some of the embodiments of the present application, and other accompanying drawings may be obtained from these drawings without creative labor for a person of ordinary skill in the art.

FIG. 1 is a structural schematic diagram of a micro-channel heat exchanger group provided in the present application from an angle of view.

FIG. 2 is a structural schematic diagram of a micro-channel heat exchanger group provided in the present application from an angle of view.

FIG. 3 is a structural schematic diagram of a circulation path of the microchannel heat exchanger group in an embodiment of the present application.

FIG. 4 is a structural schematic diagram of a circulation path of the microchannel heat exchanger group in an embodiment of the present application.

FIG. 5 is a structural schematic diagram of an air conditioning system including a microchannel heat exchanger group provided in the present application.

[0026] In the figures, 100 represents a microchannel heat exchanger group; 10 represents a fin; 11 represents an insertion slot; 111 represents a first insertion slot; 112 represents a second insertion slot; 20 represents a first heat exchanger; 21 represents a first flat tube; 22 represents a first connector assembly; 221 represents a first distributor; 222 represents a first capillary tube; 23 represents a second connector assembly; 231 represents a first collecting tube; 232 represents a first connecting tube; 30 represents a second heat exchanger; 31 represents a second flat tube; 32 represents a third connector assembly; 321 represents a second distributor; 322 represents a second capillary tube; 33 represents a fourth connector assembly; 331 represents a second collecting tube; 332 represents a second connecting tube; 40 represents a first bending tube; 41 represents a second bending tube; 50 represents an adapter; and 200 represents an air conditioning system.

DETAILED DESCRIPTION

[0027] The technical solutions in the embodiments of the present application will be described clearly and completely in the following in conjunction with the accompanying drawings in the embodiments of the present application, and it is obvious that the described embodiments are only a part of the embodiments of the present application, but not all of the embodiments. Based on the embodiments in this application, all other embodiments obtained by a person of ordinary skill in the art without making creative labor fall within the scope of protection of this application.

[0028] It is noted that when a component is said to be "fixed to" or "disposed on" another component, it may be directly on the other component or there may be a centred component. When a component is said to be "connected" to another component, it may be directly connected to the other component or there may be both centred components. The terms "vertical", "horizontal", "up", "down", "left", "right" and similar expressions used in the specification of the present application are for illustrative purposes only and are not meant to be exclusive.

[0029] Furthermore, the terms "first", "second" are used for descriptive purposes only and are not to be understood as indicating or implying relative importance or implicitly specifying the number of technical features indicated. Thus, a feature defined with the terms "first", "second" may include at least one such feature, either explicitly or implicitly. In the description of the present application, "plurality" means at least two, e.g., two, three, etc., unless otherwise expressly and specifically limited.

[0030] In the present application, unless otherwise expressly specified and limited, the first feature "on" or "under" the second feature may be that the first feature is in direct contact with the second feature, or that the first feature is in indirect contact with the second feature through an intermediate medium. Furthermore, the first feature being "above", "on" or "upon" the second feature may mean that the first feature is directly above or diagonally above the second feature, or it may simply mean that the first feature is horizontally higher than the second feature. The first feature being "below", "under" or "beneath" the second feature may be that the first feature is directly below or diagonally below the second feature, or it may simply mean that the first feature is horizontally smaller than the second feature.

[0031] Unless otherwise defined, all technical and scientific terms used in the specification of the present application have the same meaning as commonly understood by those skilled in the art to which the present application belongs. Terms used in the specification of the present application are used only for the purpose of describing specific embodiments and are not intended to limit the present application. The term "and/or" as used in the specification of the present application includes any and all combinations of one or more of the relevant listed items.

[0032] Referring to FIG.1 to FIG.4, a microchannel heat exchanger group 100 is provided in the present application, which is disposed in the air conditioning system. A medium flows in the microchannel heat exchanger group 100, and the microchannel heat exchanger group 100 can facilitate heat exchange between the medium and the outside world.

[0033] In the related art, a refrigeration system usually needs a set of microchannel heat exchanger corresponding to the refrigeration system, which makes the heat exchange of the fins in the microchannel heat exchanger cannot be fully utilized, and thus reduces the heat exchange efficiency of the microchannel heat exchanger.

[0034] In order to solve the problems of the microchannel heat exchanger group in the related art, a microchannel heat exchanger group 100 is provided in the present application. The microchannel heat exchanger group 100 includes a plurality of fins 10, wherein the plurality of fins 10 are arranged in a plurality of rows, each of the plurality of fins 10 are provided with insertion slots 11, and a first flat tube 21 and a second flat tube 31 extends in the insertion slots 11. The microchannel heat exchanger

group 100 further includes at least a first heat exchanger 20 and a second heat exchanger 30 independent of the first heat exchanger 20. The first heat exchanger 20 includes a plurality of first flat tubes 21, and the second heat exchanger 30 includes a plurality of second flat tubes 31. The plurality of first flat tubes 21 and the plurality of second flat tubes 31 are arranged in a plurality of layers along a length direction of each of the plurality of fins 10, and the plurality of first flat tubes 21 and the plurality of second flat tubes 31 are arranged in a plurality of rows along a width direction of each of the plurality of fins 10. The insertion slots 11 include a first insertion slot 111 and a second insertion slot 112, the plurality of first flat tubes 21 are inserted into the first insertion slot 111, and the plurality of second flat tubes 31 are inserted into the second insertion slot 112. The plurality of first flat tubes 21 are separated from the plurality of second flat tubes 31, and plurality of first flat tubes 21 are not in communication with the plurality of second flat tubes 31.

[0035] It should be noted that in the present application, the microchannel heat exchanger group 100 includes at least two heat exchangers. Arrangement of at least two heat exchangers independent of each other in the same set of fins 10 of the heat exchanger have following advantages. In one aspect, operation of each of the heat exchangers can be controlled according to actual conditions, so that compatibility performances of the microchannel heat exchanger group 100 can be improved; in another aspect, when one of the first heat exchanger 20 and the second heat exchanger 30 is out of work, the other one of the first heat exchanger 20 and the second heat exchanger 30 can make full use of the heat exchange area of the plurality of fins 10 to exchange heat, thereby improving an energy efficiency of the microchannel heat exchanger group.

[0036] It should be noted that in the present application, the plurality of fins 10 extend along a vertical direction, and the plurality of fins 10 are parallelly arranged in a plurality of rows. The plurality of first flat tubes 21 and the plurality of second flat tubes 31 extend along a horizontal direction. In addition, along the vertical direction, the plurality of first flat tubes 21 and the plurality of second flat tubes 31 are successively arranged and arranged in a plurality of layers. Then, the plurality of layers of first flat tubes 21 and the plurality of layers of second flat tubes 31 are arranged along the horizontal direction in a plurality of rows. The plurality of first flat tubes 21 and the plurality of second flat tubes 31 are arranged in a plurality of layers and a plurality of rows. Thus, the structure of the microchannel heat exchanger group 100 is more compact and the heat exchange efficiency of the microchannel heat exchanger group 100 is improved.

[0037] In the present embodiment, that the microchannel heat exchanger group 100 at least includes a first heat exchanger 20 and a second heat exchanger 30 indicates that the microchannel heat exchanger group 100 at least includes two independent heat exchangers. In some embodiments, the microchannel heat exchanger group

100 can further include a third heat exchanger, a fourth heat exchanger, a fifth heat exchanger and even more heat exchangers, which are not limited herein. In the present application, a microchannel heat exchanger 100 is taken as an example.

[0038] Referring to FIG. 1, each of the plurality of fins 10 extends along the vertical direction, the plurality of fins 10 are parallelly arranged along the horizontal direction in a plurality of rows. The insertion slots 11 are disposed at the same side of the fins 10 in each row of the plurality of rows of the fins 10, and the insertion slots 10 in adjacent rows of the plurality of rows of fins 10 are staggered, so that the contact area between the flat tube and the fin 10 is great, improving the heat exchange efficiency of the heat exchanger group 100.

[0039] In some embodiments, both sides of each of the plurality of rows of fins are provided with the insertion slots 11, and the insertion slots 11 at both sides of each of the plurality of fins 10 are staggered. The flat tubes extend through each of the staggered insertion slots 11. The flat tubes extend along the horizontal direction. Since the flat tubes are staggered, the contact area between the flat tubes and the air is greater, so that the heat exchange efficiency of the microchannel heat exchanger group 100 is improved.

[0040] Referring to FIG. 2, the first heat exchanger 20 includes a first connector assembly 22 and a second connector assembly 23. The first connector assembly 22 includes a first distributor 221 and a plurality of first capillary tubes 222 being connected to and in communication with the first distributor 221. Both ends of each of the plurality of first capillary tubes 222 are connected to and in communication with the first distributor 221 and corresponding one of the plurality of first flat tubes 21, respectively. The refrigerant in the first distributor 221 are distributed into each of the plurality of first flat tubes 21 via the plurality of first capillary tubes 222. That is, the refrigerant flows into the first distributor 221 from an end of the first distributor 221 away from the first capillary tube 222. Since an outlet of the first distributor 221 is provided with a plurality of small holes being connected to and in communication with the plurality of first capillary tubes 222, an end of each of the plurality of first capillary tubes 222 are correspondingly connected to and in communication with each of the small holes of the outlet of the first distributor 211, and the other end of each of the plurality of first capillary tubes 222 are correspondingly connected to and in communication with each of the plurality of first flat tubes 21 of the microchannel heat exchanger group 100. The refrigerant flows into each of the plurality of first flat tubes 21 via each of the plurality of first capillary tubes 222, so that the refrigerant is distributed into each of the plurality of first capillary tubes 222 more evenly.

[0041] The second connector assembly 23 includes a first collecting tube 231 and a plurality of first connecting tubes 232 being connected to and in communication with the first collecting tube 231. Both ends of each of the

plurality of the first connecting tubes 232 are connected to and in communication with the first collecting tube 231 and corresponding one of the plurality of first flat tubes 21. The refrigerant in the plurality of first flat tubes 21 are gathered in the first collecting tube 231 via the plurality of first connecting tubes 232. That is, the first collecting tube 231 is provided with a plurality of flowing holes configured for communicating the first connecting tubes 232. An end of each of the plurality of first connecting tubes 232 are connected to and in communication with each of the plurality of flowing holes on the first collecting tubes 231, respectively; and the other end of each of the plurality of first connecting tubes 232 are connected to and in communication with each of the plurality of first flat tubes 21 of the microchannel heat exchanger 100, respectively. The refrigerant flows into each of the plurality of first flat tubes 21 via each of the plurality of first capillary tubes 222, and then flows into each of the plurality of first connecting tubes 232, and the flows into and gathers in the first collecting tube 231 from the plurality of first connecting tubes 232, and then entirely flows out from the first collecting tube 231. Therefore, a heat exchange circulation process in the first heat exchanger 20 is accomplished.

[0042] The second heat exchanger 30 includes a third connector assembly 32 and a fourth connector assembly 33. The third connector assembly 32 includes a second distributor 321 and a plurality of second capillary tubes 322 being connected to and in communication with the second distributor 321. Both ends of each of the plurality of second capillary tubes 322 are connected to and in communication with the second distributor 321 and corresponding one of the plurality of second flat tubes 31, respectively. The refrigerant in the second distributor 321 are distributed into each of the plurality of second flat tubes 31 via the plurality of second capillary tubes 322. That is, the refrigerant flows into the second distributor 321 from an end of the second distributor 321 away from the second capillary tube 322. Since an outlet of the second distributor 321 is provided with a plurality of small holes being connected to and in communication with the plurality of second capillary tubes 322, an end of each of the plurality of second capillary tubes 322 are correspondingly connected to and in communication with each of the small holes of the outlet of the second distributor 321, and the other end of each of the plurality of second capillary tubes 322 are correspondingly connected to and in communication with each of the plurality of second flat tubes 31 of the microchannel heat exchanger group 100. The refrigerant flows into each of the plurality of second flat tubes 31 via each of the plurality of second capillary tubes 322, so that the refrigerant is distributed into each of the plurality of second capillary tubes 322 more evenly.

[0043] The fourth connector assembly 33 includes a second collecting tube 331 and a plurality of second connecting tubes 332 being connected to and in communication with the second collecting tube 331. Both ends of each of the plurality of the second connecting

tubes 332 are connected to and in communication with the second collecting tube 331 and corresponding one of the plurality of second flat tubes 31. The refrigerant in the plurality of second flat tubes 31 are gathered in the second collecting tube 331 via the plurality of second connecting tubes 332. That is, the second collecting tube 331 is provided with a plurality of flowing holes configured for communicating the second connecting tubes 332. An end of each of the plurality of second connecting tubes 332 are connected to and in communication with each of the plurality of flowing holes on the second collecting tubes 331, respectively; and the other end of each of the plurality of second connecting tubes 332 are connected to and in communication with each of the plurality of second flat tubes 31 of the microchannel heat exchanger 100, respectively. The refrigerant flows into each of the plurality of second flat tubes 31 via each of the plurality of second capillary tubes 322, and then flows into each of the plurality of second connecting tubes 332, and the flows into and gathers in the second collecting tube 331 from the plurality of second connecting tubes 332, and then entirely flows out from the second collecting tube 331. Therefore, a heat exchange circulation process in the second heat exchanger 30 is accomplished.

[0044] In some embodiments, the plurality of first flat tubes 21 and the plurality of second flat tubes 31 alternate with each other and separated from each other. In this way, when one of the first heat exchanger 20 and the second heat exchanger 30 is out of work, the other one of the first heat exchanger 20 and the second heat exchanger 30 can make full use of the heat exchange area of the plurality of fins 10 to exchange heat, thereby improving an energy efficiency of the microchannel heat exchanger group 100. It should be noted that when all of the first flat tubes 21 are parallelly arranged in an upper section of the microchannel heat exchanger group 100, all of the second flat tubes 31 are correspondingly arranged in a lower section of the microchannel heat exchanger group 100; optionally, when all of the first flat tubes 21 are parallelly arranged in the lower section of the microchannel heat exchanger group 100, all of the second flat tubes 31 are correspondingly arranged in the upper section of the microchannel heat exchanger group 100. Therefore, when one of the first heat exchanger 20 and the second heat exchanger 30 is out of work, the first flat tube 21 or the second flat tube 31 can only make use of a half of the area of the fins 10 in the microchannel heat exchanger group 100 to exchange heat. In comparison to the method in which the first flat tubes 21 and the second flat tubes 31 alternate in the microchannel heat exchanger group 100, it is obvious that the method in which the first flat tubes 21 and the second flat tubes 31 alternate with each other can make best use of the heat change area of the fins 10, thereby improving the energy efficiency of the microchannel heat exchanger group 100.

[0045] In some embodiments, microchannel heat exchanger group 100 includes at least two rows of the first flat tubes 21 and at least two rows of the second flat tubes

31. The microchannel heat exchanger group 100 can further include a plurality of first bending tubes 40 and a plurality of second bending tubes 41. The first flat tubes 21 arranged in adjacent rows of the plurality of first flat tubes 21 are connected to and in communication with each other via corresponding one of the plurality of first bending tubes 40, and the plurality of first bending tubes 40 are independent of the plurality of first flat tubes 21; and the second flat tubes 31 arranged in adjacent rows of the plurality of second flat tubes 31 are connected to and in communication with each other via corresponding one of the plurality of second bending tubes 41, and the plurality of second bending tubes 41 are independent of the plurality of second flat tubes 31.

[0046] It should be noted that in the microchannel heat exchanger group in the related art, the fins are arranged in a plurality of rows by bending the fins, which may cause deformation of the fins in the bending process and affect the heat exchange efficiency. Therefore, in order to solve the problem described above, adjacent flat tubes are connected to and in communication with each other via the bending tubes in the present application, so that the refrigerant can make a turn, and deformation of the plurality of fins 10 caused by bending of the plurality of fins 10 can be avoided.

[0047] In some embodiments, the microchannel heat exchanger group 100 further includes an adapter 50, the adapter 50 is disposed between the plurality of first capillary tubes 222 and the plurality of first flat tubes 21 and between the plurality of second capillary tubes 332 and the plurality of second flat tubes 31. In one aspect, since the first capillary tube 222 and the second capillary tube 322 are thin and has circular-shaped across section, and the cross section of the first flat tube 21 and the cross section of the second flat tube 31 are stripe-shaped, the cross section of the first capillary tube 222 and the cross section of the section capillary tube 322 cannot directly match with and connect to the cross section of the first flat tube and the cross section of the second flat tube 31, and transition of the adapter 50 is required to accomplish the communication between the plurality of first capillary tubes 222 and the plurality of first flat tubes 21 and between the plurality of second capillary tubes 332 and the plurality of second flat tubes 31. An end of the adapter 50 adjacent to the first capillary tube 222 or the second capillary tube 322 are set as circular-shaped matching with the capillary tubes, and an end of the adapter adjacent to the first flat tube 21 or the second flat tube 31 are set as stripe-shaped matching with the flat tubes. In another aspect, a plurality of flowing channels are generally disposed in the flat tubes to increase the heat exchange area, but only one flowing channel is disposed in the capillary tubes. Thus, transition of the adapter 50 is required to accomplish communication between the only one flowing channel in the capillary tubes and the plurality of flowing channels in the flat tube.

[0048] Specifically, the refrigerant in the first heat exchanger 20 flows in the first heat exchanger 20 from the

first distributor 221, flows into the first flat tube 21 via the first capillary tube 222, then flows into the first collecting tube 231 via the first connecting tube 232 and then flows out from the first collecting tube 231 to define a first circulation path. The refrigerant in the second heat exchanger 30 flows in the second heat exchanger 30 from the second distributor 321, flows into the second flat tube 31 via the second capillary tube 322, then flows into the second collecting tube 331 via the second connecting tube 332 and then flows out from the second collecting tube 331 to define a second circulation path. It should be noted that when the heat exchanger group includes two rows of first flat tubes 21, the refrigerant in the first heat exchanger 20 flows in the first heat exchanger 20 from the first distributor 221, flows into the first flat tube 21 via the first capillary tube 222, bends via the first bending tube 40, flows into the first flat tube 21 in an adjacent row of first flat tubes 21, then flows into the first collecting tube 231 via the first connecting tube 232 and then flows out from the first collecting tube 231 to define a first circulation path. When the heat exchanger group includes three rows of first flat tubes 21, both ends of the first flat tube 21 and the second flat tube 31 are provided with the first bending tube 40 and the second bending tube 41, the refrigerant in the first heat exchanger 20 flows in the first heat exchanger 20 from the first distributor 221, flows into the first flat tube 21 via the first capillary tube 222, bends via the first bending tube 40, flows into the first flat tube 21 in the second row of first flat tubes 21, bends via the first bending tube 40, flows into the first flat tube 21 in the third row of first flat tubes 21, then flows into the first collecting tube 231 via the first connecting tube 232 and then flows out from the first collecting tube 231 to define a first circulation path. The second circulation path of the second heat exchanger 30 are the same, which is not limited herein.

[0049] In some embodiments, a group of the first circulation path and a group of the second circulation path and are isolated from one another, the number of the first circulation path in the group of the first circulation path is defined as M , the number of the second circulation path in the group of the second circulation path is defined as N .

[0050] In some embodiments, the number M of the first circulation path in the group of the first circulation path and the number N of the second circulation path in the group of the second circulation path satisfy the following formula: $M = N$.

[0051] Referring to FIG. 3, when the number M of the first circulation path in the group of the first circulation path is equal to the number N of the second circulation path in the group of the second circulation path. In some embodiments, each of the first circulation paths and each of the second circulation paths are disposed in turn and insulated from each other. For use ratio of fins 10 of each of the heat exchanger, the use ratio is the maximum with the circulation path arrangement.

[0052] Referring to FIG. 4, when the number M of the first circulation path in the group of the first circulation

path is equal to the number N of the second circulation path in the group of the second circulation path, in some embodiments, every two of the first circulation paths and every two of the second circulation paths are disposed in turns and insulated from each other.

[0053] When the number M of the first circulation path in the group of the first circulation path is equal to the number N of the second circulation path in the group of the second circulation path, in some embodiments, the number M of the first circulation path in the group of the first circulation path and the number N of the second circulation path in the group of the second circulation path can be any positive integer greater than 0, which are not illustrated herein.

[0054] The circulation paths can be disposed in many ways, and the number M of the first circulation path in the group of the first circulation path can be not equal to the number N of the second circulation path in the group of the second circulation path. For example, every two of the first circulation paths and each of the second circulation paths are disposed in turns and insulated from each other; optionally, each of the first circulation paths and every two of the second circulation paths are disposed in turns and insulated from each other; optionally, every three of the first circulation paths and every two of the second circulation paths are disposed in turns and insulated from each other, which are not limited herein. By adjusting the arrangement method of the circulation paths, heat exchange intensity of the first heat exchanger 20 and the second heat exchanger 30 can be adjusted according to actual conditions, so as to change the heat exchange intensity at different positions of the microchannel heat exchanger group 100 and effectively control the specific heat exchange method of the microchannel heat exchanger group 100.

[0055] The present application further provides a following technical solution.

[0056] An air conditioning system, which includes the microchannel heat exchanger group 100. The microchannel heat exchanger group 100 includes the same advantages with the air conditioning system.

[0057] In the microchannel heat exchanger group 100 provided in the present application, since the microchannel heat exchanger group 100 further includes a first heat exchanger 20 and a second heat exchanger 30 independent of each other, when one of the first heat exchanger 20 and the second heat exchanger 30 is out of work, the other one of the first heat exchanger 20 and the second heat exchanger 30 can make full use of the heat exchange area of the plurality of fins 10 to exchange heat, thereby improving an energy efficiency of the microchannel heat exchanger group 100.

[0058] The technical features of the above-mentioned embodiments can be combined arbitrarily. In order to make the description concise, not all possible combinations of the technical features are described in the embodiments. However, as long as there is no contradiction in the combination of these technical features, the com-

binations should be considered as in the scope of the present application.

[0059] The above-described embodiments are only several implementations of the present application, and the descriptions are relatively specific and detailed, but they should not be construed as limiting the scope of the present application. It should be understood by those of ordinary skill in the art that various modifications and improvements can be made without departing from the concept of the present application, and all fall within the protection scope of the present application. Therefore, the patent protection of the present application shall be defined by the appended claims.

Claims

1. A microchannel heat exchanger group, comprising

a plurality of fins, wherein the plurality of fins are arranged in a plurality of rows, and each of the plurality of fins are provided with insertion slots; **characterized in that** the microchannel heat exchanger group further at least comprises a first heat exchanger and a second heat exchanger, the first heat exchanger comprises a plurality of first flat tubes, the second heat exchanger comprises a plurality of second flat tubes, the plurality of first flat tubes and the plurality of second flat tubes are arranged in a plurality of layers along a length direction of each of the plurality of fins, the plurality of first flat tubes and the plurality of second flat tubes are arranged in a plurality of rows along a width direction of each of the plurality of fins; and the insertion slots comprise a first insertion slot and a second insertion slot, the plurality of first flat tubes are inserted into the first insertion slot, the plurality of second flat tubes are inserted into the second insertion slot, and the plurality of first flat tubes are separated from the plurality of second flat tubes.

2. The microchannel heat exchanger of claim 1, wherein the plurality of first flat tubes and the plurality of second flat tubes alternate with each other along the length direction of the plurality of fins.

3. The microchannel heat exchanger group of claim 2, wherein the first heat exchanger comprises a first connector assembly and a second connector assembly,

each of the plurality of first flat tubes, the first connector assembly and the second connector assembly are connected to and in communication with each other, a first circulation path is defined by a refrigerant flowing into one of the

- plurality of first flat tubes from the first connector assembly, and flowing out from the second connector assembly; and
the second heat exchanger comprises a third connector assembly and a fourth connector assembly, each of the plurality of second flat tubes, the third connector assembly and the fourth connector assembly are connected to and in communication with each other, a second circulation path is defined by the refrigerant flowing into one of the plurality of first flat tubes from the third connector assembly, and flowing out from the fourth connector assembly;
wherein a group of the first circulation path and a group of the second circulation path and are isolated from one another, the number of the first circulation path in the group of the first circulation path is defined as M , the number of the second circulation path in the group of the second circulation path is defined as N , and both the number M of the first circulation path in the group of the first circulation path and the number N of the second circulation path in the group of the second circulation path are natural numbers equal to or greater than 1.
4. The microchannel heat exchanger group of claim 3, wherein the number M of the first circulation path in the group of the first circulation path and the number N of the second circulation path in the group of the second circulation path satisfy a following formula: $M = N$.
5. The microchannel heat exchanger group of claim 1, wherein the insertion slots are disposed at a same side of the plurality of fins, the insertion slots at adjacent rows of the plurality of fins alternate with each other; optionally wherein both sides of each of the plurality of fins are provided with the insertion slots, and the insertion slots disposed at both sides of each of the plurality of fins alternate with each other.
6. The microchannel heat exchanger group of claim 3, wherein the first connector assembly comprises a first distributor and a plurality of first capillary tubes being connected to and in communication with the first distributor, both ends of each of the plurality of first capillary tubes are connected to and in communication with the first distributor and corresponding one of the plurality of first flat tubes, respectively; and the third connector assembly comprises a second distributor and a plurality of second capillary tubes being connected to and in communication with the second distributor, both ends of each of the plurality of second capillary tubes are connected to and in communication with the second distributor and corresponding one of the plurality of second flat tubes, respectively.
7. The microchannel heat exchanger group of claim 6, wherein the second connector assembly comprises a first collecting tube and a plurality of first connecting tubes being connected to and in communication with the first collecting tube, both ends of each of the plurality of the first connecting tubes are connected to and in communication with the first collecting tube and corresponding one of the plurality of first flat tubes; and the fourth connector assembly comprises a second collecting tube and a plurality of second connecting tubes being connected to and in communication with the second collecting tube, both ends of each of the plurality of the second connecting tubes are connected to and in communication with the second collecting tube and corresponding one of the plurality of second flat tubes.
8. The microchannel heat exchanger group of claim 1, wherein both the plurality of first flat tubes and the plurality of second flat tubes are arranged in a plurality of rows, the first heat exchanger comprises a plurality of first bending tubes, the second heat exchanger comprises a plurality of second bending tubes, the first flat tubes arranged in adjacent rows of the plurality of first flat tubes are connected to and in communication with each other via corresponding one of the plurality of first bending tubes, and the plurality of first bending tubes and the plurality of first flat tubes are separately arranged; and the second flat tubes arranged in adjacent rows of the plurality of second flat tubes are connected to and in communication with each other via corresponding one of the plurality of second bending tubes, and the plurality of second bending tubes and the plurality of second flat tubes are separately arranged.
9. The microchannel heat exchanger group of claim 6, further comprising an adapter, the adapter is disposed between the plurality of first capillary tubes and the plurality of first flat tubes and between the plurality of second capillary tubes and the plurality of second flat tubes, and a tube orifice of the adapter opposite to the plurality of first flat tubes matches with a tube orifice of corresponding one of the plurality of first flat tube and another tube orifice of the adapter opposite to the plurality of second flat tubes matches with a tube orifice of corresponding one of the plurality of second flat tube.
10. An air conditioning system, **characterized by** comprising the microchannel heat exchanger group of claims 1 to 9.

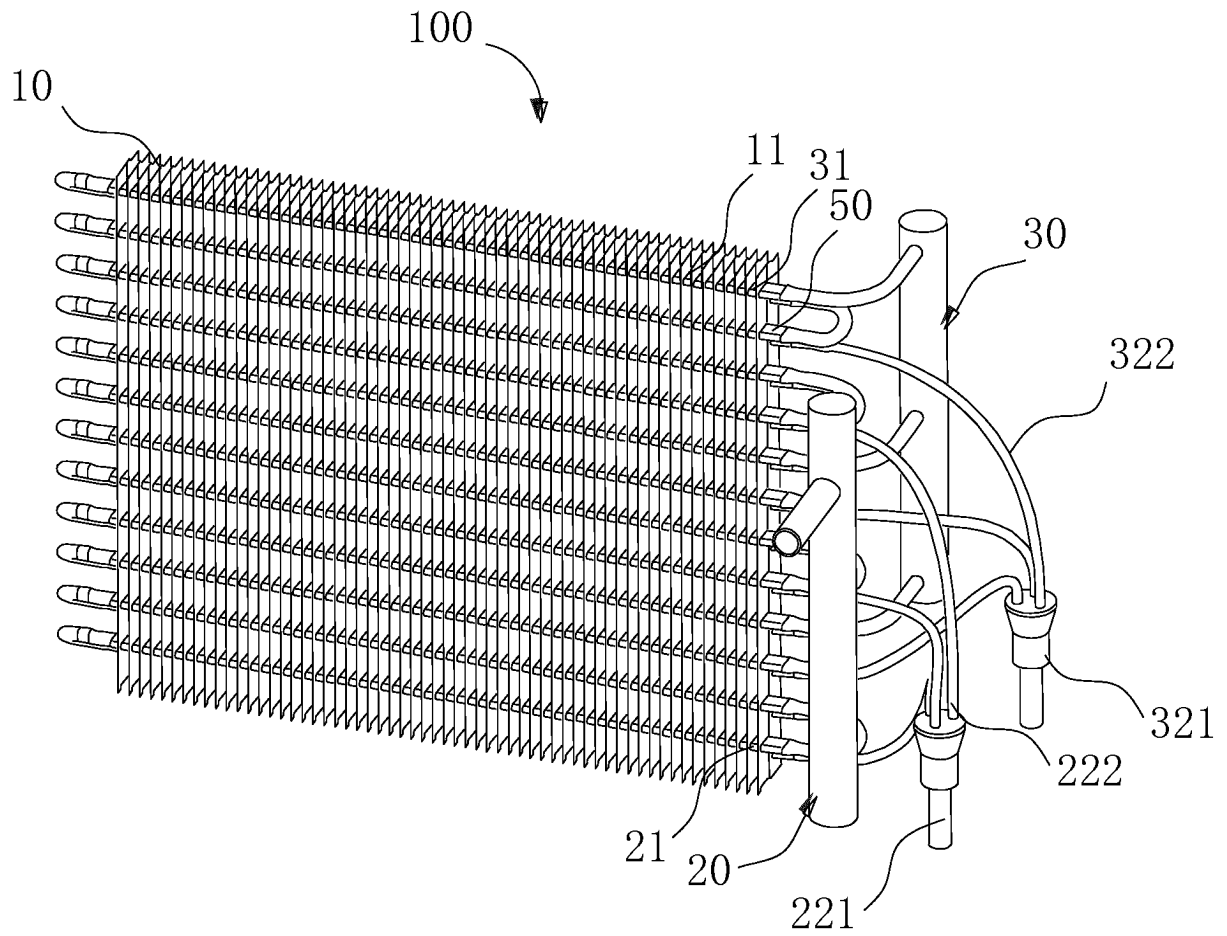


FIG. 1

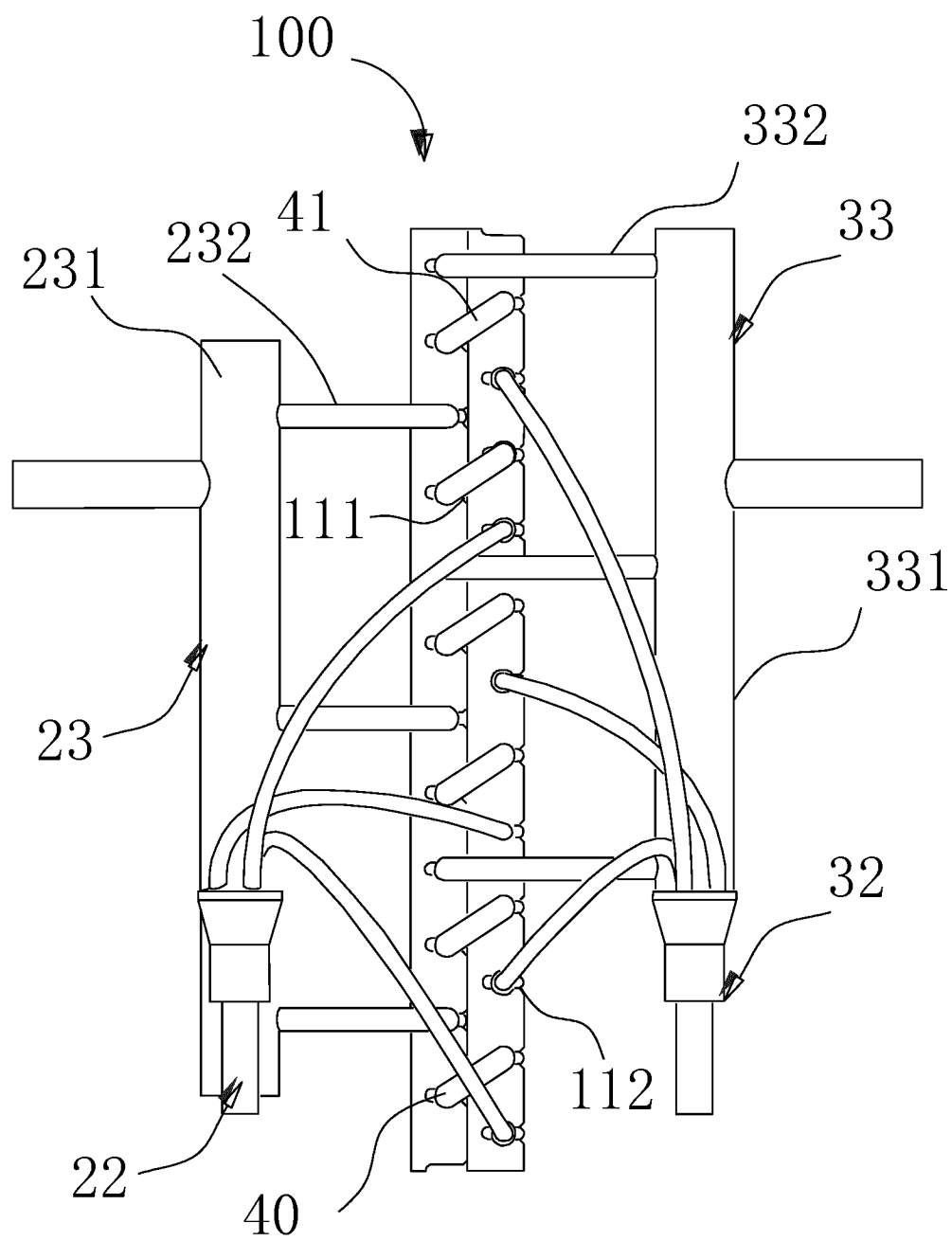


FIG. 2

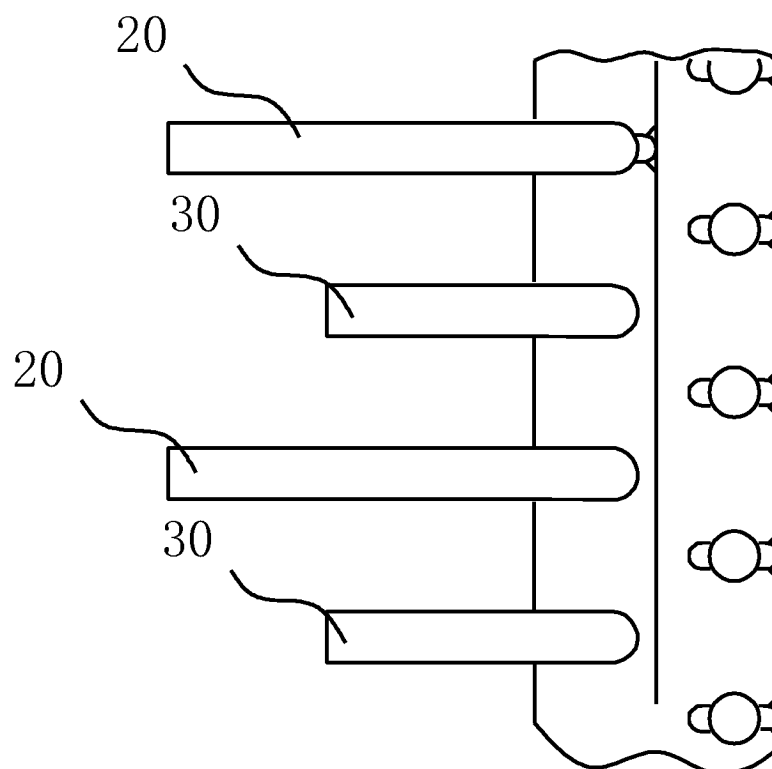


FIG. 3

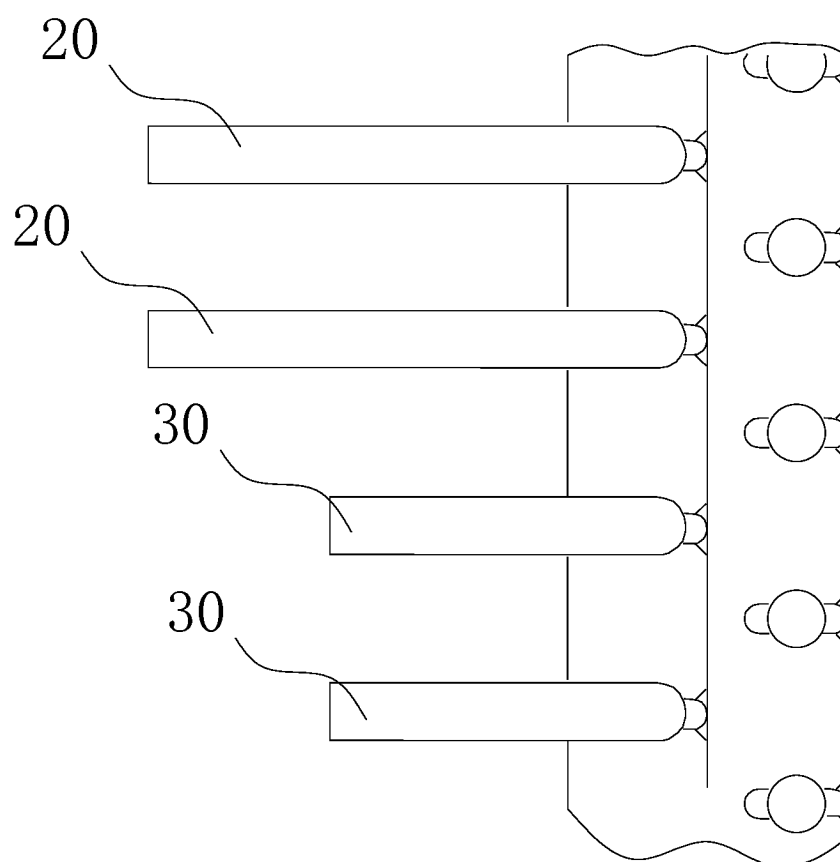


FIG. 4

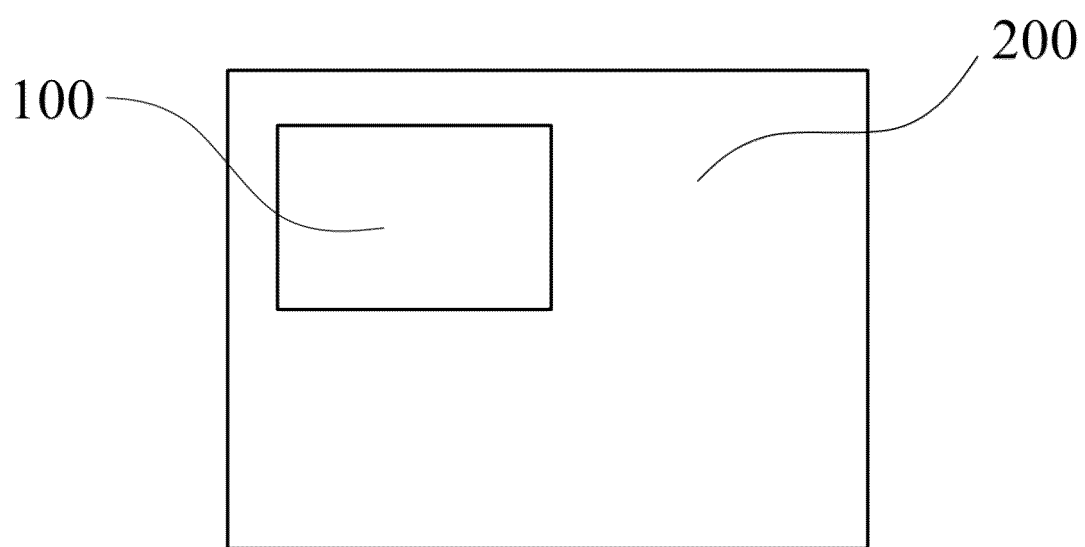


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2023/091268

A. CLASSIFICATION OF SUBJECT MATTER

F25B 39/00(2006.01)i; F28F 9/26(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)

IPC: F25B F24F F28F

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

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

CNTXT; CNKI; WPABS; DWPI; USTXT; EPTXT; WOTXT; ISI_Web of Science: 微通道, 换热, 热交换, 第二, 两个, 多个, 管, 独立, Microchannel, heat exchanger, second, couple, two, pipe, tube, independently

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 217464958 U (ZHEJIANG DUNAN THERMAL TECHNOLOGY CO., LTD.) 20 September 2022 (2022-09-20) claims 1-10	1-10
X	CN 111520934 A (ZHEJIANG DUNAN THERMAL TECHNOLOGY CO., LTD.) 11 August 2020 (2020-08-11) description, paragraph 0002 and 0027-0040, and figures 1 and 2	1-10

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

* Special categories of cited documents:

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“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

21 July 2023

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2023/091268

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN	217464958	U	20 September 2022	None	
CN	111520934	A	11 August 2020	None	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202221085342 [0001]