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(54) HEAT EXCHANGER ASSEMBLY AND USE THEREOF

(57) A heat exchanger assembly and use thereof, the heat exchanger assembly includes a micro-channel evaporator and a micro-channel condenser. The micro-channel evaporator includes a first header, a second header, a plurality of first circulating tubes each being configured to connect the first header with the second header, and first fins in contact with the first circulating tubes. The first circulating tubes are each provided with a plurality of first micro-channel cavities each being configured to allow refrigerant to flow. The micro-channel condenser includes a third header, a fourth header, a plurality of second circulating tubes each being configured to connect the third header with the fourth header, and second fins in contact with the second circulating tubes. The second circulating tubes are each provided with a plurality of second micro-channel cavities each being configured to allow the refrigerant to flow. The first circulating tubes are arranged up-to-down, and the condensate water may flow downward under the action of the gravity to facilitate discharging water. The second circulating tubes are arranged transversely, thereby uniformly distributing the refrigerant.

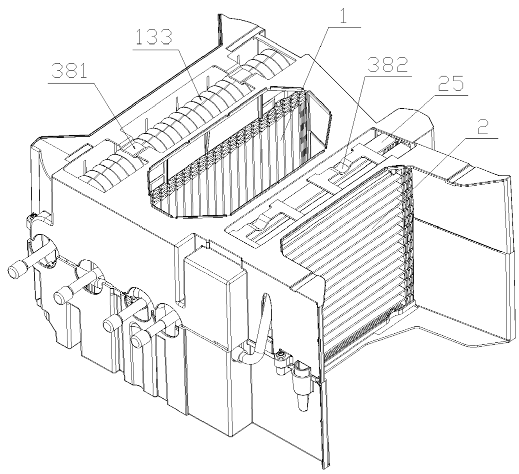

Fig. 5

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Description

TECHNICAL FIELD

[0001] The present application relates to a heat exchanger assembly and use thereof.

BACKGROUND

[0002] The conventional heat pump system usually includes a compressor, a condenser, a throttling element and an evaporator, and the evaporator and the condenser are collectively referred to as a heat exchanger.

[0003] Some conventional dryers or washer-dryers use the heat pump system to heat air and then dry wet clothes. A tube-fin evaporator and a tube-fin condenser are usually employed in the conventional technology.

[0004] However, with the development of technology, technical problems urgently to be solved in the field are to improve the efficiency, and reduce the size and weight of the heat exchanger assembly.

SUMMARY

[0005] A heat exchanger assembly and use thereof are provided according to the present application, wherein the heat exchanger assembly has an evaporator with better drainage performance, and a condenser with better oil return performance.

[0006] The following technical solutions are provided according to the present application. A heat exchanger assembly includes a micro-channel evaporator and a micro-channel condenser, the micro-channel evaporator and the micro-channel condenser are arranged with space, wherein the micro-channel evaporator includes a first header, a second header, a plurality of first circulating tubes each being configured to connect the first header with the second header, and first fins in contact with the first circulating tubes, and each of the first circulating tubes is provided with a plurality of first micro-channel cavities for allowing refrigerant to flow; the micro-channel condenser includes a third header, a fourth header, a plurality of second circulating tubes each being configured to connect the third header with the fourth header, and second fins in contact with the second circulating tubes, and each of the second circulating tubes is provided with a plurality of second micro-channel cavities for allowing the refrigerant to flow; and the first circulating tubes are arranged upright, and the second circulating tubes are arranged transversely.

[0007] As a further improved technical solution of the present application, the micro-channel evaporator and the micro-channel condenser are arranged in order along a flowing direction of air, the micro-channel evaporator is a multilayer evaporator and at least includes a first heat exchanger core and a second heat exchanger core, and each first circulating tube includes a first circulating portion connected to the first header and located at the first heat exchanger core, and a second circulating portion connected to the second header and located at the second heat exchanger core; and
the micro-channel condenser is a multilayer condenser and at least includes a third heat exchanger core and a fourth heat exchanger core, and each second circulating tube includes a third circulating portion connected to the third header and located at the third heat exchanger core, and a fourth circulating portion connected to the fourth header and located at the fourth heat exchanger core.

[0008] As a further improved technical solution of the present application, each of the first circulating tubes includes a first reversing portion connecting the first circulating portion with the second circulating portion, the first reversing portion is located at a top of the micro-channel evaporator, and the first header and/or the second header are/is located at a bottom of the micro-channel evaporator; the second circulating portion includes a second reversing portion connecting the third circulating portion with the fourth circulating portion, the second reversing portion is located at one side of the micro-channel condenser, and the third header and/or the fourth header are/is located at another side of the micro-channel condenser.

[0009] As a further improved technical solution of the present application, the first circulating portion, the second circulating portion and the first reversing portion on the same first circulating tube are formed by bending the same flat tube; and the third circulating portion, the fourth circulating portion and the second reversing portion on the same second circulating tube are formed by bending the same flat tube.

[0010] The heat exchanger assembly further includes a housing configured to limit the positions of the micro-channel evaporator and the micro-channel condenser, the housing includes a first housing and a second housing configured to be assembled with the first housing and to cooperate with the first housing, and the micro-channel evaporator and the micro-channel condenser are fixed between the first housing and the second housing; and the first housing and the second housing are assembled in an up-down direction or a left-right direction to form a mounting space for the micro-channel evaporator and the micro-channel condenser.

[0011] The first reversing portion is a third finless area which is not connected to the first fins, and the housing includes a second baffle wall configured to shield the third finless area along the flowing direction of the air; the second reversing portion includes a sixth finless area which is not connected to the second fins, and the housing includes a wall portion configured to shield the sixth finless area along the flowing direction of the air.

[0012] The first housing is a lower housing, and the second housing is an upper housing, and the first housing and the second housing are assembled in the up-down direction to form the mounting space for the micro-channel evaporator and the micro-channel condenser; the first housing includes a bottom wall, a first side wall extending upward from one side of the bottom wall, and a second side wall extending upward from another side of the bottom wall and opposite to the first side wall; the second housing includes a top wall, a third side wall extending downward from one side of the top wall, and a fourth side wall extending downward from another side of the top wall and opposite to the third side wall, the first side wall corresponds to the third side wall, and the second side wall corresponds to the fourth side wall; the wall portion includes a third wall portion arranged on the first side wall, and a seventh wall portion arranged on the third side wall, the third wall portion is provided with a second recess portion, the seventh wall portion is provided with a fourth recess portion, and the second recess portion and the fourth recess portion are configured to accommodate the second reversing portion of the micro-channel condenser.

[0013] The bottom wall is provided with a post protruding upward into the second recess portion, and the second reversing portion is sleeved on the post.

[0014] The housing is provided with a locating block protruding upward from the bottom wall; and the locating block is provided with a recess portion configured to locate the third header and/or the fourth header, and at least a part of the third header and/or the fourth header is inserted into the recess portion; or, the third header and/or the fourth header are/is provided with an end cap, the end cap is provided with a notch, and at least a part of the locating block protrudes into the notch.

[0015] The housing is provided with a plurality of locating structures to limit the position of the micro-channel evaporator or the micro-channel condenser; the locating structures are fixedly arranged on the top wall or the bottom wall, and each includes a limiting portion having an elasticity, the limiting portion has two ends connected to the bottom wall and includes at least one arc section or curve section, and a linear section, and the limiting portion cooperates with the micro-channel evaporator or the micro-channel condenser via the arc section or the curve section, to limit the position of the micro-channel evaporator or the micro-channel condenser.

[0016] A top portion of the arc section or curve section of the limiting portion of the locating structure is provided with an inclined portion which is of a necked shape and functions as a guide portion in installation to guide the micro-channel evaporator or the micro-channel condenser.

[0017] The first header and the second header are arranged in order along the flowing direction of the air, the housing is provided with a first protruding portion, a second protruding portion, a third protruding portion and a fourth protruding portion which all protrude upward from the bottom wall and are arranged in order along the flowing direction of the air, the first protruding portion and the second protruding portion are configured to locate a bottom of the micro-channel evaporator, and the third protruding portion and the fourth protruding portion are configured to locate a bottom of the micro-channel condenser; the micro-channel evaporator includes a first connecting pipe connected to the first header, and a second connecting pipe connected to the second header, wherein the second connecting pipe is an inlet pipe of the micro-channel evaporator, and the first connecting pipe is an outlet pipe of the micro-channel evaporator.

[0018] The micro-channel evaporator further includes a throttling element and a dry filter which are connected to the second connecting pipe in series, and the housing includes a sleeve configured to fix the dry filter; the sleeve is provided with a slot penetrating the sleeve in a depth direction of the sleeve, and the slot extends through a wall of the sleeve laterally.

[0019] The first header and the second header are both located at a bottom of the micro-channel evaporator, and are arranged with a certain space to form a drain channel.

[0020] Use of a heat exchanger assembly in a dehumidification device is further provided according to the present application, wherein the dehumidification device is provided with a heat pump system or a refrigeration system, the heat exchanger assembly is the above heat exchanger assembly, and is connected in the heat pump system or the refrigeration system, and the dehumidification device is configured to dehumidify and dry wet objects in the dehumidification device by using the heat exchanger assembly; the dehumidification device is provided with a shell configured to mount the heat exchanger assembly, the shell includes an inlet end and an outlet end, the micro-channel evaporator is adjacent to the inlet end, and the micro-channel condenser is adjacent to the outlet end.

[0021] Compared with the conventional technology, a micro-channel evaporator and a micro-channel condenser are provided according to the present application, which improves the heat exchange performance of the heat exchanger assembly. Besides, by arranging the first circulating tubes upright, condensate water may flow downward under the action of gravity, which facilitates drainage; by arranging the second circulating tubes transversely, lubricating oil in the refrigerant being severely accumulated at the bottom of the third header and the fourth header due to the influence of gravity can be avoided, thus realizing a better oil return performance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

Figure 1 is a perspective schematic view showing a heat exchange system according to an embodiment of the present application.

Figure 2 is a perspective schematic view of a shell shown in Figure 1.

Figure 3 is a perspective schematic view of a lower shell shown in Figure 2.

Figure 4 is a perspective schematic view of a heat exchanger assembly of the present application.

Figure 5 is a perspective schematic view of the heat exchanger assembly in Figure 4 viewed from another angle.

Figure 6 is a perspective schematic view of the heat exchanger assembly in Figure 4 viewed from yet another angle, wherein a wind shielding sheet is mounted between a first side plate of a micro-channel evaporator, and a second side wall and a fourth side wall of a housing.

Figure 7 is a perspective partial schematic view showing the heat exchanger assembly in the Figure 6, wherein the wind shielding sheet is not mounted.

Figure 8 is a perspective partially exploded view of the heat exchanger assembly in Figure 4, wherein a first housing and a second housing are separated from each other.

Figure 9 is a perspective exploded view of the heat exchanger assembly in Figure 4.

Figure 10 is a top view of the heat exchanger assembly according to the present application with the second housing removed.

Figure 11 is a right view of a micro-channel evaporator and a micro-channel condenser in Figure 10.

Figure 12 is a perspective schematic view of the micro-channel evaporator in Figure 10.

Figure 13 is a perspective schematic view of the micro-channel condenser in Figure 10.

Figure 14 is a front view showing the micro-channel evaporator in Figure 10 after being rotated by a certain angle.

Figure 15 is a perspective schematic view of a partition in Figure 14.

Figure 16 is a perspective schematic view of a first circulating tube.

Figure 17 is a perspective schematic view of a second circulating tube.

Figure 18 is a perspective schematic view showing the first housing and a capillary tube which cooperate with each other in a first embodiment.

Figure 19 is a partially enlarged view of the circled part in Figure 18.

Figure 20 is a perspective schematic view showing the first housing and the capillary tube which cooperate with each other in a second embodiment.

Figure 21 is a partially enlarged view of the circled part in Figure 20.

Figure 22 is a perspective schematic view showing the first housing in cooperation with a dry filter.

Figure 23 is a partially enlarged view showing the circled part in Figure 22.

Figure 24 is a perspective view of the first housing in Figure 22 viewed from another angle.

Figure 25 is a partially enlarged view showing the circled part in Figure 24.

Figure 26 is a perspective schematic view showing the first housing before cooperating with the micro-channel evaporator.

Figure 27 is a perspective schematic view of the first housing viewed from another angle.

Figure 28 is a perspective schematic view of the first housing viewed from another angle.

Figure 29 is a perspective schematic view showing the first housing and the second body before being assembled.

Figure 30 is a partially enlarged view showing the circled part in Figure 29.

DETAILED DESCRIPTION

[0023] Reference is made to Figure 1 to Figure 4. A heat exchange system is provided according to embodiments shown in figures of the present application, which includes a shell 200 and a heat exchanger assembly 100 mounted inside the shell 200. The shell 200 includes an inlet end 201 and an outlet end 202. In embodiments shown in figures of the present application, the outlet end 202 and the inlet end 201 are perpendicular to each other. The shell 200 includes an upper shell 203, a lower shell 204, and a mounting space 205 between the upper shell 203 and the lower shell 204. Referring to Figure 3, the lower shell 204 is provided with a location rib 206 protruding upward into the mounting space 205, to facilitate installing and locating the heat exchanger assembly 100.

[0024] Reference is made to Figure 3 to Figure 9. The heat exchanger assembly 100 includes a micro-channel evaporator 1, a micro-channel condenser 2, and a housing 3 used for limiting the positions of the micro-channel evaporator 1 and the micro-channel condenser 2. The micro-channel evaporator 1 and the micro-channel condenser 2 are arranged with space, and arranged in order along a flowing direction A-A of the air. The micro-channel evaporator 1 is adjacent to the inlet end 201, and the micro-channel condenser 2 is adjacent to the outlet end 202. The micro-channel evaporator 1 and the micro-channel condenser 2 may be a single layer heat exchanger or a multilayer heat exchanger. The multilayer heat exchanger includes two or more heat exchanger cores.

[0025] Reference is made to Figure 10 to Figure 12. The micro-channel evaporator 1 includes a first header 11, a second header 12, a plurality of first circulating tubes 13 connecting the first header 11 with the second header 12, and first fins 14 in contact with the first circulating tubes 13. The manner for allowing the first fins 14 to be in contact with the first circulating tubes 13 includes, but not limited to, welding, pasting with glue or surface contact. Referring to Figure 16, each of the first circulating tubes 13 is provided with a plurality of first micro-channel cavities 130 which are separated from each other and configured to allow refrigerant to flow. Since the micro-channel technology can be understood by the person skilled in the field of the heat exchanger, which will not be described herein. In the embodiments shown in figures of the present application, the first fin 14 is of a corrugate shape, and is fixed between the two adjacent first circulating tubes 13 by welding, pasting or other manners, to enhance the heat exchange with the air, and improve the heat exchanging performance. Compared with a tube-fin evaporator, the micro-channel evaporator 1 according to the present application has a better performance, a smaller size, a lighter weight and many other advantages.

[0026] In embodiments shown in the figures of the present application, the micro-channel evaporator 1 is a multilayer evaporator, and specifically, the micro-channel evaporator 1 is a two-layer evaporator. The micro-channel evaporator 1 includes a first heat exchanger core 110 and a second heat exchanger core 120 which are arranged in order along the flowing direction A-A of the air. Each heat exchanger core includes the first header or the second header, a part of the first circulating tubes 13 and a part of the first fins 14. Each of the first circulating tubes 13 includes a first circulating portion 131 connected to the first header 11 and located at the first heat exchanger core 110, a second circulating portion 132 connected to the second header 12 and located at the second heat exchanger core 120, and a first reversing portion 133 connecting the first circulating portion 131 to the second circulating portion 132. The first fin 14 is located between the two adjacent first circulating portions 131 and between the two adjacent second circulating portions 132, to enhance heat exchange. Two adjacent first fins 14 at the same heat exchanger core are separated from each other. Reference is made to Figures 9 and 12. In embodiments shown in the figures of the present application, a portion of the first circulating portion 131, adjacent to the first header 11, is a first finless area 134, that is, said portion is not connected to the first fin 14. A portion of the second circulating portion 132, adjacent to the second header 12, is a second finless area 135, that is, said portion is not connected to the first fin 14. Besides, the first reversing portion 133 is a third finless area 136, that is, said portion is connected to the first fin 14. Referring to Figure 12, it should be noted that, for simplicity, only two ends of the first fin 14 are shown, and in embodiments shown in the figures of the present application, an area, corresponding to the first circulating portion 131 and the second circulating portion 132, of the first fin 14 is continuous. In addition, in the case that the micro-channel evaporator includes three or more layers of heat exchanger cores, the heat exchanger core(s) in the middle may have no header.

[0027] In embodiments shown in the figures of the present application, the first circulating portion 131, the second circulating portion 132, and the first reversing portion 133 of the same first circulating tube 13 are formed by bending one flat tube. Of course, in other embodiments, the first circulating portion 131, the second circulating portion 132, and the first reversing portion 133 may also be assembled by different components. For example, the first reversing portion 133 may be subsequently assembled at one end of the first circulating portion 131 and one end of the second circulating portion 132 to connect the first circulating portion 131 to the second circulating portion 132. The first reversing portion 133 is named to refer to that the flowing direction of the refrigerant is changed at this portion.

[0028] In embodiments shown in the figures of the present application, the first circulating tube 13 is the flat tube, and arranged up-to-down. It should be noted that, "being arranged up-to-down" in embodiments of the present application includes, but not limited to, being arranged vertically, and also includes being arranged obliquely at a certain angle, that is any arrangement, that allows the condensate water from the air to be discharged downward along the first circulating tubes 13 and/or end portions of the first fins 14 under the action of gravity, is deemed to fall into the scope of "being arranged up-to-down". In embodiments shown in the figures of the present application, the first circulating portion 131 and the second circulating portion 132 are arranged substantially vertically, and the first header 11 and the second header 12 are arranged substantially horizontally. The refrigerant may be in a gas-liquid two-phase state when entering into the micro-channel evaporator 1, the above arrangement may improve the distribution uniformity of the refrigerant in the flat tube, thereby better restraining the separation of the gas-liquid two-phase refrigerant. Besides, the above arrangement also facilitates the condensate water flowing downward along the first circulating portion 131 and the second circulating portion 132 under the action of gravity, thereby facilitating drainage.

[0029] In embodiments shown in the figures of the present application, the first header 11 and the second header 12 are arranged in order along the flowing direction A-A of the air. The first header 11 and the second header 12 are both of a cylindrical shape, to increase the burst pressure. The first reversing portion 133 is located at a top portion of the micro-channel evaporator 1, and the first header 11 and/or the second header 12 are/is located at a bottom portion of the micro-channel evaporator 1. In embodiment shown in the figures of the present application, the first header 11 and the second header 12 are both located at the bottom portion of the micro-channel evaporator 1.

[0030] The micro-channel evaporator 1 further includes a plurality of first side plates 15 which are located at two sides of the micro-channel evaporator 1, and the first fin 14 is also provided between the first side plate 15 and the first circulating tube 13 adjacent to the side plates 15. Further, the first fins 14 are arranged between the first side plate 15 and the first circulating portion 131 as well as between the first side plate 15 and the second circulating portion 132. The micro-channel evaporator 1 is provided with a first spare space 150. Referring to Figure 12, in embodiments shown in the figures of the present application, the first spare space 150 is located above the first side plates 15 and adjacent to the first reversing portion 133.

[0031] The micro-channel condenser 2 includes a third header 21, a fourth header 22, a plurality of second circulating tubes 23 connecting the third header 21 with the fourth header 22, and second fins 24 in contact with the second circulating tubes 23. The manner for allowing the second fins 24 to be in contact with the second circulating tubes 23 includes, but not limited to, welding, pasting with glue or surface contact. Referring to Figure 17, each of the second circulating tubes 23 is provided with a plurality of second micro-channel cavities 230 which are separated from each other and configured to allow the refrigerant to flow. Since the micro-channel technology can be understood by the person skilled in the field of the heat exchanger, which will not be described herein. The second fin 24 is of a corrugate shape, and is fixed between the two adjacent second circulating tubes 23 by welding, pasting or other manners, to enhance the heat exchange with the air, and improve the heat exchanging performance. Compared with a tube-fin condenser, the micro-channel condenser 2 according to the present application has a better performance, a smaller size, a lighter weight and many other advantages.

[0032] The micro-channel condenser 2 is a multilayer condenser, and specifically the micro-channel condenser 2 is a two-layer condenser in the embodiments shown in the figures of the present application. The micro-channel condenser 2 includes a third heat exchanger core 210 and a fourth heat exchanger core 220 which are arranged in order along the flowing direction A-A of the air. Each of the third heat exchanger core and the fourth heat exchanger core includes the third header or the fourth header, a part of the second circulating tubes 23 and a part of the second fins 24. Each of the second circulating tubes 23 includes a third circulating portion 231 connected to the third header 21 and located at the third heat exchanger core 210, a fourth circulating portion 232 connected to the fourth header 22 and located at the fourth heat exchanger core 220, and a second reversing portion 233 connecting the third circulating portion 231 with the fourth circulating portion 232. The second fin 24 is located between the two adjacent third circulating portions 231 and between the two adjacent fourth circulating portions 232, to improve the heat exchange performance. Two adjacent second fins 24 at the same heat exchanger core are separated from each other. Reference is made to Figures 13 and 26. In embodiments shown in the figures of the present application, a portion of the third circulating portion 231, adjacent to the third header 21, is a fourth finless area 234, that is, said portion is not connected to the second fin 24. A portion of the fourth circulating portion 232, adjacent to the fourth header 22, is a fifth finless area 235, that is, said portion is not connected to the second fin 24. Besides, the second reversing portion 233 is a sixth finless area 236, that is, said portion is not connected to the second fin 24. Referring to Figure 13, it should be noted that, for simplicity, only two ends of the second fin 24 are shown, however in embodiments shown in the figures of the present application, an area, corresponding to the third circulating portion 231 and the fourth circulating portion 232, of the second fin 24 is continuous.

[0033] In embodiments shown in the figures of the present application, the third circulating portion 231, the fourth circulating portion 232, and the second reversing portion 233 of the same second circulating tube 23 are formed by bending one flat tube. Of course, in other embodiments, the third circulating portion 231, the fourth circulating portion 232, and the second reversing portion 233 may also be assembled by different components. For example, the second reversing portion 233 is subsequently assembled at one end of the third circulating portion 231 and one end of the fourth circulating portion 232 to connect the third circulating portion 231 to the fourth circulating portion 232. The second reversing portion 233 is named to refer to that the flowing direction of the refrigerant is changed at this portion.

[0034] In embodiments shown in the figures of the present application, the second circulating tube 23 is the flat tube, and is arranged transversely. It should be noted that, "being arranged transversely" in embodiments of the present application includes, but not limited to, being arranged horizontally, and also includes being arranged obliquely at a certain angle. In embodiments shown in the figures of the present application, the third circulating portion 231 and the fourth circulating portion 232 are arranged substantially horizontally, to avoid lubricating oil in the refrigerant being severely accumulated at the bottom of the third header 21 and the fourth header 22 due to the influence of gravity which may result in that an effective circulation flow cannot be performed.

[0035] In embodiments shown in the figures of the present application, the third header 21 and the fourth header 22 are arranged in order along the flowing direction A-A of the air, and are arranged substantially vertically. The third header 21 and the fourth header 22 are both of a cylindrical shape. The second reversing portion 233 is located at one side of the micro-channel condenser 2 (such as the left side in Figure 13), and the third header 21 and/or the fourth header 22 are/is located at another side of the micro-channel condenser 2 (such as the right side in Figure 13). In embodiment shown in the figures of the present application, the third header 21 and the fourth header 22 are both located at the other side of the micro-channel condenser 2 (such as the right side in Figure 13). In the case that the condenser has a structure with three or more layers, the third header and the fourth header may be located at the same side, and also may be located at the two different sides.

[0036] The micro-channel condenser 2 further includes a plurality of second side plates 25 which are located at an upper side and a lower side of the micro-channel condenser 2, and the second fin 24 is also provided between the second side plate 25 and the second circulating tube 23 adjacent to the second side plate 25. The micro-channel condenser 2 is provided with a second spare space 250. Referring to Figure 13, in embodiments shown in the figures of the present application, the second spare space 250 is located between the second side plates 25 and the third header 21 and between the second side plates 25 and the fourth header 22.

[0037] The third header 21 and the fourth header 22 are each provided with end caps 26 disposed at an upper end and a lower end. Each of the end caps 26 at the lower ends of the third header 21 and the fourth header 22 is provided with a notch 261 denting inward.

[0038] Reference is made to Figures 10 and 11. The micro-channel evaporator 1 includes a first connecting pipe 17 connected to the first header 11, and a second connecting pipe 18 connected to the second header 12. The micro-channel condenser 2 includes a third connecting pipe 27 connected to the third header 21, and a fourth connecting pipe 28 connected to the fourth header 22, wherein the second connecting pipe 18 and the fourth connecting pipe 28 are inlet pipes, and the first connecting pipe 17 and the third connecting pipe 27 are outlet pipes. The second connecting pipe 18 runs through the first spare space 150, and the fourth connecting pipe 28 runs through the second spare space 250. Such arrangement, on one hand, may save space and have a compact structure, and on the other hand, may avoid excessive hard interference with corresponding heat exchanger core which may damage the heat exchanger core. In embodiments shown in the figures of the present application, a portion of the first connecting pipe 17 where the first connecting pipe 17 is connected to the first header 11, and a portion of the second connecting pipe 18 where the second connecting pipe 18 is connected to the second header 12 are arranged in order in the flow direction A-A of the air, and a portion of the third connecting pipe 27 where the third connecting pipe 27 is connected to the third header 21, and a portion of the fourth connecting pipe 28 where the fourth connecting pipe 28 is connected to the fourth header 22 are arranged in order in the flow direction A-A of the air.

[0039] In embodiments shown in the figures of the present application, the first header 11, the second header 12, the third header 21 and the fourth header 22 are each an aluminum pipe, and the first connecting pipe 17, the second connecting pipe 18, the third connecting pipe 27 and the fourth connecting pipe 28 are each a copper aluminum connecting pipe. A portion of each connecting pipe where the connecting pipe is connected to the respective header is an aluminum tube, to reduce the welding difficulty, and improve the welding reliability and the property of corrosion resistance; while an outer port of each connecting pipe is a copper tube, to improve the reliability of connection with the user side. Reference is made to Figures 10 and 11. The outer ports of the connecting pipes along the flow direction A-A of the air are, in order, the outer port of the second connecting pipe 18, the outer port of the third connecting pipe 27, the outer port of the first connecting pipe 17, and the outer port of the fourth connecting pipe 28.

[0040] For the micro-channel evaporator 1, since the inlet pipe is located behind the outlet pipe in the flow direction A-A of the air, an average surface temperature of the second heat exchanger core 120 is lower than an average surface temperature of the first heat exchanger core 110. With such design, the air flowing in the flow direction A-A may be progressively dehumidified, that is, the first heat exchanger core 100 with a low average surface temperature firstly condenses most part of moisture in the air, and then the second heat exchanger core 120 with a lower average surface temperature condenses a small part of moisture in the air, thus a good dehumidification effect is achieved. Similarly, for the micro-channel condenser 2, since the inlet pipe is located behind the outlet pipe in the flow direction A-A of the air, an average surface temperature of the fourth heat exchanger core 220 is higher than an average surface temperature of the third heat exchanger core 210. With such design, the air flowing in the flow direction A-A may be progressively heated up, that is, the third heat exchanger core 210 with a high average surface temperature firstly heats the air to a certain temperature, and then the fourth heat exchanger core 220 with a higher average surface temperature further heats up the air, thus a good warming effect is achieved.

[0041] Referring to Figure 10, an inner space 10 is provided between the micro-channel evaporator 1 and the micro-channel condenser 2. In embodiments shown in the figures of the present application, the heat exchanger assembly 100 further includes a throttling element 4 and a dry filter 5 which are connected to the second connecting pipe 18 in series. The throttling element 4 and the dry filter 5 are located in the inner space 10. In embodiments shown in the figures of the present application, the throttling element 4 is a capillary tube, and of course, in other embodiments, the throttling element may also be a thermal expansion valve or an electronic expansion valve which has the throttling and depressurizing effect. The dry filter 5 is substantially of a cylindrical shape with a thick middle and two thin ends.

[0042] In embodiments shown in the figures of the present application, the micro-channel evaporator 1 and the micro-channel condenser 2 are arranged straightly and are substantially in parallel with each other. Of course, in other embodiments, the micro-channel evaporator 1 may be arranged to form an included angle with respect to the micro-channel condenser 2. For example, the micro-channel evaporator 1 is arranged obliquely, thus, on one hand, in the case that the mounting height is limited, the micro-channel evaporator 1 arranged obliquely to a horizontal direction may have a low height; and on the other hand, in the case that the mounting width is limited, the micro-channel evaporator 1 arranged obliquely has a larger heat exchanging area than the micro-channel evaporator 1 arranged straightly, which may enhance the heat exchanging capacity to some extent.

[0043] The housing 3 is fixed outside the micro-channel evaporator 1 and the micro-channel condenser 2, thus on one hand, the housing 3, the micro-channel evaporator 1 and the micro-channel condenser 2 may form a whole, and on the other hand, the housing 3 can also have the function of guiding the air. Referring to Figures 4, 8 and Figure 20 to Figure 30, the housing 3 includes a first housing 31 and a second housing 32 which are assembled with each other. In embodiments shown in the figures of the present application, the first housing 31 is a lower housing, the second housing 32 is an upper housing, and the first housing 31 and the second housing 32 are assembled together along a vertical direction. Of course, in other embodiments, the first housing 31 and the second housing 32 may also be assembled together in the horizontal direction.

[0044] The first housing 31 and the second housing 32 according to this embodiment are described in detail hereinafter. The first housing 31 includes a bottom wall 311, a first side wall 312 extending upward from one end of the bottom wall 311, and a second side wall 313 extending upward from another end of the bottom wall 311 and opposite to the first side wall 312. The first housing 31 is provided with a first space 3111 which at least accommodates a part of the micro-channel evaporator 1, and a second space 3112 which at least accommodates a part of the micro-channel condenser 2. After being installed in the housing 3, the micro-channel evaporator 1 and the micro-channel condenser 2 are located between the first side wall 312 and the second side wall 313. The first side wall 312 includes a first wall portion 3121, a second wall portion 3122, a third wall portion 3123, and a fourth wall portion 3124 which are arranged in order along the flow direction A-A of the air. The first wall portion 3121 corresponds to one side of the micro-channel evaporator 1, and the third wall portion 3123 corresponds to one side of the micro-channel condenser 2. The second wall portion 3122 is located between the micro-channel evaporator 1 and the micro-channel condenser 2 in the flow direction A-A of the air. The second wall portion 3122 is located in the vertical plane obliquely, and is inclined inward in the flow direction A-A of the air, that is, a part, adjacent to the first wall portion 3121, of the second wall portion 3122 is relatively outward, while a part, adjacent to the third wall portion 3123, of the second wall portion 3122 is inward, and a part, adjacent to the second reversing portion 233, of the second wall portion 3122 is indented inwards. With such arrangement, the second wall portion 3122 may have the function of guiding the air.

[0045] Referring to Figure 18, an inner side of the first wall portion 3121 is provided with a first recess portion 3125 in communication with the first space 3111, and the first recess portion 3125 is used for guiding the first side plate 15 located at one side (such as the left side) of the micro-channel evaporator 1. The bottom wall 311 is provided with a first protruding portion 3113, a second protruding portion 3114, a third protruding portion 3115 and a fourth protruding portion 3116 which all extend upward and are arranged in order along the flow direction A-A of the air. The first protruding portion 3113 and the second protruding portion 3114 are configured to locate the bottom of the micro-channel evaporator 1, and the third protruding portion 3115 and the fourth protruding portion 3116 are configured to locate the bottom of the micro-channel condenser 2. The first protruding portion 3113 is provided with a first baffle wall 3117 with a certain height in the vertical direction, and the first baffle wall 3117 is configured to shield the first finless area 134 in the flow direction A-A of the air. In embodiments shown in the figures of the present application, the second finless area 135 is located right behind the first finless area 134, thus when the first baffle wall 3117 shields the first finless area 134, the second finless area 135 is also shielded by the first baffle wall 3117, thereby reducing air leakage. In addition, the second protruding portion 3114 and the fourth protruding portion 3116 are both provided with a plurality of locating structures 3118 which are used for locating the micro-channel evaporator 1 and the micro-channel condenser 2 at a front-rear direction. In embodiments shown in the figures of the present application, each of the locating structures 3118 is an elastic sheet, and includes a limiting portion 333 having relative elasticity. Two ends of the limiting portion 333 are connected to the bottom wall 311, that is, the limiting portion 333 is not entirely connected to the bottom wall 311, but has only two ends connected to the bottom wall. The limiting portion includes at least one arc section and a linear section, and the limiting portion cooperates with the micro-channel evaporator 1 or the micro-channel condenser 2 to locate the same via the arc section. Even if the micro-channel evaporator 1 or the micro-channel condenser 2 has a poor consistency after being bent, when the locating structure 3118 cooperates with the micro-channel evaporator 1 or the micro-channel condenser 2 to be assembled to the same, the locating structure 3118 generates an elastic deformation during installation since only two ends of the locating structure 3118 are connected to the bottom wall, thereby realizing a good location effect. A top of the limiting portion 333 of each of the locating structures 3118 is provided with an inclined portion 332 which is of a necked shape, and the inclined portions 332 are configured to guide the micro-channel evaporator 1 and the micro-channel condenser 2 respectively. The bottom wall 311 is provided with a drain connection 310 running through the bottom wall 311 in an up-down direction, and the drain connection 310 corresponds to the first space 3111 and is located below the first header 11 and the second header 12. The locating structures and the first housing 31 may be formed integrally by injection molding.

[0046] In addition, reference is made to Figures 6, 7 and 9. A first gap 314 exists between the first side plate 15 located at another side of the micro-channel evaporator 1 and the second side wall 313, thus the housing 3 is further provided with a wind shielding sheet 315 inside the first gap 314. In embodiments shown in the figures of the present application, the second side wall 313 is provided with a mounting groove 331, and the wind shielding sheet 315 is provided with a mounting strip 3151 which is inserted into the mounting groove 331 from top to bottom. A cross-section of the mounting strip 3151 is I-shaped, and the wind shielding sheet 315 may be stably retained on the second side wall 313 due to such arrangement. The wind shielding sheet 315 may block the first gap 314 in the flow direction A-A of the air, thereby preventing wind from directly flowing through the first gap.

[0047] Referring to Figure 18, an inner side of the third wall portion 3123 is provided with a second recess portion 3131 in communication with the second space 3112, and the second recess portion 3131 is configured to accommodate the second reversing portions 233 of the micro-channel condenser 2. The third wall portion 3123 is configured to block at least a part of the sixth finless area 236 in the flow direction A-A of the air, thereby reducing air leakage in the respective area and increasing the air heating temperature. Referring to Figure 28, the bottom wall 311 is provided with a post 3119 protruding upward into the second recess portion 3131, and the second reversing portions 233 are sleeved on the post 3119 to be located. Besides, the bottom wall 311 is further provided with a locating block 316 protruding upward into the second recess portion 3131, a first supporting block 3162, and a second supporting block 3163. The locating block 316 is provided with a recess portion 3161, and an inner diameter of the recess portion 3161 is slightly greater than an outer diameter of the third header 21 and/or an outer diameter of the fourth header 22. In assembling, the third header 21 and/or the fourth header 22 are/is inserted into the recess portion 3161 to be located. The first supporting block 3162 is substantially of a strip shape to be in a linear contact with the respective header, and at this moment, even if an end face of the header is not very flat, the linear contact may also improve the installation accuracy. The second supporting block 3163 is used to contact the second side plate 25 at the bottom of the micro-channel condenser 2 to form a mutual constraint. With such arrangement, problems caused by machining, assembling or welding deformation, such as local wear, assembly dislocation and vibration of the heat exchanger core, can be avoided or reduced in assembling the micro-channel condenser 2. Of course, in other embodiments, an outer diameter of the locating block 316 may be set to be slightly smaller than an inner diameter of a notch 261 of the end cap 26. The locating block 316 can be clamped in the notch 261 during installation, which may also realize the function of locating the micro-channel condenser 2 at a certain dimension. The elastic sheets 3118 located on the third protruding portion 3115 and/or the fourth protruding portion 3116 are used for locating a front end and a rear end of the micro-channel condenser 2 in the front-rear direction, to facilitate installation and prevent shaking. The fourth wall portion 3124 and a portion of the second side wall 313 extend beyond the micro-channel condenser 2 in the flow direction A-A of the air, to guide the wind.

[0048] Referring to Figures 20 and 21, in an embodiment of the present application, the bottom wall 311 is provided with a convex portion 317 protruding upward into the inner space 10, and the capillary tube functioning as the throttling component is twined around the convex portion 317 to be located. The convex portion 317 is provided with a circular arc-shaped outer surface 3171 to facilitate twining the capillary tube. Besides, the housing 3 may be further provided with a strapping tape (not shown in the figures) to bundle and fix the capillary tube. Referring to Figures 18 and 19, in another embodiment, the bottom wall 311 is further provided with a fastener portion 318 protruding upward into the inner space 10, and the fastener portion 318 is provided with a hook 3181 to secure the capillary tube in the vertical direction. The fastener portions 318 are arranged in pairs, and the capillary tube is secured in a gap between the fastener portions 318 arranged in pairs. Preferably, the fastener portions 318 arranged in pairs are arranged in order along the flow direction of the air, the capillary tube after being twined forms a structure similar to an oval shape or a shape with two circular arc-shaped ends and a square middle, and the long side of said structure has a better deformability than the short side of said structure, thereby facilitating securing the capillary tube in the fastener portions 318.

[0049] Referring to Figure 22 to Figure 25, the housing 3 further includes a sleeve 319 which protrudes inward into the inner space 10 and is configured to fix the dry filter 5. In embodiments shown in the figures of the present application, the sleeve 319 is integrally formed with the second side wall 313 by extending from the second side wall 313. The sleeve 319 is provided with a receiving space 3191 configured to limit the dry filter 5, and the receiving space 3191 runs through the sleeve 319 in the vertical direction to receive the dry filter 5. The sleeve 319 is provided with a plurality of protruding ribs 3192 which are located on an inner surface of the sleeve 319 and extend along the vertical direction. The protruding ribs 3192 abut against an outer surface of the dry filter 5 to realize a better clamping effect. The sleeve 319 is provided with a slot 3193 which extends through the sleeve 319 in the vertical direction, and the slot 3193 extends through a wall of the sleeve 319 laterally, which makes the sleeve 319 to have a certain elasticity. In addition, the sleeve 319 is provided with a tapered portion 3194 at a bottom end, the tapered portion 3194 is provided with a plurality of slits 3195 which are extending in the radial direction to separate the tapered portion 3194 into a plurality of supporting portions 3196 distributed in the circumferential direction, and the supporting portions 3196 are used for supporting the dry filter 5.

[0050] In addition, referring to Figure 27, the bottom wall 311 of the first housing 31 is provided with a pair of supporting plates 374 protruding downward and a locating groove 375 located between the supporting plates 374. In assembling, the locating rib 206 is clamped in the locating groove 375, and inner surfaces of the supporting plates 374 cooperate with an outer surface of the locating rib 206 to prevent the first housing 31 from moving horizontally with respect to the lower shell 204.

[0051] Reference is made to Figures 9 and 29. The second housing 32 includes a top wall 321, a third side wall 322 extending downward from one side of the top wall 321, and a fourth side wall 323 extending downward from another side of the top wall 321 and opposite to the third side wall 322. The second housing 32 is provided with a third space 3211 configured to accommodate a part of the micro-channel evaporator 1, and a fourth space 3212 configured to accommodate a part of the micro-channel condenser 2. After being installed, the micro-channel evaporator 1 and the micro-channel condenser 2 are located between the third side wall 322 and the fourth side wall 323. The third side wall 322 includes a fifth wall portion 3221, a sixth wall portion 3222, a seventh wall portion 3223, and an eighth wall portion 3224 which are arranged in order along the flow direction A-A of the air. The fifth wall portion 3221 corresponds to one side of the micro-channel evaporator 1, the seventh wall portion 3223 corresponds to one side of the micro-channel condenser 2, and the sixth wall portion 3222 is located between the micro-channel evaporator 1 and the micro-channel condenser 2 in the flow direction A-A of the air. The sixth wall portion 3222 is located in the vertical plane obliquely, and is inclined inward along the flow direction A-A of the air, that is, a part, adjacent to the first wall portion 3121, of the sixth wall portion 3222 is outward, while a part, adjacent to the third wall portion 3123, of the sixth wall portion 3222 is inward. With such arrangement, the sixth wall portion 3222 may have a function of guiding the air. In embodiments shown in the figures of the present application, the first wall portion 3121, the second wall portion 3122, the third wall portion 3123, the fourth wall portion 3124, the fifth wall portion 3221, the sixth wall portion 3222, the seventh wall portion 3223, and the eighth wall portion 3224 are collectively referred to as wall portions.

[0052] Reference is made to Figures 5, 6 and 9. An inner side of the fifth wall portion 3221 is provided with a third recess portion 3225 in communication with the third space 3211, and the third recess portion 3225 is configured to locate the first side plate 15 at one side (such as the left side) of the micro-channel evaporator 1. The top wall 321 is provided with a second baffle wall 3216 which extends downward and has a certain height in the vertical direction, and the second baffle wall 3216 shields the third finless area 136 in the flow direction A-A of the air to reduce air leakage. In embodiments shown in the figures of the present application, the first baffle wall 3117 and the second baffle wall 3216 are both referred to as baffle walls. The baffle walls are arranged on or mounted on the housing 3. Referring to Figure 6, in embodiments shown in the figures of the present application, the second baffle wall 3216 is provided with a plurality of air slots 3218 which extend downward through the second baffle wall 3216. In addition, an inner side (i.e. the lower surface) of the top wall 321 is provided with a plurality of limiting structures to limit the micro-channel evaporator 1 and the micro-channel condenser 2. The limiting structures are in contact with both the micro-channel evaporator 1 and the micro-channel condenser 2 in an elastically pressing manner. The limit structures include a plurality of first elastic sheets 381 and a plurality of second elastic sheets 382. The first elastic sheets 381 are configured to press down on the first reversing portions 133. The second elastic sheets 382 are configured to press down on the second side plate 25 located on the top of the third heat exchanger core 210, or the second elastic sheets 382 are configured to press down on the second side plate 25 located on the top of the fourth heat exchanger core 220, thereby realizing a single-side pressing. With such arrangement, over-positioning is prevented. In embodiments shown in the figures of the present application, the limiting structures are elastic sheets, and the elastic sheets are simply-supported beams. The top wall 321 is provided with an opening 3261 between the micro-channel evaporator 1 and the micro-channel condenser 2, and wind shielding ribs 3262 surrounding periphery of the opening 3261. The wind shielding ribs 3262 are not continuous to make the wind shielding ribs 3262 have a low reinforcing effect on the top wall 321, and to further make the second housing 32 have a better deformability, thus the assembling adaptability is improved. Moreover, the wind shielding ribs 3262 are staggered from each other in the flow direction A-A of the air to form a wind barrier to reduce the wind passing through the second housing 32 from the upper side.

[0053] Referring to Figures 6 to 9, an inner side of the seventh wall portion 3223 is provided with a fourth recess portion 3231 in communication with the fourth space 3212, and the fourth recess portion 3231 is used for accommodating the second reversing portions 233 of the micro-channel condenser 2. The seventh wall portion 3223 may block at least a part of the sixth finless area 236 in the flow direction A-A of the air, thereby reducing air leakage in the respective area and increasing the air heating temperature.

[0054] Moreover, the housing 3 is provided a wind shielding strip 325 with a certain height in the vertical direction, and the wind shielding strip 325 is configured to block the fourth finless area 234 in the flowing direction A-A of the air. In embodiments shown in the figures of the present application, the wind shielding strip 325 is arranged on the second housing 32. Since the fifth finless area 235 is located right behind the fourth finless area 234, the fifth finless area 235 is also covered by the wind shielding strip 325 meanwhile when the wind shielding strip 325 shields the fourth finless area 234, thereby reducing the air leakage and optimizing the distribution uniformity of the air flowing through the micro-channel condenser 2. Referring to Figures 29 and 30, the first housing 31 is provided with a guide groove 327 which is configured to guide and assemble the wind shielding strip 325 in the vertical direction.

[0055] During assembling, firstly the micro-channel evaporator 1, the micro-channel condenser 2, the throttling element 4 and the dry filter 5 are assembled on the first housing 31 and fixed; secondly, the second housing 32 is assembled to the first housing 31 and fixed (such as via screws). In embodiments shown in the figures of the present application, the first housing 31 and the second housing 32 are, respectively, provided with a guide plate 35 and a clamping groove 36 which cooperate with each other to facilitate assembling and fixing. An outer surface of the guide plate 35 is a circular arc surface, and an inner surface of the clamping groove 36 is also a circular arc surface, thus the installation accuracy is improved. Of course, in other embodiments, the guide plate 35 and the clamping groove 36 may also be designed as a non-circular-arc surface and other structures. After the assembling process, the first wall portion 3121 corresponds to the fifth wall portion 3221, the second wall portion 3122 corresponds to the sixth wall portion 3222, the third wall portion 3123 corresponds to the seventh wall portion 3223, and the fourth wall portion 3124 corresponds to the eighth wall portion 3224. In order to reduce the air leakage at the junction where the second wall portion 3122 joins with the sixth wall portion 3222, in embodiments shown in the figures of the present application, the second wall portion 3122 is provided with a notch 3141, and the sixth wall portion 3222 is partially inserted into the notch 3141, thus the junction face of the two wall portions has no clearance or has a small clearance, which improves the sealing performance of the assembled housing and reduces the air leakage. Of course, in other embodiments, the notch may also be provided in the sixth wall portion 3222, and the second wall portion 3122 is partially inserted into the notch, which may also realize the object of reducing the air leakage. In addition, the object of reducing the air leakage may also be realized by pasting adhesive tapes or smearing sealants on the junction. Besides, partially inserting the sixth wall portion 3222 into the notch 3141 may also facilitate assembling the first housing 31 and the second housing 32 together, to limit the relative movement between the housings.

[0056] The heat exchanger assembly 100 according to the present application may be used in a dehumidification device (such as a dish washer, a clothes dryer, a washer-dryers, and etc.), and the micro-channel evaporator 1 and the micro-channel condenser 2 are connected to a heat pump system of the dehumidification device. During the operation of the heat pump system, air moves along the flowing direction A-A and the micro-channel evaporator 1 exchanges heat with the air to condense the moisture in the air. In embodiments shown in the figures of the present application, the first header 11 is spaced from the second header 12 by a certain distance to form a drain channel 111, thereby ensuring that the condensate water can be discharged in time and may not be accumulated at the bottom of the micro-channel evaporator 1, to improve the water discharging capacity of the micro-channel evaporator 1. Referring to Figures 14 and 15, the micro-channel evaporator 1 is provided with one or more partitions 112 clamped between the first header 11 and the second header 12. By arranging the partitions 112, the drain channel 111 may be formed, and the connection between the first header 11 and the second header 12 may be reinforced. In embodiments shown in the figures of the present application, two sides of the partition 112 are each provided with a circular arc surface 1121, to improve the degree of cooperation between the first header 11 and the second header 12. Condensate water separated out from the air is discharged via the drain channel 111 and the drain connection 310. Various wind shielding structures are arranged on the housing 3 to make the air pass through the fin areas of the first heat exchanger core 110 and the second heat exchanger core 120 to the greatest extent, thereby condensing more moisture from the air and improving the efficiency.

[0057] After passing through the micro-channel evaporator 1, the air is changed to dry air having a low humidity, and the dry air is heated by the micro-channel condenser 2. Similarly, various wind shielding structures are arranged on the housing 3 to make the air flow through the fin areas of the third heat exchanger core 210 and the fourth heat exchanger core 220 to the greatest extent, to heat the air to a high temperature. Eventually, the dry air with a high temperature blows through wet objects (such as wet clothes) and brings the moisture away, thereby realizing the function of drying the wet objects.

[0058] After the operation of the heat exchange system is finished, ventilation is generally performed to remove the condensate water adhered on the micro-channel evaporator 1, to reach a certain dryness requirement and avoid mildew growth after a long time running. Due to the effect of the second baffle wall 3216, the condensate water adhered on the first reversing portions 133 of the micro-channel evaporator 1 can not be easily removed. However, as shown in Figure 6, the air slots 3218 are provided to allow a certain amount of air to flow through the first reversing portions 133, thereby ensuring that the micro-channel evaporator 1 may reach the dryness requirements of the system.

[0059] Compared with a tube-fin heat exchanger assembly, the heat exchanger assembly 100 according to the present application includes a micro-channel evaporator 1 and a micro-channel condenser 2, and employs the micro-channel technology, thus the heat exchanger assembly 100 has an improved heat exchange performance, a reduced size and an improved corrosion resistance capacity. Moreover, since the micro-channel evaporator 1 and the micro-channel condenser 2 have high design flexibilities (in installation and arrangement), design of the dehumidification device may be upgraded effectively. In embodiments shown in figures of the present application, the housings 3 is provided to hold the micro-channel evaporator 1 and the micro-channel condenser 2, thereby better fixing the micro-channel evaporator 1 and the micro-channel condenser 2; besides, the housing 3 is arranged inside the shell 200, thus is better fixed. In conclusion, under the circumstance of not changing the conventional shell 200, the micro-channel evaporator 1 and the micro-channel condenser 2 are mounted inside the shell 200 via the housing 3 according to the present application, and by designing wind shielding structures, the heat exchange efficiency with the air is improved.

[0060] It should be noted that, expressions like "first", "second" and "third" and other similar expressions in the above embodiments are only for naming, and does not intend to limit the order. Besides, some limiting structures or locating structures in the above embodiments may also be interchanged, for example being arranged between the first housing and the second housing in an interchanged manner. The above embodiments are only intended for describing the present application, and should not be interpreted as limitation to the technical solutions described by the present application. Although the present application is described in detail by reference to the above embodiments, it should be understood by the person skilled in the art that, modifications or equivalent substitutions may still be made to the present application by the person skilled in the art; and any technical solutions and improvements thereof without departing from the scope of the present application also fall into the scope of the present application defined by the claims.

Claims

1. A heat exchanger assembly, comprising a micro-channel evaporator and a micro-channel condenser, the micro-channel evaporator and the micro-channel condenser being arranged with space, wherein the micro-channel evaporator comprises a first header, a second header, a plurality of first circulating tubes each being configured to connect the first header with the second header, and first fins in contact with the first circulating tubes, and each of the first circulating tubes is provided with a plurality of first micro-channel cavities for allowing refrigerant to flow; the micro-channel condenser comprises a third header, a fourth header, a plurality of second circulating tubes each being configured to connect the third header with the fourth header, and second fins in contact with the second circulating tubes, and each of the second circulating tubes is provided with a plurality of second micro-channel cavities for allowing the refrigerant to flow; and the first circulating tubes are arranged up-to-down, and the second circulating tubes are arranged transversely.

2. The heat exchanger assembly according to claim 1, wherein the micro-channel evaporator and the micro-channel condenser are arranged in order along a flowing direction of air, the micro-channel evaporator is a multilayer evaporator and at least comprises a first heat exchanger core and a second heat exchanger core, and each first circulating tube comprises a first circulating portion connected to the first header and located at the first heat exchanger core, and a second circulating portion connected to the second header and located at the second heat exchanger core; and
the micro-channel condenser is a multilayer condenser and at least comprises a third heat exchanger core and a fourth heat exchanger core, and each second circulating tube comprises a third circulating portion connected to the third header and located at the third heat exchanger core, and a fourth circulating portion connected to the fourth header and located at the fourth heat exchanger core.

3. The heat exchanger assembly according to claim 2, wherein each of the first circulating tubes comprises a first reversing portion connecting the first circulating portion with the second circulating portion, the first reversing portion is located at a top of the micro-channel evaporator, and the first header and/or the second header are/is located at a bottom of the micro-channel evaporator; the second circulating portion comprises a second reversing portion connecting the third circulating portion to the fourth circulating portion, the second reversing portion is located at one side of the micro-channel condenser, and the third header and/or the fourth header are/is located at another side of the micro-channel condenser.

4. The heat exchanger assembly according to claim 3, wherein the first circulating portion, the second circulating portion and the first reversing portion on the same first circulating tube are formed by bending the same flat tube; and the third circulating portion, the fourth circulating portion and the second reversing

portion on the same second circulating tube are formed by bending the same flat tube.

5. The heat exchanger assembly according to any one of claim 1 to claim 4, wherein the heat exchanger assembly comprises a housing configured to limit the positions of the micro-channel evaporator and the micro-channel condenser, the housing comprises a first housing and a second housing configured to be assembled with the first housing and to cooperate with the first housing, and the micro-channel evaporator and the micro-channel condenser are fixed between the first housing and the second housing; and the first housing and the second housing are assembled in an up-down direction or a left-right direction to form a space for mounting the micro-channel evaporator and the micro-channel condenser.

6. The heat exchanger assembly according to claim 5, wherein the first reversing portion is a third finless area which is not connected to the first fins, and the housing comprises a second baffle wall configured to shield the third finless area along the flowing direction of the air; the second reversing portion comprises a sixth finless area which is not connected to the second fins, and the housing comprises a wall portion configured to shield the sixth finless area along the flowing direction of the air.

7. The heat exchanger assembly according to claim 6, wherein the first housing is a lower housing, and the second housing is an upper housing, and the first housing and the second housing are assembled in the up-down direction to form the mounting space for the micro-channel evaporator and the micro-channel condenser; the first housing comprises a bottom wall, a first side wall extending upward from one side of the bottom wall, and a second side wall extending upward from another side of the bottom wall and opposite to the first side wall; the second housing comprises a top wall, a third side wall extending downward from one side of the top wall, and a fourth side wall extending downward from another side of the top wall and opposite to the third side wall, the first side wall corresponds to the third side wall, and the second side wall corresponds to the fourth side wall; the wall portion comprises a third wall portion arranged on the first side wall, and a seventh wall portion arranged on the third side wall, the third wall portion is provided with a second recess portion, the seventh wall portion is provided with a fourth recess portion, and the second recess portion and the fourth recess portion are configured to accommodate the second reversing portion of the micro-channel condenser.

8. The heat exchanger assembly according to claim 7, wherein the bottom wall is provided with a post protruding upward into the second recess portion, and the second reversing portion is sleeved on the post.

9. The heat exchanger assembly according to claim 7, wherein the housing is provided with a locating block protruding upward from the bottom wall; and the locating block is provided with a recess portion configured to locate the third header and/or the fourth header, and at least a part of the third header and/or the fourth header is inserted into the recess portion; or, the third header and/or the fourth header are/is provided with an end cap, the end cap is provided with a notch, and at least a part of the locating block protrudes into the notch.

10. The heat exchanger assembly according to claim 7, wherein the housing is provided with a plurality of locating structures to limit the position of the micro-channel evaporator or the micro-channel condenser; the locating structures are fixedly arranged on the top wall or the bottom wall, and each comprises a limiting portion having an elasticity, the limiting portion has two ends connected to the bottom wall and comprises at least one arc section or curve section, and a linear section, and the limiting portion cooperates with the micro-channel evaporator or the micro-channel condenser via the arc section or the curve section, to limit the position of the micro-channel evaporator or the micro-channel condenser.

11. The heat exchanger assembly according to claim 10, wherein a top portion of the arc section or curve section of the limiting portion of the locating structure is provided with an inclined portion which is of a necked shape and functions as a guide portion in installation to guide the micro-channel evaporator or the micro-channel condenser.

12. The heat exchanger assembly according to claim 7, wherein the first header and the second header are arranged in order along the flowing direction of the air, the housing is provided with a first protruding portion, a second protruding portion, a third protruding portion and a fourth protruding portion which all protrude upward from the bottom wall and are arranged in order along the flowing direction of the air, the first protruding portion and the second protruding portion are configured to locate a bottom of the micro-channel evaporator, and the third protruding portion and the fourth protruding portion are configured to locate a bottom of the micro-channel condenser; the micro-channel evaporator comprises a first nozzle connected to the first header, and a second nozzle connected to the second header, wherein the second nozzle is an inlet pipe of the micro-channel evaporator, and the first nozzle is an outlet pipe of the micro-channel evaporator.

13. The heat exchanger assembly according to claim 12, wherein the micro-channel evaporator further comprises a throttling element and a dry filter which are connected to the second nozzle in series, and the housing comprises a sleeve configured to fix the dry filter; the sleeve is provided with a slot penetrating the sleeve in a depth direction of the sleeve, and the slot extends through a wall of the sleeve laterally.

14. The heat exchanger assembly according to claim 3, wherein the first header and the second header are both located at a bottom of the micro-channel evaporator, and are arranged with a certain space to form a drain channel.

15. Use of a heat exchanger assembly in a dehumidification device, wherein the dehumidification device is provided with a heat pump system or a refrigeration system, the heat exchanger assembly is the heat exchanger assembly according to any one of claims 1 to claim 14, and is connected in the heat pump system or the refrigeration system, and the dehumidification device is configured to dehumidify and dry wet objects in the dehumidification device by using the heat exchanger assembly; the dehumidification device is provided with a shell configured to mount the heat exchanger assembly, the shell comprises an inlet end and an outlet end, the micro-channel evaporator is adjacent to the inlet end, and the micro-channel condenser is adjacent to the outlet end.

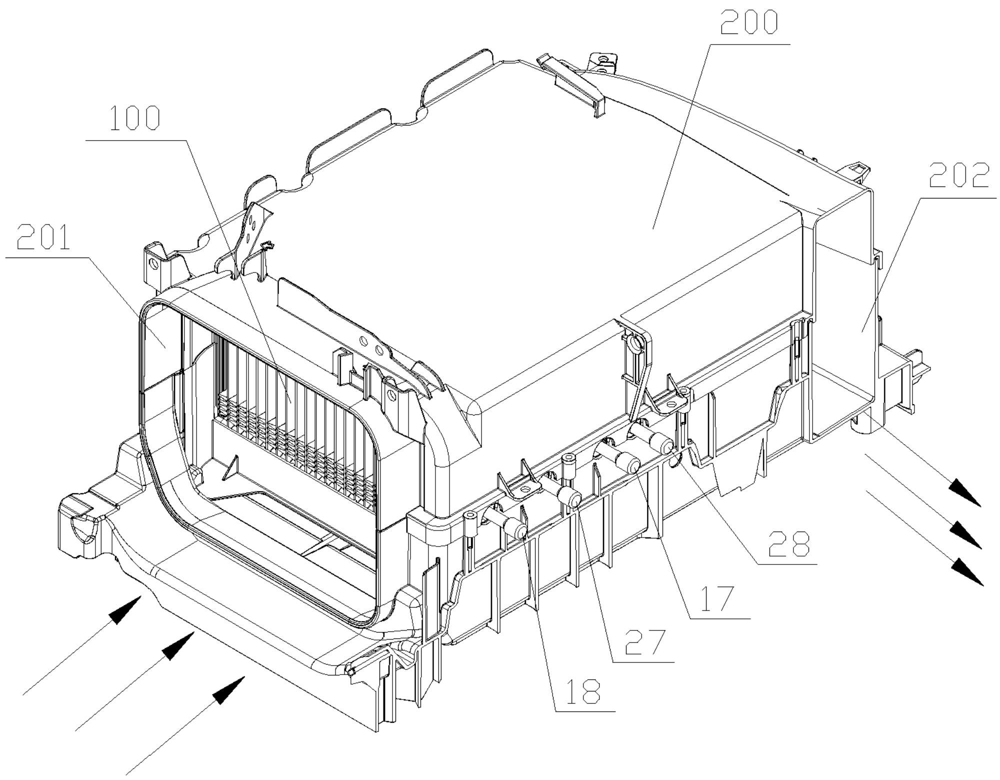


Fig. 1

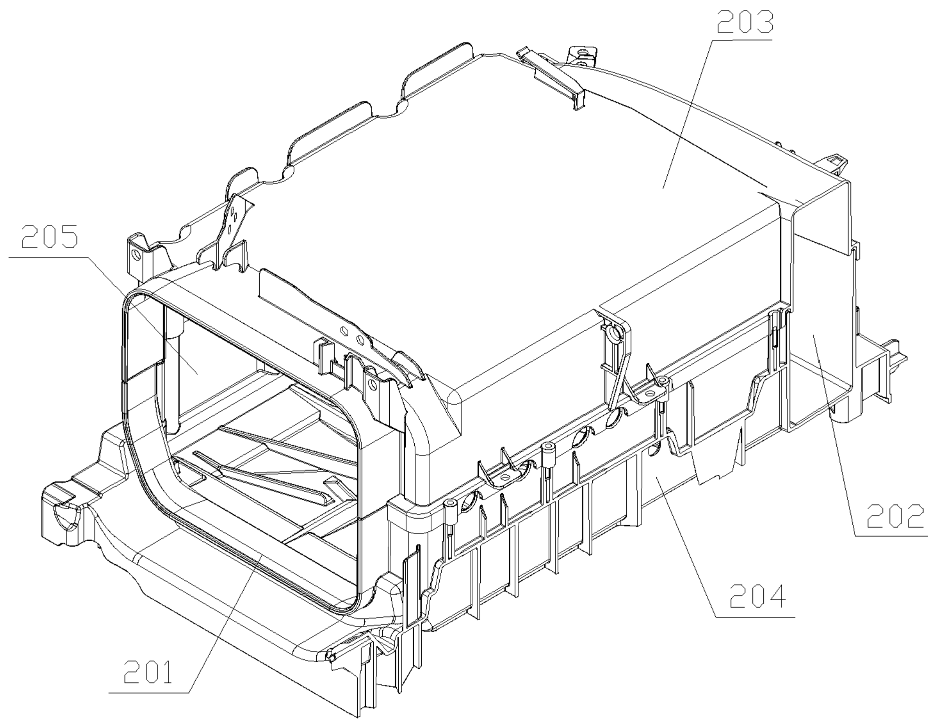
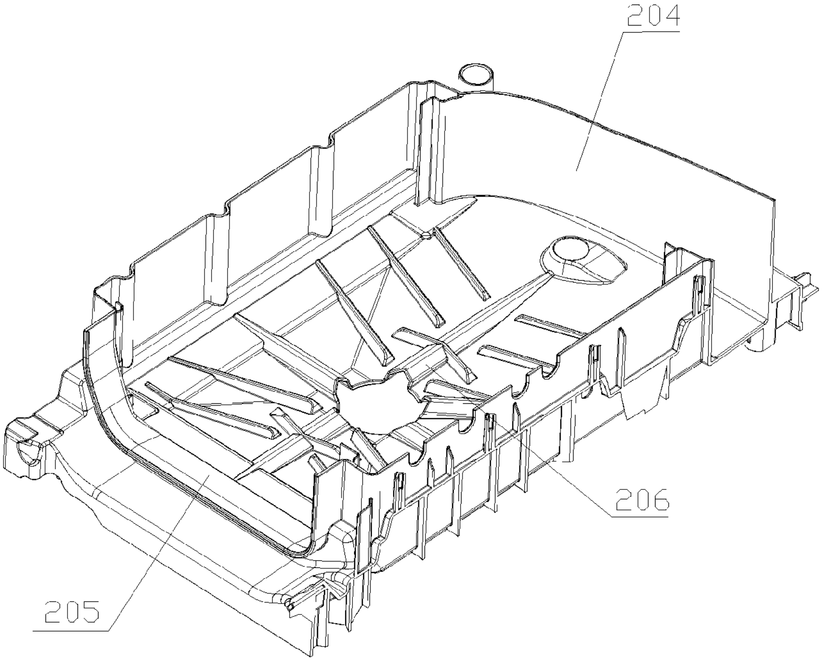


Fig. 2



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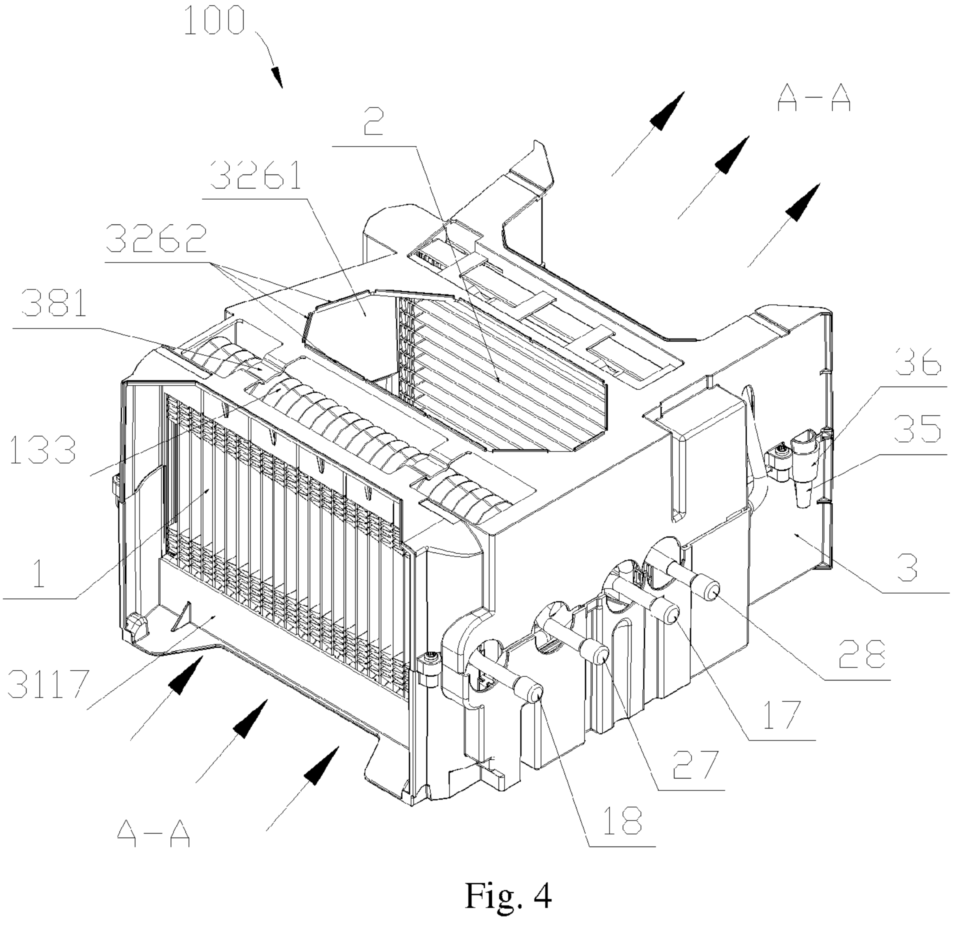

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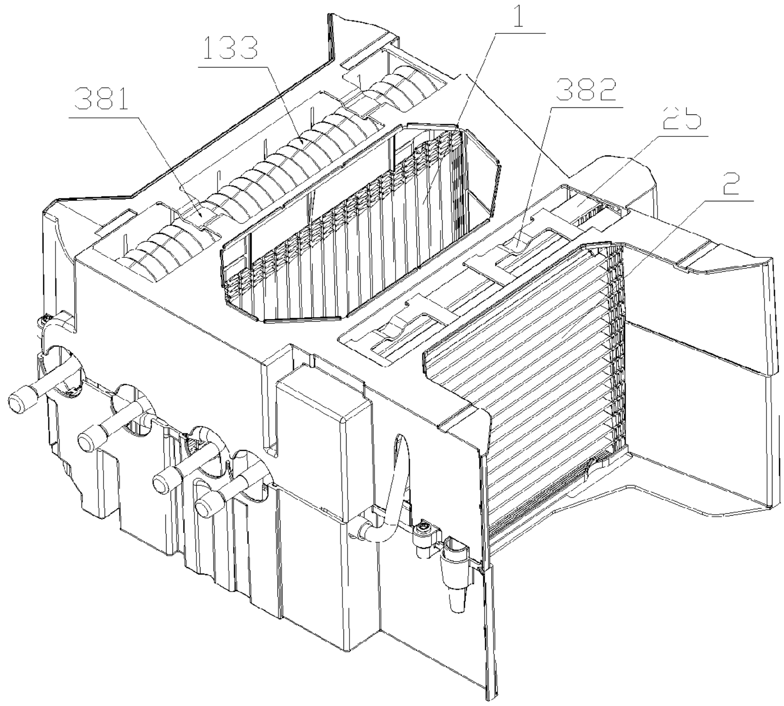

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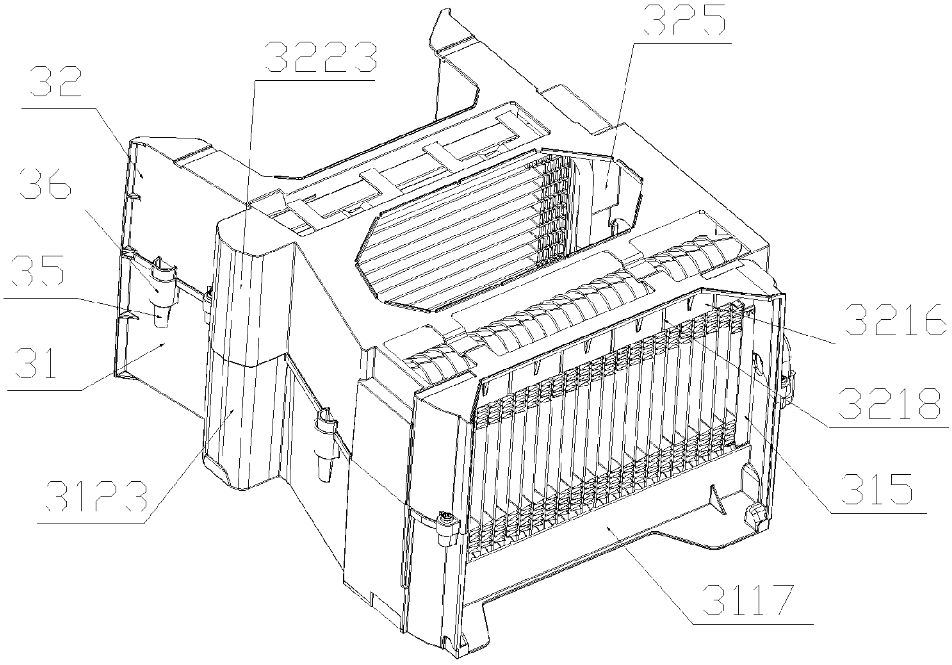

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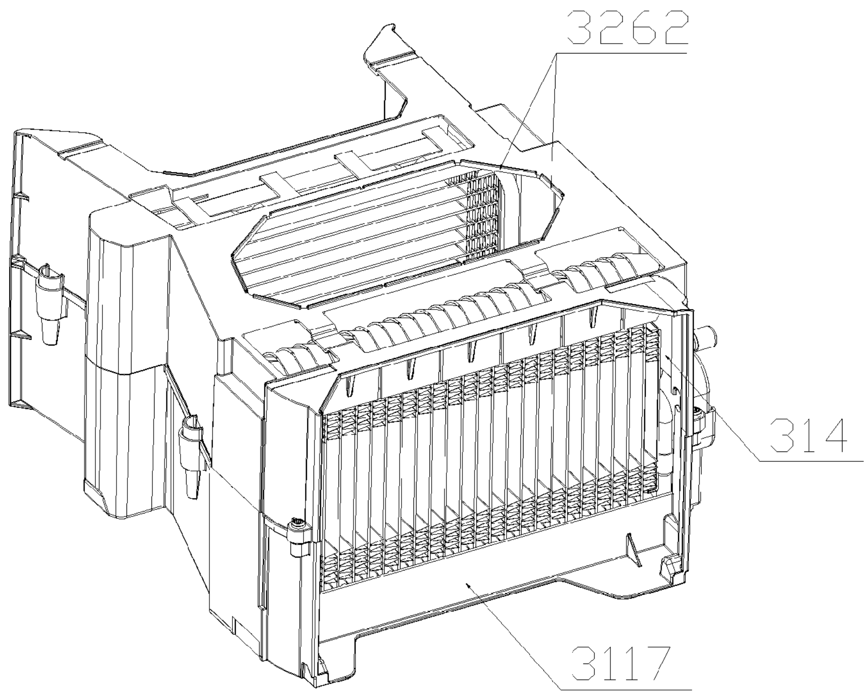
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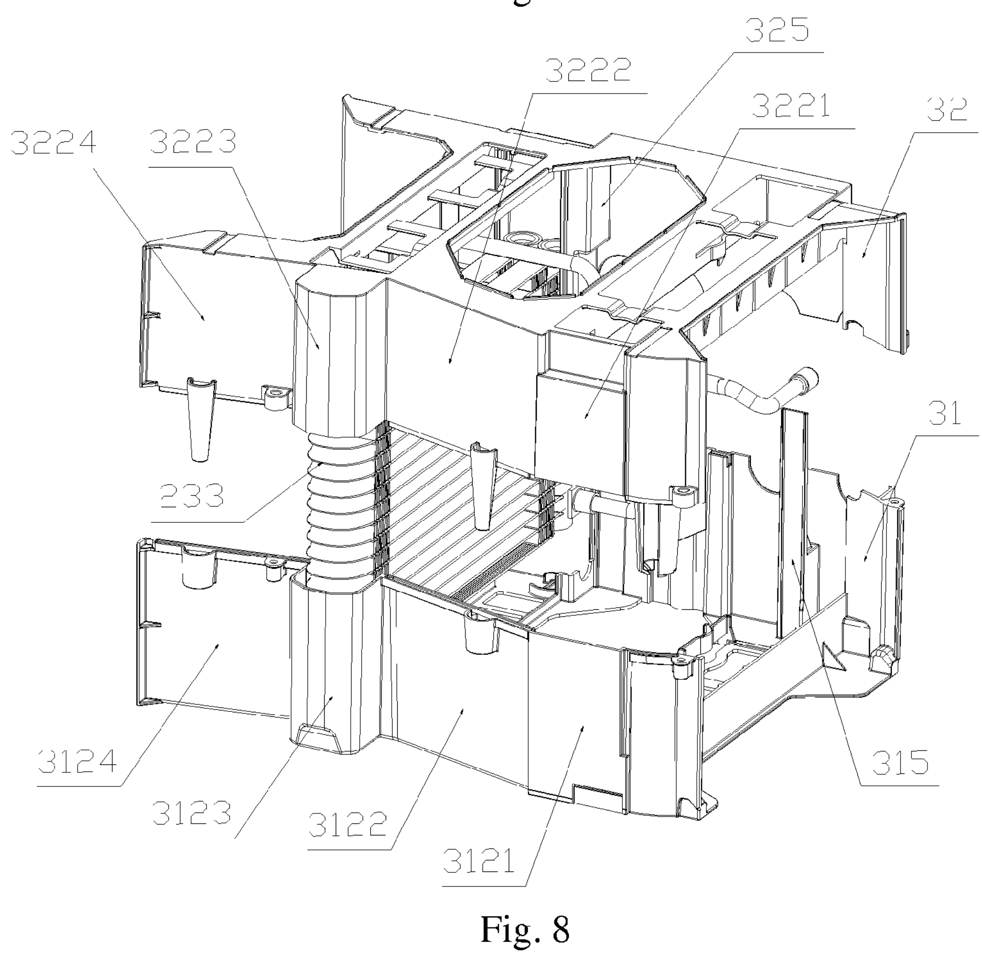
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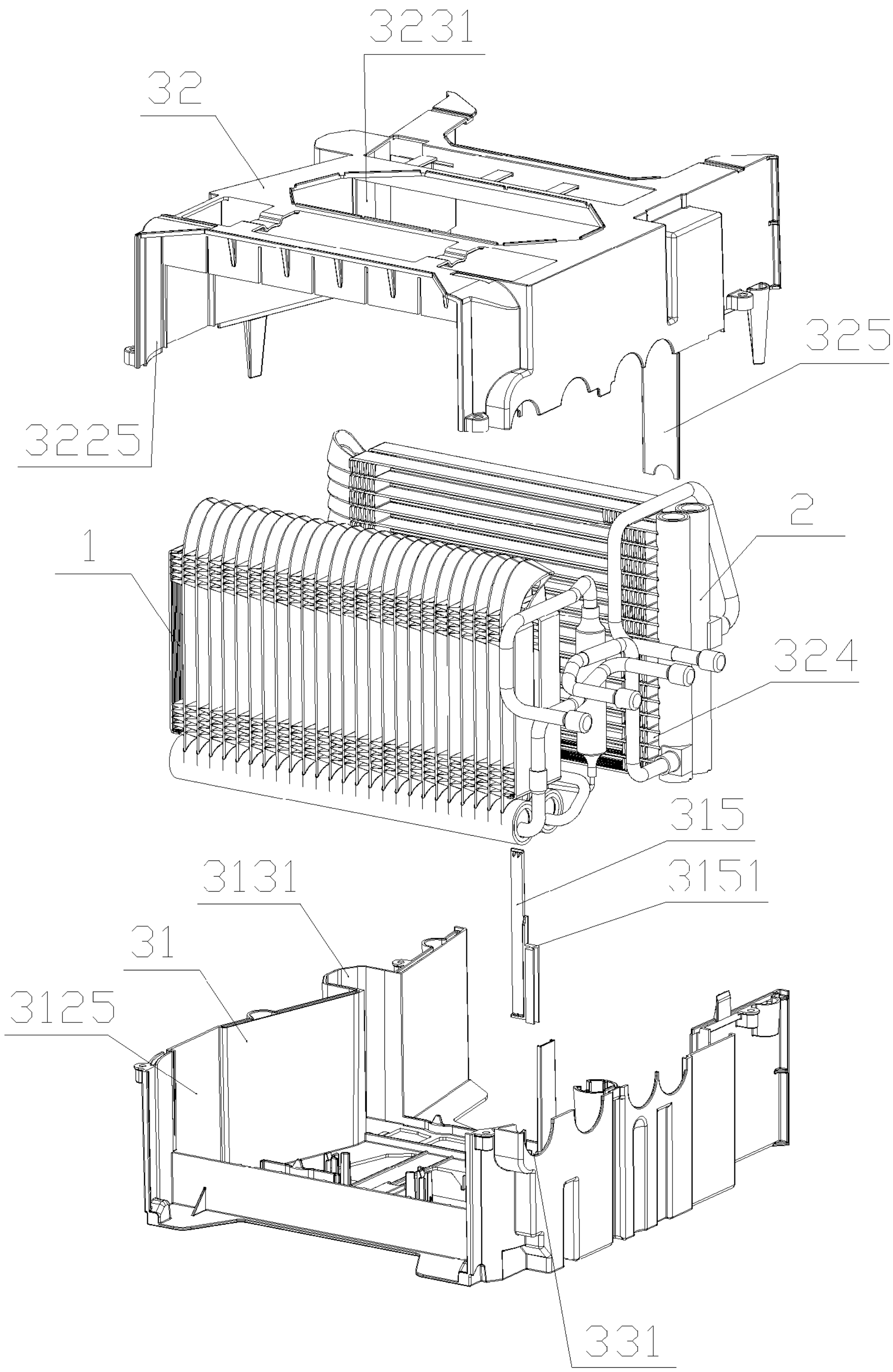
Fig. 8



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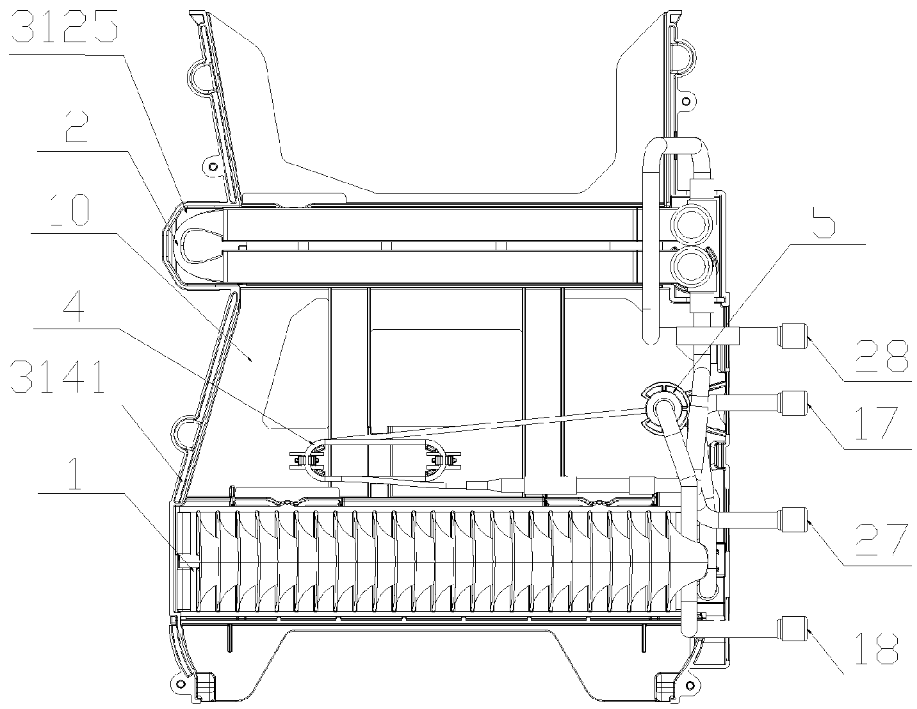
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Fig. 10

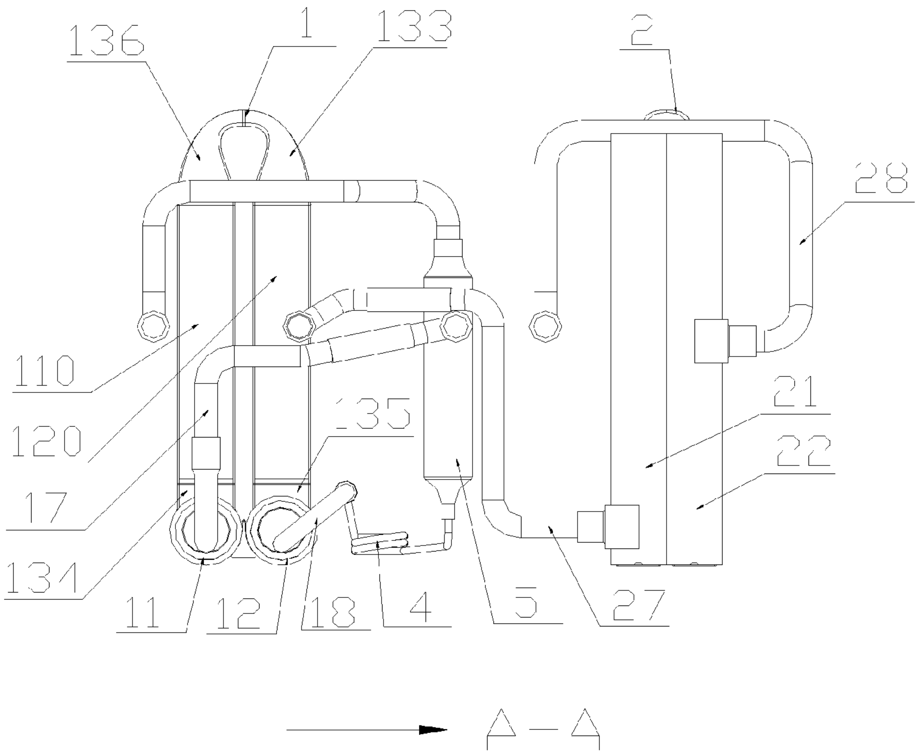
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Fig. 11

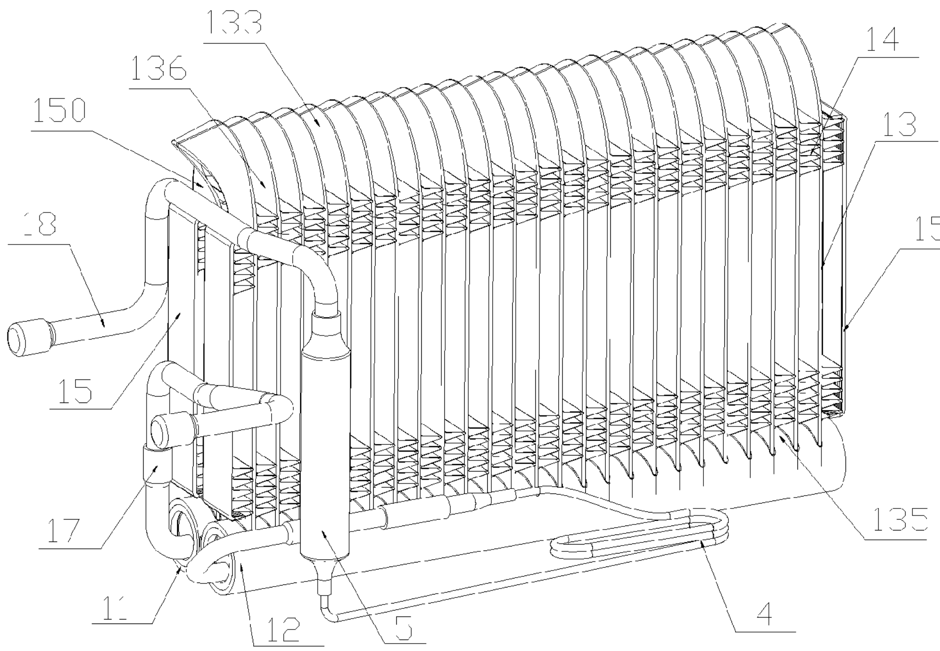
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Fig. 12

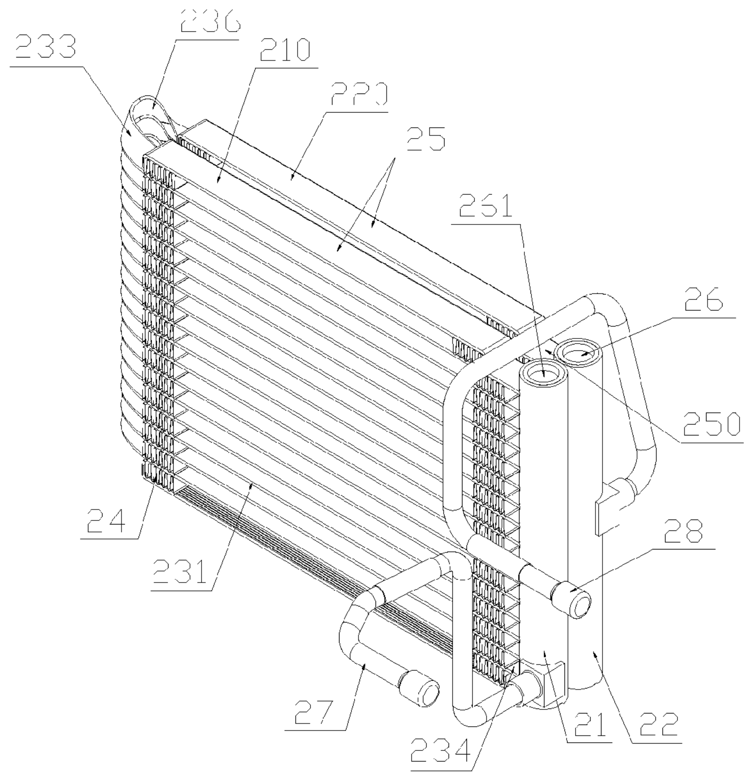
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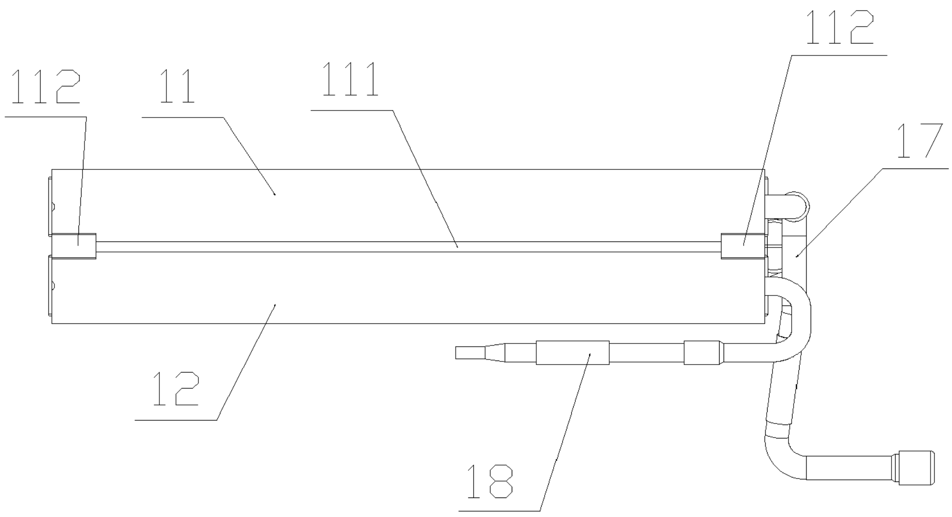
Fig. 13



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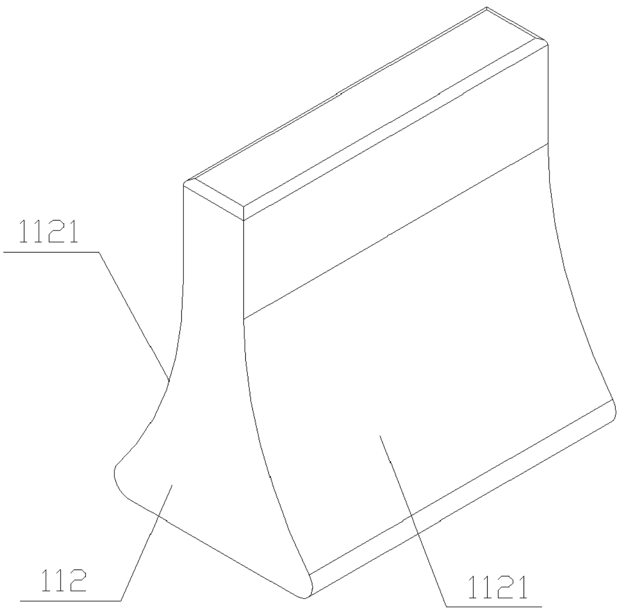

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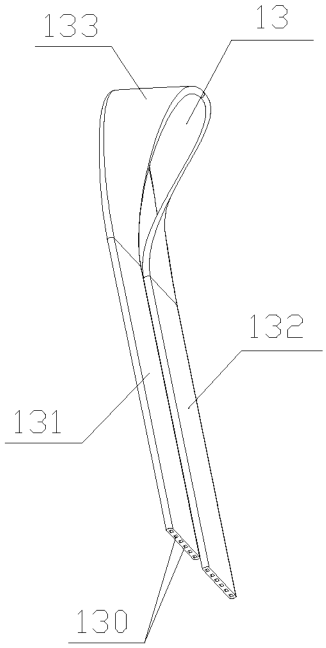

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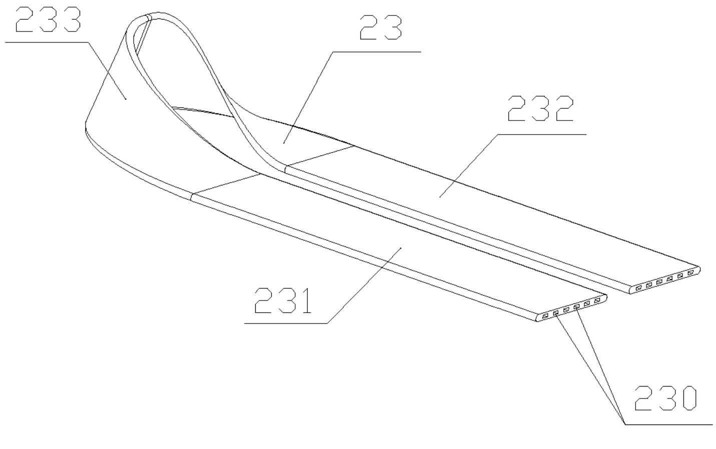

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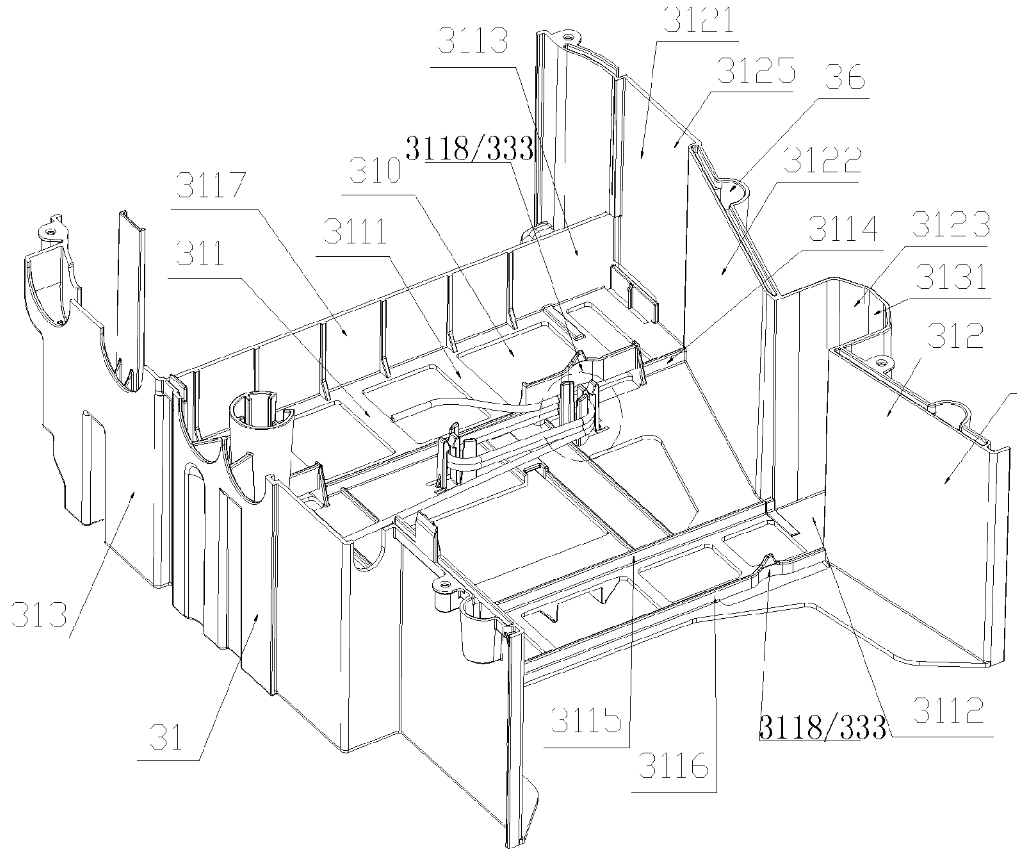
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Fig. 18

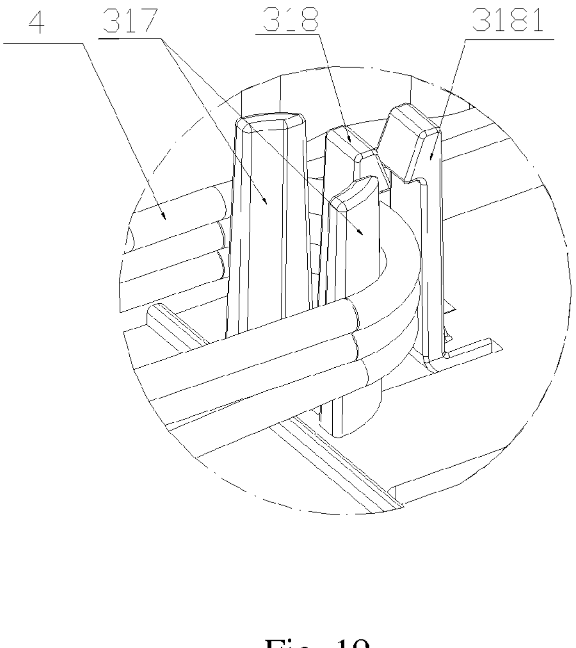
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Fig. 19

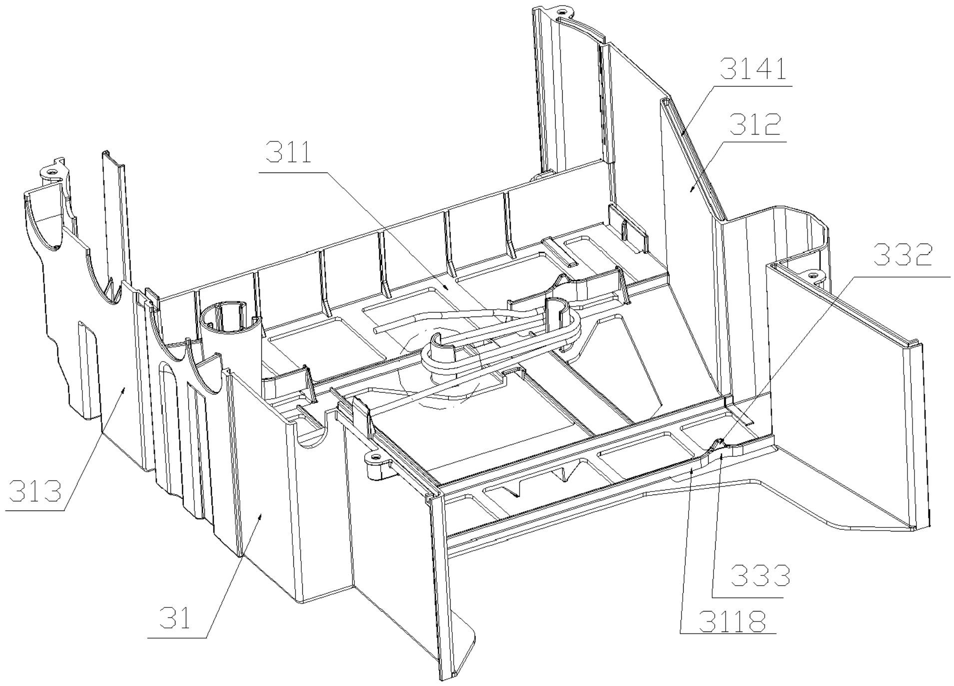
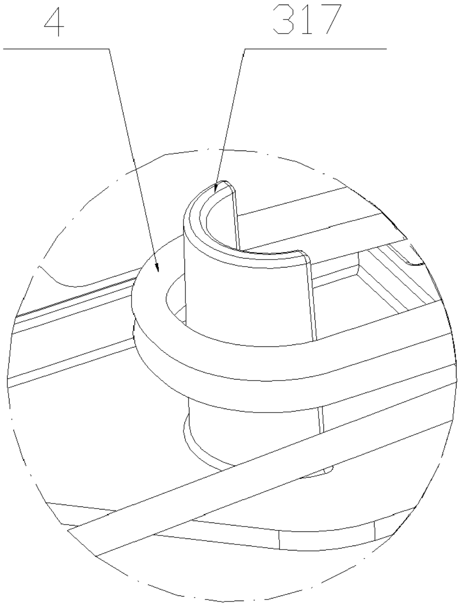


Fig. 20



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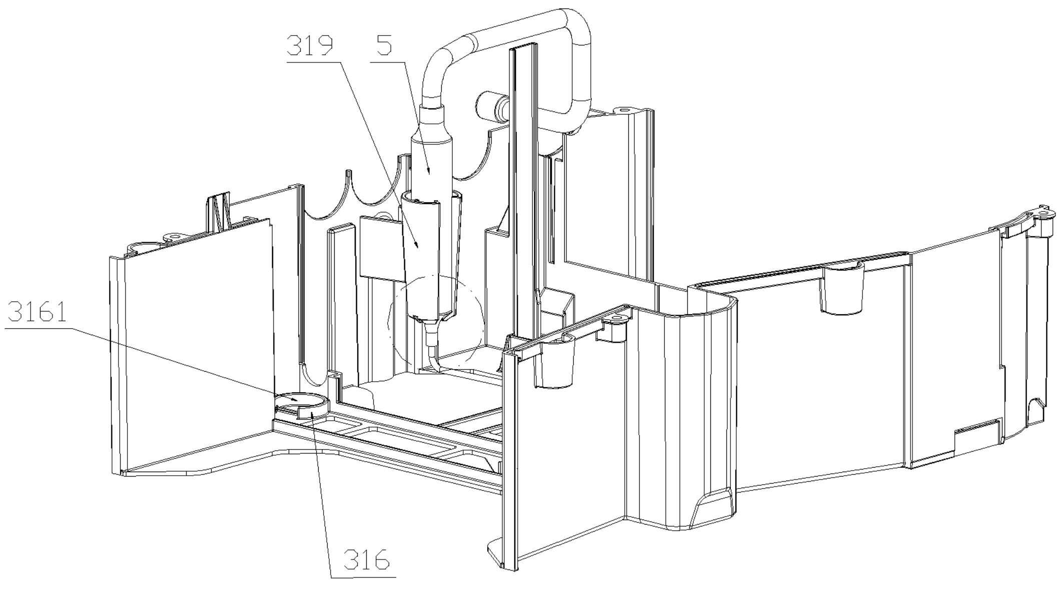

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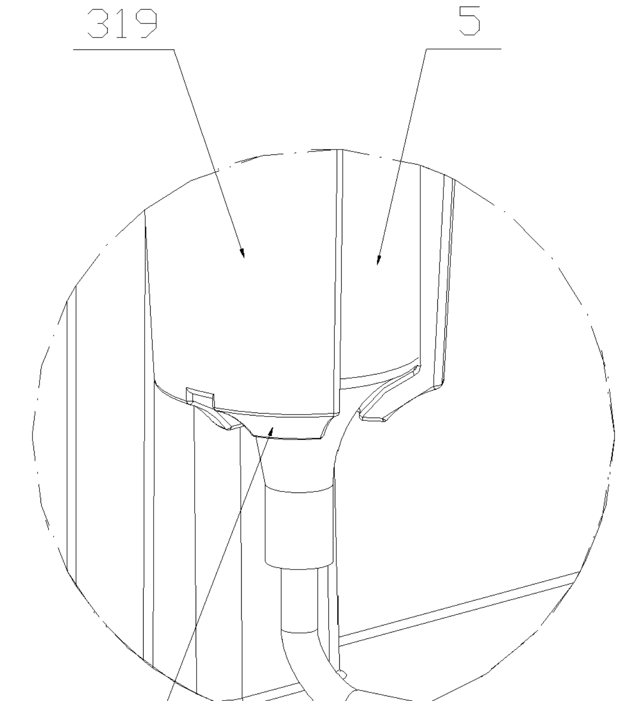


Fig.23

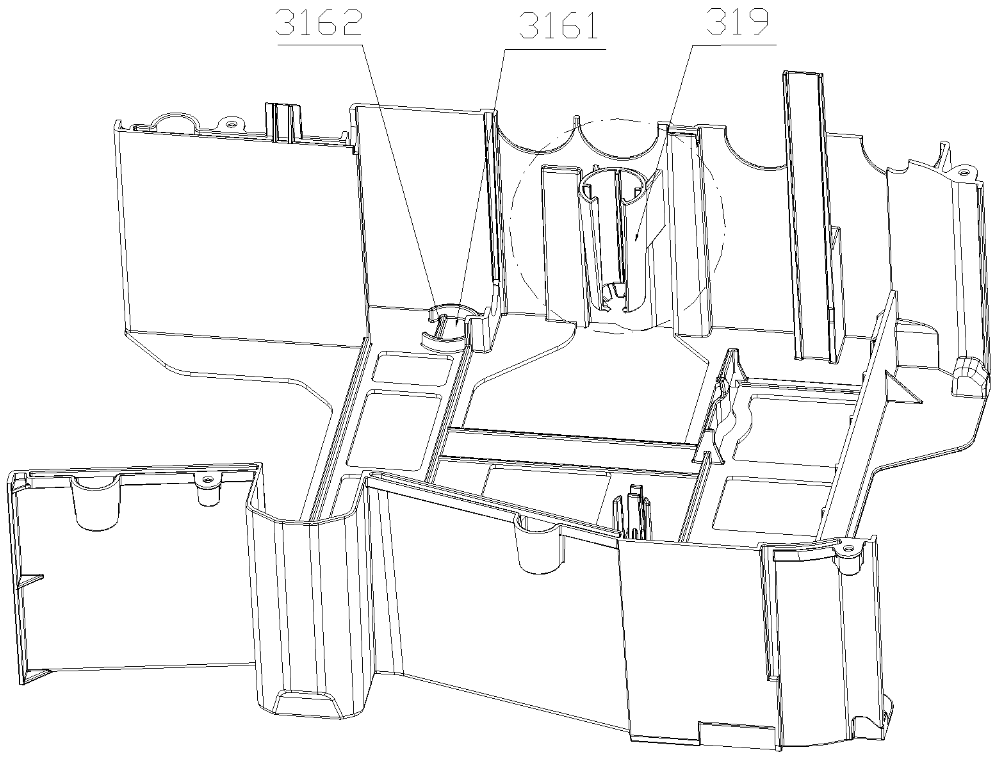


Fig. 24

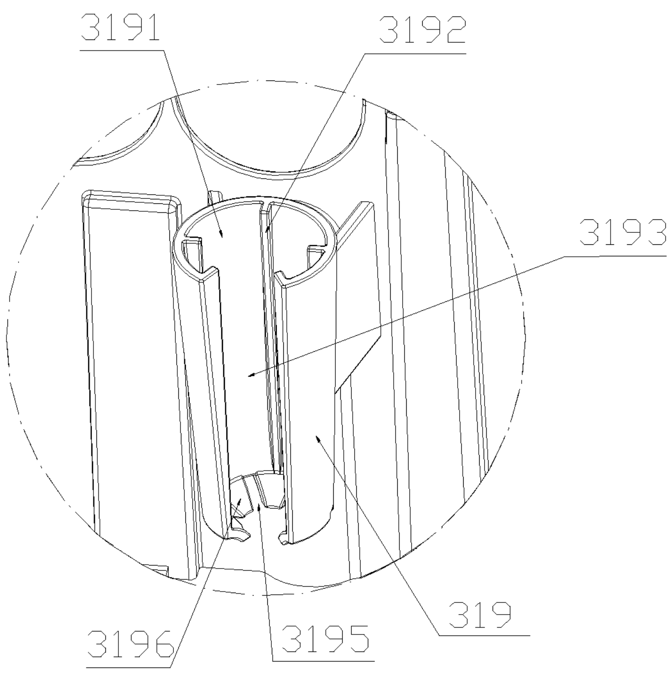


Fig. 25

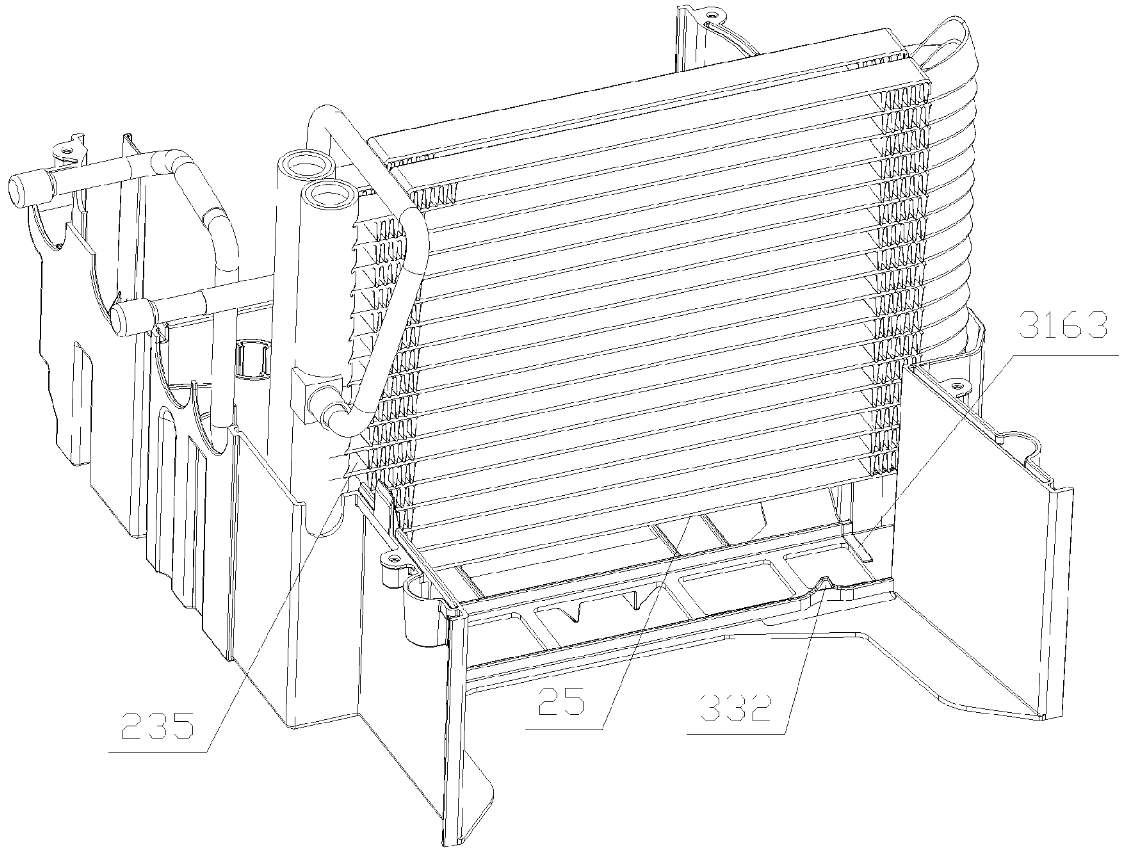
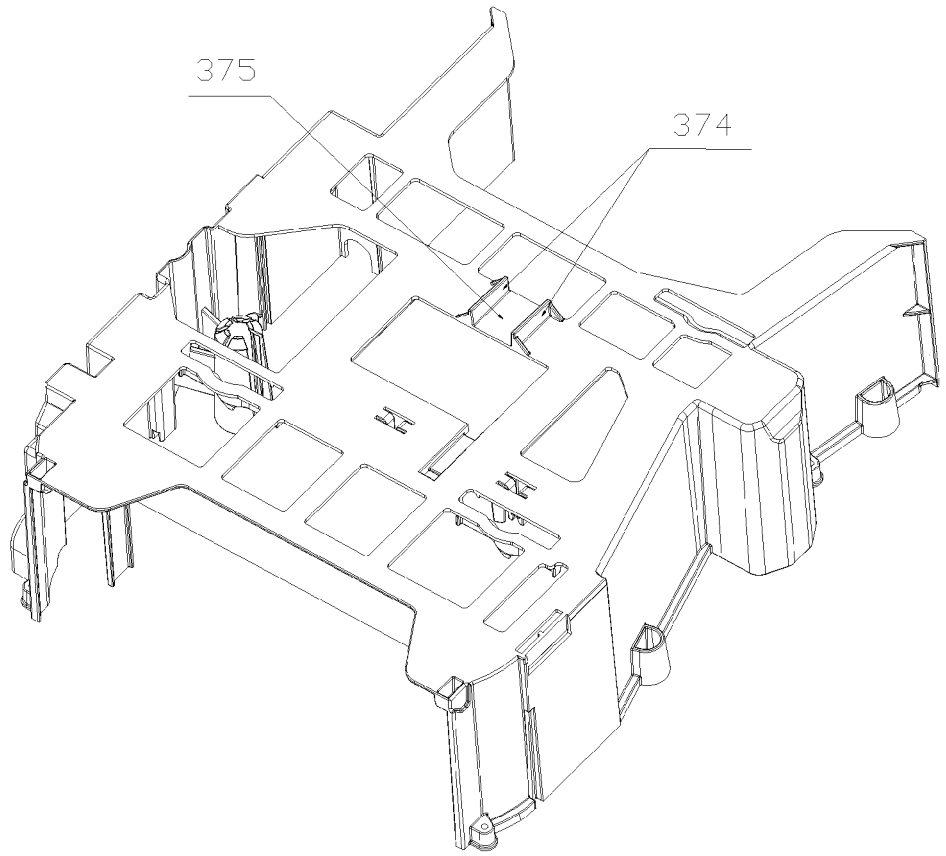


Fig. 26



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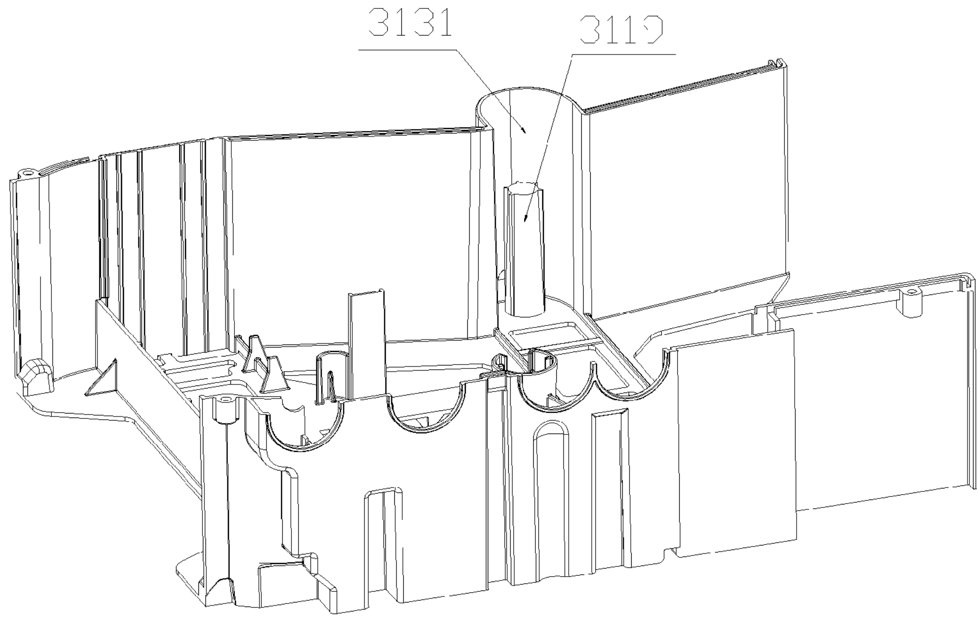

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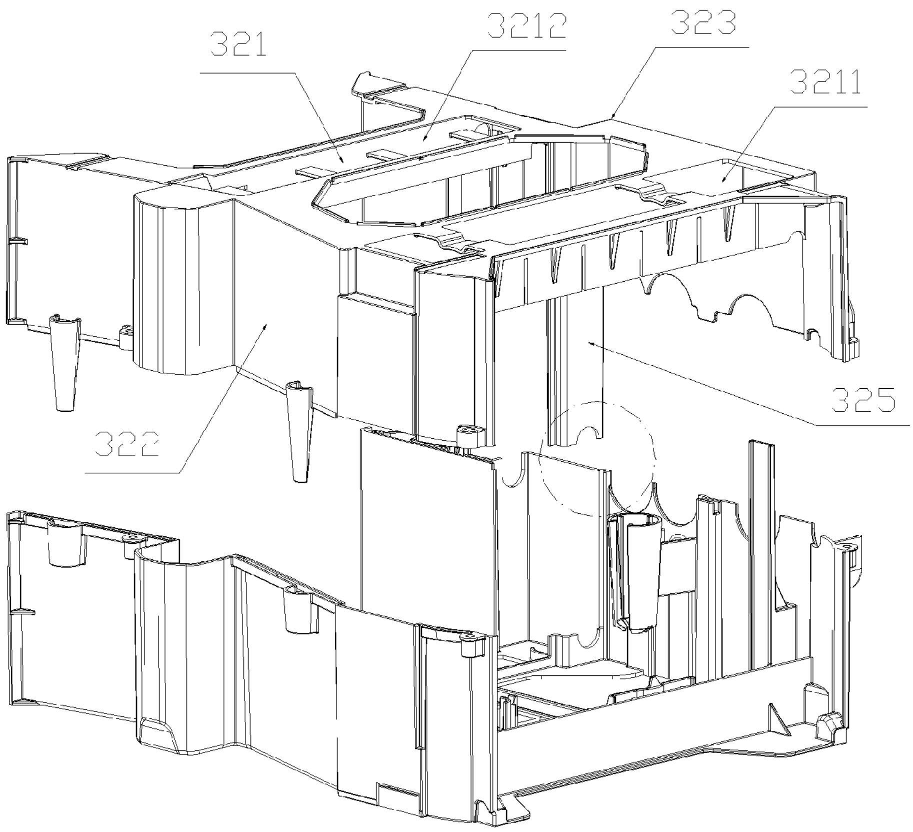

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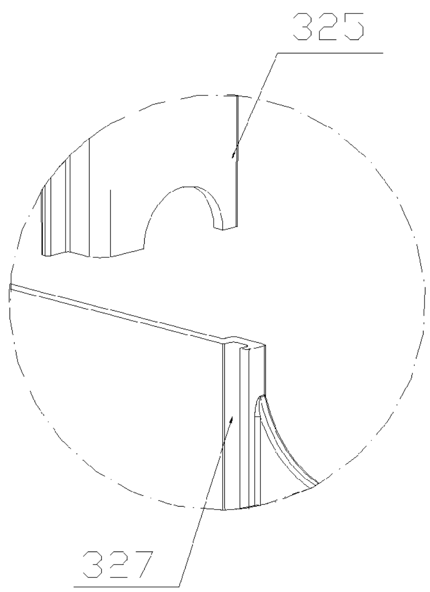

Fig. 30

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 2347

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F28D
F28F
B60H
D06F
F26B
F25B
F24F

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	7 September 2015	Vassoille, Bruno

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