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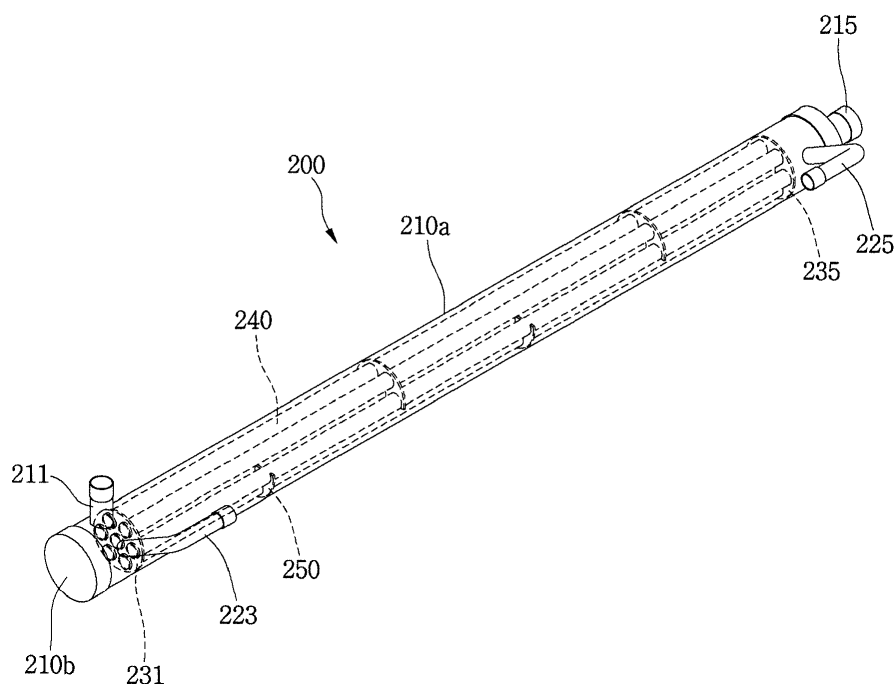
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(54) **SUBCOOLER AND AIR CONDITIONER INCLUDING THE SAME**

(57) A subcooler and an air conditioner including the same are provided. The includes a supercooling body to receive a first refrigerant passed through a condenser and a second refrigerant branched from the first refrigerant, a plurality of internal tubes provided inside the supercooling body and through which the first refrigerant flows, a flow path through which the second refrigerant flows, the flow path being a space external to the internal

tubes in the supercooling body, and a baffle to support at least one of the internal tubes, wherein the baffle comprises a baffle body having an outer circumferential surface that is coupled to the supercooling body, a through-hole formed at the baffle body and through which a first internal tube of the internal tubes passes, and a support groove to support a second internal tube of the internal tubes.

Fig. 3



Description

[0001] The present disclosure relates to a subcooler and an air conditioner including the same.

[0002] An air conditioner is an apparatus which controls an indoor temperature to create a pleasant indoor air environment. For example, as disclosed in Korean Patent Publication No. 2013-0027290, a conventional air conditioner generally includes an indoor unit which is installed at an interior, and an outdoor unit which supplies a refrigerant to the indoor unit. One or more indoor units may be connected to the outdoor unit. The air conditioner may perform a warming or cooling operation by supplying the refrigerant to the indoor unit. The warming operation or the cooling operation of the air conditioner is determined by a flow of the circulating refrigerant..

[0003] The refrigerant compressed in a compressor of the outdoor unit is converted into a middle temperature and high pressure liquid refrigerant. When the liquid refrigerant is supplied to the indoor unit, the refrigerant may evaporate while expanding in a heat exchanger of the indoor unit. The temperature of the air around the heat exchanger of the indoor unit is lowered due to evaporation of the refrigerant. The air near the heat exchanger of the indoor unit of which the temperature is lowered is discharged to the interior location when a fan of the indoor unit is rotated.

[0004] When a high temperature and high pressure gas refrigerant is supplied from the compressor of the outdoor unit to the indoor unit, the high temperature and high pressure gas refrigerant may be liquefied in the heat exchanger of the indoor unit. Energy discharged by liquefaction of the refrigerant increases the temperature of the air near the heat exchanger of the indoor unit. The air near the heat exchanger of the indoor unit of which the temperature is increased may be discharged to the interior location when the fan of the indoor unit is rotated.

[0005] The air conditioner may include a subcooler which supercools the refrigerant condensed in a condenser before the condensed refrigerant expands. The subcooler may include an internal tube through which a main refrigerant circulating in a refrigeration cycle flows, and an external tube through which a branched refrigerant exchanging heat with the main refrigerant flows. The internal tube may be provided at an inner space of the external tube.

[0006] The branched refrigerant is a refrigerant which is at least partially branched from the main refrigerant. The branched refrigerant may exchange heat with the main refrigerant after expansion thereof. In such a heat exchanging process, the main refrigerant may be supercooled.

[0007] In the case of a conventional subcooler, while the main refrigerant and the branched refrigerant flow, the internal tube may become in contact with the external tube, and thus an impact noise may be generated, and also a refrigerant flowing noise may be generated while the internal tube is shaken.

[0008] The present disclosure is directed to a subcooler which is able to have enhanced durability and also to prevent generation of a noise due to a flow of a refrigerant, and an air conditioner including the same.

[0009] According to an aspect of the present disclosure, a subcooler includes a supercooling body to receive a first refrigerant passed through a condenser and a second refrigerant branched from the first refrigerant, a plurality of internal tubes provided inside the supercooling body and through which the first refrigerant flows, a flow path through which the second refrigerant flows, the flow path being a space external to the internal tubes in the supercooling body, and a baffle to support at least one of the internal tubes, wherein the baffle comprises a baffle body having an outer circumferential surface that is coupled to the supercooling body, a through-hole formed at the baffle body and through which a first internal tube of the internal tubes passes, and a support groove to support a second internal tube of the internal tubes.

[0010] According to another aspect of the present disclosure, air conditioner includes a compressor to compress a refrigerant, a condenser to condense the refrigerant passed through the compressor, and a sub-cooler to supercool the refrigerant condensed in the condenser, wherein the sub-cooler comprises an external tube, a plurality of internal tubes provided inside the external tube, a baffle to support the internal tubes, the baffle formed with a through-hole in which a first internal tube of the internal tubes is coupled and a support groove to support a second internal tube of the internal tubes.

[0011] According to yet another aspect of the present disclosure, a subcooler includes a supercooling body to receive a first refrigerant and a second refrigerant branched from the first refrigerant, a plurality of internal tubes provided inside the supercooling body and through which the first refrigerant flows, a plurality of baffles to support the plurality of internal tubes, wherein each of the baffles comprise a baffle body having an outer circumferential surface that is coupled to an inner circumferential surface of the supercooling body, a through-hole formed in at least a portion of the baffle body and through which a first internal tube of the internal tubes passes, a plurality of support grooves that are spaced apart from the through-hole and support at least a second internal tube of the internal tubes, and a groove connection part to connect ends of the supporting grooves.

[0012] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

FIG. 1 is a cycle view illustrating a configuration of an air conditioner according to an embodiment of the present disclosure;

FIG. 2 is a view illustrating an external configuration of a subcooler according to the embodiment of the

present disclosure;

FIG. 3 is a view illustrating an internal configuration of the subcooler according to the embodiment of the present disclosure;

FIG. 4 is an exploded perspective view illustrating a configuration of an internal tube and a baffle according to the embodiment of the present disclosure;

FIG. 5 is a view illustrating a state in which a refrigerant flows in the subcooler according to the embodiment of the present disclosure;

FIG. 6 is a perspective view illustrating a configuration of the baffle according to the embodiment of the present disclosure;

FIG. 7 is a front view illustrating the configuration of the baffle according to the embodiment of the present disclosure; and

FIG. 8 is a cross-sectional view illustrating an internal configuration of the subcooler according to the embodiment of the present disclosure.

[0013] Advantages, features, and methods for achieving those of embodiments may become apparent upon referring to embodiments described later in detail together with the attached drawings. However, embodiments are not limited to the embodiments disclosed hereinafter, but may be embodied in different modes. The same reference numbers may refer to the same elements throughout the specification.

[0014] FIG. 1 is a cycle view illustrating a configuration of an air conditioner according to an embodiment of the present disclosure.

[0015] Referring to the embodiment of FIG. 1, an air conditioner 10 includes an outdoor unit 100 which is provided at an exterior space, and an indoor unit which is provided at an interior space. The indoor unit may include an indoor heat exchanger to exchange heat with air in the indoor space.

[0016] The outdoor unit 100 may include a plurality of compressors 110 and 112, and oil separators 120 and 122 disposed at outlet sides of the compressors 110 and 112 to separate oil from a refrigerant discharged from the compressors 110 and 112.

[0017] The compressors 110 and 112 include a first compressor 110 and a second compressor 112 which are connected in parallel with each other. For example, the first compressor 110 may be a main compressor, and the second compressor 112 may be a sub compressor. The compressors 110 and 112 are not limited to any particular number of compressors.

[0018] The first compressor 110 may be first operated, and then the second compressor 112 may be additionally operated. The first compressor 110 and the second compressor 112 may include an inverter compressor.

[0019] An outlet pipe 111 extends from each of the outlet sides of the first compressor 110 and the second compressor 112. An outlet temperature sensor 115 to detect a temperature of the refrigerant compressed in the first and second compressors 110 and 112 may be

provided at the outlet pipe 111.

[0020] The oil separators 120 and 122 include a first oil separator 120 which is provided at the outlet side of the first compressor 110, and a second oil separator 122 which is provided at the outlet side of the second compressor 112. The oil separators 120 and 122 are not limited to any particular number of oil separators.

[0021] The outdoor unit 100 may include an oil collection path 117 to collect oil from each of the first and second oil separators 120 and 122 and directs the oil to each of the first and second compressors 110 and 112. The oil collection path 117 may extend from the first oil separator 120 to the first compressor 110 and separately from the second oil separator 122 to the second compressor 112.

[0022] An oil valve 118 to control an amount of the oil that is collected, and a first check valve 118a to guide a one-way flow of the refrigerant from each of the first and second oil separators 120 and 122 to each of the first and second compressors 110 and 112, respectively, may be installed at the oil collection path 117.

[0023] The outdoor unit 100 may further include a bypass path 117a which extends from each of the first and second oil separators 120 and 122 to the oil collection path 117.

[0024] A second check valve 124 may be provided at each of outlet sides of the first and second oil separators 120 and 122. The refrigerant discharged from each of the first and second oil separators 120 and 122 passes through the second check valve 124 and then combined.

[0025] The outdoor unit 100 may further include a high pressure sensor 125 to detect a high pressure of the compressed refrigerant, and a high pressure switch 126 to selectively block a flow of the refrigerant according to the pressure detected by the high pressure sensor 125. The high pressure sensor 125 and the high pressure switch 126 may be provided at a pipe for the refrigerant which is passed through the second check valve 124 and combined.

[0026] The outdoor unit 100 may further include flow switching parts 130 and 135 to switch a flowing direction of the refrigerant. The flow switching parts 130 and 135 may include a first flow switching part 130 and a second flow switching part 135 to guide the refrigerant passed through the high pressure sensor 125 toward an outdoor heat exchanger 140 or the indoor unit.

[0027] The first and second flow switching parts 130 and 135 may be connected in series. For example, the first and second flow switching parts 130 and 135 may include a four-way valve of which one inlet and outlet ports are blocked.

[0028] When the air conditioner 10 performs a cooling operation, the refrigerant is introduced from the first flow switching part 130 into the outdoor heat exchanger 140, and the refrigerant evaporated in the indoor heat exchanger of the indoor unit is introduced into a gas-liquid separator 160 through a low pressure engine 195.

[0029] However, when the air conditioner 10 performs

a warming operation, the refrigerant flows from the second flow switching part 135 toward the indoor heat exchanger of the indoor unit through a high pressure engine 196, and the refrigerant evaporated in the outdoor heat exchanger 140 is introduced into the gas-liquid separator 160 through the first flow switching part 130.

[0030] The outdoor heat exchanger 140 may include a plurality of heat exchanging parts 141 and 142 and an outdoor fan 143. The plurality of heat exchanging parts 141 and 142 may include a first heat exchanging part 141 and a second heat exchanging part 142 that may be connected in parallel. The heat exchanging parts 141 and 142 are not limited to any particular number of heat exchanging parts.

[0031] In the cooling operation, the refrigerant passed through the first flow switching part 130 may be restricted by a check valve 145a from flowing to the second heat exchanging part 142, and may be introduced into the first heat exchanging part 141.

[0032] The outdoor unit 100 may further include a first heat exchanging part temperature sensor 140a to detect a temperature of the refrigerant in the first heat exchanging part 141, a second heat exchanging part temperature sensor 140b to detect a temperature of the refrigerant in the second heat exchanging part 142, and an outdoor temperature sensor 140c to detect a temperature of external air.

[0033] The outdoor heat exchanger 140 may further include a variable path 144 to guide the flow of the refrigerant from an outlet side of the first heat exchanging part 141 to an inlet side of the second heat exchanging part 142. The variable path 144 may extend from an outlet side pipe 147 of the first heat exchanging part 141 to an inlet side pipe of the second heat exchanging part 142.

[0034] A variable valve 145 may be provided at the variable path 144 to selectively block the flow of the refrigerant. Accordingly, the refrigerant passed through the first heat exchanging part 141 may be selectively introduced into the second heat exchanging part 142 according to ON/OFF control of the variable valve 145. The variable valve 145 may include a solenoid valve.

[0035] For example, when the variable valve 145 is switched on, the refrigerant passed through the first heat exchanging part 141 is introduced into the second heat exchanging part 142 through the variable path 144. At this point, a first outdoor valve 147a which may be provided at the outlet side pipe 147 of the first heat exchanging part 141 may be closed.

[0036] A second outdoor valve 148a may be provided at an outlet side pipe 148 of the second heat exchanging part 142, and the refrigerant which exchanges heat in the second heat exchanging part 142 may be introduced into a first subcooler 150 through the opened second outdoor valve 148a.

[0037] However, when the variable valve 145 is switched off, the flow of the refrigerant toward the second heat exchanging part 142 is restricted, and the refrigerant passed through the first heat exchanging part 141 may

be introduced into the first subcooler 150 through the first outdoor valve 147a.

[0038] Here, the first outdoor valve 147a and the second outdoor valve 148a may be arranged in parallel corresponding to an arrangement of the first and second heat exchanging parts 141 and 142. For example, the first and second outdoor valves 147a and 148a may include an electronic expansion valve (EEV) to depressurize the refrigerant.

[0039] A first bypass pipe 149a and a second bypass pipe 149b are connected to the outlet side pipe 147 of the first heat exchanging part 141 and the outlet side pipe 148 of the second heat exchanging part 142, respectively.

[0040] The first bypass pipe 149a and the second bypass pipe 149b extend from an inlet side of the first flow switching part 130 to the outlet side pipes 147 and 148, and selectively bypass the high pressure refrigerant discharged from the first and second compressors 110 and 112 toward the first and second heat exchanging parts 141 and 142. A first bypass valve 149c and a second bypass valve 149d to control an opening degree may be installed at the first and second bypass pipes 149a and 149b.

[0041] A heat exchanging part bypass pipe which bypasses the second outdoor valve 148a, and a third check valve 148b which is installed at the heat exchanging part bypass pipe are further provided at the outlet side pipe 148 of the second heat exchanging part 142.

[0042] First and second subcoolers 150 and 170 are provided at an outlet side of the outdoor heat exchanger 140. The first and second subcoolers 150 and 170 include the first subcooler 150 and a second subcooler 170.

[0043] When the air conditioner 10 operates the cooling operation, the refrigerant condensed in the outdoor heat exchanger 140 may pass, in turn, through the first subcooler 150 and the second subcooler 170. However, when the air conditioner 10 operates the warming operation, the refrigerant passed through the second subcooler 170 may be introduced into the first subcooler 150.

[0044] For example, the first subcooler 150 may be a first intermediate heat exchanger in which a first refrigerant circulating in a refrigerant system and some (a second refrigerant) of the first refrigerant are branched and then exchange heat. The second refrigerant which exchanges heat in the first subcooler 150 may be injected to the first and second compressors 110 and 112.

[0045] The outdoor unit 100 may include a first supercooling path 151 which branches and guides the second refrigerant to the first subcooler 150. The first supercooling path 151 may extend from the first subcooler 150 to the first and second compressors 110 and 112.

[0046] A first supercooling expansion device 153 to depressurize the second refrigerant may be installed at the first supercooling path 151. The first supercooling expansion device 153 may include the EEV.

[0047] A plurality of temperature sensors 154 and 155 may be provided at the first supercooling path 151. The

plurality of temperature sensors 154 and 155 may include a first temperature sensor 154 to detect a temperature of the refrigerant before the refrigerant is introduced into the first subcooler 150, and a second temperature sensor 155 to detect a temperature of the refrigerant after the refrigerant passes through the first subcooler 150.

[0048] The first refrigerant may be supercooled and the second refrigerant may be heated while the first refrigerant and the second refrigerant exchange heat in the first subcooler 150.

[0049] A "first superheat degree" of the second refrigerant may be recognized based on a temperature value of the refrigerant that is detected by each of the first temperature sensor 154 and the second temperature sensor 155. For example, the first superheat degree may be a value obtained by subtracting a temperature value detected by the first temperature sensor 154 from a temperature value detected by the second temperature sensor 155.

[0050] The second refrigerant which exchanges heat in the first subcooler 150 may be branched and then may be injected to the first and second compressors 110 and 112. The first supercooling path 151 may be referred to as a "first injection path". For example, the first supercooling path 151 may be branched into a first branching path 156a and a second branching path 156b, and then may be connected to the first and second compressors 110 and 112, respectively. The first and second branching paths 156a and 156b together may be understood as the first injection path.

[0051] A portion of the refrigerant in the first supercooling path 151 which exchanges heat in the first subcooler 150 may be injected into a first injection port of the first compressor 110 via the first branching path 156a. The remaining refrigerant in the first supercooling path 151 which exchanges heat in the first subcooler 150 may be injected into a first injection port of the second compressor 112 via the second branching path 156b. At this point, the refrigerant injected to the first and second compressors 110 and 112 may have an intermediate pressure that is greater than a suction pressure of the compressor and less than an outlet pressure thereof.

[0052] A first branching part 158 may be provided at an outlet side of the first subcooler 150. The first refrigerant passed through the first subcooler 150 may be branched at the first branching part 158, and one portion thereof may be introduced into an electronic component cooling part 159, and another portion thereof may be introduced into a receiver 162. The electronic component cooling part 159 may pass through one side of an electronic component part at which heat generating components are installed, and may cool the heat generating components.

[0053] The second subcooler 170 may be installed at an outlet side of the electronic component cooling part 159. The first subcooler 150, the electronic component cooling part 159 and the second subcooler 170 may be arranged in series.

[0054] In the cooling operation, the first refrigerant which exchanges heat in the first subcooler 150 may be introduced into the second subcooler 170 via the electronic component cooling part 159. However, in the warming operation, the refrigerant which exchanges heat in the second subcooler 170 may be introduced into the first subcooler 150 via the electronic component cooling part 159.

[0055] The second subcooler 170 may be understood as a second intermediate heat exchanger in which the first refrigerant circulating in the refrigerant system and some (the second refrigerant) of the refrigerant are branched and then exchange heat.

[0056] The outdoor unit 100 may include a second supercooling path 171 to which the second refrigerant is branched. A supercooling expansion device 173 to depressurize the second refrigerant may be installed at the second supercooling path 171. The supercooling expansion device 173 may include the EEV.

[0057] A plurality of temperature sensors 174 and 175 may be provided at the second supercooling path 171. The plurality of temperature sensors 174 and 175 may include a third temperature sensor 174 to detect a temperature of the refrigerant before the refrigerant is introduced into the second subcooler 170, and a fourth temperature sensor 175 to detect a temperature of the refrigerant after the refrigerant passes through the second subcooler 170.

[0058] The first refrigerant may be supercooled and the second refrigerant may be heated while the first refrigerant and the second refrigerant exchange heat in the second subcooler 170.

[0059] A "second superheat degree" of the second refrigerant may be recognized based on a temperature value of the refrigerant detected by each of the third temperature sensor 174 and the fourth temperature sensor 175. For example, the "second superheat degree" may be a value obtained by subtracting a temperature value detected by the third temperature sensor 174 from a temperature value detected by the fourth temperature sensor 175.

[0060] The second refrigerant which exchanges heat in the second subcooler 170 may be injected to the first and second compressors 110 and 112, or may be bypassed to the gas-liquid separator 160.

[0061] The second supercooling path 171 may include second injection paths 176a and 176b through which the refrigerant is injected to the first and second compressors 110 and 112, and a second branching part 182 which is branched to a bypass path 181 for bypassing the refrigerant to the gas-liquid separator 160.

[0062] The second injection paths 176a and 176b may include a third branching path 176a and a fourth branching path 176b which may extend to the first and second compressors 110 and 112, respectively. The third branching path 176a may be connected to a second injection port of the first compressor 110, and the fourth branching path 176b may be connected to a second in-

jection port of the second compressor 112.

[0063] An injection valve 177 to control a flow rate of the refrigerant may be installed at the third and fourth branching paths 176a and 176b. The injection valve 177 may include the EEV to control an opening degree thereof.

[0064] One portion of the refrigerant in the second supercooling path 171 which exchanges heat in the second subcooler 170 may be branched at the second branching part 182, and may be injected to the second injection port of the first compressor 110 via the third branching path 176a. Another portion branched at the second branching part 182 may be injected to the second injection port of the second compressor 112 via the fourth branching path 176b. At this point, the injected refrigerant has the intermediate pressure which is greater than the suction pressure of the compressor and less than the outlet pressure thereof. Meanwhile, the gas-liquid separator 160 functions to separate a gas refrigerant before the refrigerant is introduced into the first and second compressors 110 and 112.

[0065] The gas-liquid separator 160 may be integrally formed with the receiver 162. For example, the outdoor unit 100 may include a refrigerant storing tank which has the gas-liquid separator 160 and the receiver 162, and a partition part to divide or separate an internal space of the refrigerant storing tank. The gas-liquid separator 160 may be provided at a lower side of the partition part in the internal space of the refrigerant storing tank, and the receiver 162 may be provided at an upper side thereof.

[0066] The outdoor unit 100 further may include a low pressure pipe 184 which extends from each of the first and second flow switching parts 130 and 135 to the gas-liquid separator 160. The low pressure refrigerant evaporated in the refrigerant cycle may be introduced from the first flow switching part 130 or the second flow switching part 135 into the gas-liquid separator 160 via the low pressure pipe 184.

[0067] The gas-liquid separator 160 may include a first gas-liquid separation port to which the low pressure pipe 184 is connected, and a second gas-liquid separation port to which the bypass path 181 is connected. The bypass path 181 may extend from the second branching part 182 to the second gas-liquid separation port of the gas-liquid separator 160.

[0068] A bypass valve 183 to selectively block the flow of the refrigerant may be provided at the bypass path 181. The bypass valve 183 may control (e.g., by an ON/OFF control) an amount of the refrigerant introduced into the gas-liquid separator 160. The bypass valve 183 may include a solenoid valve.

[0069] The receiver 162 may store at least some of the refrigerant circulating in the system.

[0070] The outdoor unit 100 may further include a receiver inlet path 163 which is connected to an inlet side of the receiver 162. The receiver inlet path 163 may extend from the first branching part 158 to the receiver 162.

[0071] A receiver inlet valve 164a to control the flow of

the refrigerant may be provided at the receiver inlet path 163. Accordingly, when the receiver inlet valve 164a is opened, at least some of the refrigerant circulating in the system may be introduced into the receiver 162. The receiver inlet valve 164a may include a solenoid valve.

[0072] A depressurizing device 164b may be provided at the receiver inlet path 163 to depressurize the refrigerant introduced into the receiver 162. The depressurizing device 164b may include a capillary tube.

[0073] The outdoor unit 100 may further include a receiver outlet pipe 165 which extends from the receiver 162 to the gas-liquid separator 160. At least some of the refrigerant stored in the receiver 162 may be introduced into the gas-liquid separator 160 through the receiver outlet pipe 165. A gas-liquid separation port to which the receiver outlet pipe 165 is connected may be provided at an upper portion of the gas-liquid separator 160.

[0074] A receiver outlet valve 166 to control an amount of the refrigerant discharged from the receiver 162 may be provided at the receiver outlet pipe 165. The amount of the refrigerant introduced into the gas-liquid separator 160 may be controlled according to ON/OFF of the receiver outlet valve 166 or the opening degree thereof. The receiver outlet valve 166 may include a solenoid valve.

[0075] The outdoor unit 100 may further include a suction pipe 169 which extends from the gas-liquid separator 160 toward each of the first and second compressors 110 and 112 and guides suctioning of the refrigerant to the compressor. The suction pipe 169 may be branched and connected to a first port of the first compressor 110 and a first port of the second compressor 112.

[0076] A low pressure sensor 169a to detect a pressure of the refrigerant introduced into the first and second compressors 110 and 112, i.e., a low pressure of the system, may be installed at the suction pipe 169.

[0077] The outdoor unit 100 may further include an oil return pipe 190 which extends from the gas-liquid separator 160 to the suction pipe 169. Oil stored in the gas-liquid separator 160 may be introduced into the suction pipe 169 through the oil return pipe 190. An oil valve 191 to control a flow rate of the oil may be installed at the oil return pipe 190. The oil valve 191 may include a solenoid valve.

[0078] The outdoor unit 100 may further include oil supply pipes 119 to supply the oil in the first and second compressors 110 and 112 to the suction pipe 169. The oil supply pipes 119 may extend from the first and second compressors 110 and 112, respectively, and are combined with each other, and then connected to the suction pipe 169.

[0079] Meanwhile, the first refrigerant passed through the second subcooler 170 may be introduced into the indoor unit through a liquid pipe 197. A liquid pipe temperature sensor 197a to detect a temperature of the refrigerant flowing through the liquid pipe 197 may be installed at the liquid pipe 197.

[0080] FIG. 2 is a view illustrating an external config-

uration of the subcooler according to the embodiment of the present disclosure, FIG. 3 is a view illustrating an internal configuration of the subcooler according to the embodiment of the present disclosure, FIG. 4 is an exploded perspective view illustrating a configuration of an internal tube and a baffle according to the embodiment of the present disclosure, and FIG. 5 is a view illustrating a state in which the refrigerant flows in the subcooler according to the embodiment of the present disclosure.

[0081] Referring to FIGS. 2 to 5, a subcooler 200 may include a first subcooler 150 or a second subcooler 170, such as illustrated in FIG. 1.

[0082] For example, the subcooler 200 may include a supercooling body 210 as an external tube, and a first introduction part 211 provided at one side of the supercooling body 210 and in which the first refrigerant is introduced.

[0083] The supercooling body 210 may be formed in a cylindrical shape, but is not limited thereto. For example, the supercooling body 210 may include a body part 210a of which both side ends are opened, and a cap 210b to block each of the side ends of the body part 210a. A flowing space in which the first refrigerant and the second refrigerant flow may be formed inside the supercooling body 210.

[0084] The subcooler 200 may include a supercooling path 220 through which the second refrigerant branched from the first refrigerant flows, and a supercooling expansion device 221 which is provided at the supercooling path 220 to depressurize the second refrigerant. The supercooling path 220 may include the first supercooling path 151 or the second supercooling path 171 which is illustrated in FIG. 1, and the supercooling expansion device 221 may include the first supercooling expansion device 153 or the second supercooling expansion device 173.

[0085] The supercooling path 220 may include a second introduction part 223 through which the second refrigerant is introduced into the supercooling body 210. The second refrigerant may be depressurized in the supercooling expansion device 221, and then introduced into the supercooling body 210 through the second introduction part 223.

[0086] The first refrigerant introduced through the first introduction part 211 may flow through a plurality of internal tubes 240, and the second refrigerant introduced through the second introduction part 223 may flow through an external space of the plurality of internal tubes 240. During such process, heat may be exchanged between the first refrigerant and the second refrigerant.

[0087] The subcooler 200 may include a first discharge part 215 through which the first refrigerant is discharged. The first discharge part 215 may be coupled to the cap 210b. The first introduction part 211 may be provided at one side of the supercooling body 210, and the first discharge part 215 may be provided at the other side of the supercooling body 210. It is understood that the other side is a side opposite to the one side. The first refrigerant

discharged through the first discharge part 215 may exchange heat with the second refrigerant, and then may be discharged in a supercooled state.

[0088] The subcooler 200 may include a second discharge part 225 through which the second refrigerant is discharged. The second refrigerant discharged through the second discharge part 225 may be discharged in a heated state while exchanging heat with the first refrigerant.

[0089] The subcooler 200 may include the plurality of internal tubes 240 which are provided inside the supercooling body 210 to guide the flow of the first refrigerant, and a plurality of supporting members 231 and 235 to support both sides of the plurality of internal tubes 240.

[0090] The plurality of internal tubes 240 may be spaced apart from each other, and may extend from an inside of the first introduction part 211 toward the first discharge part 215. The plurality of supporting members 231 and 235 may include a first supporting member 231 which is coupled to one sides of the plurality of internal tubes 240, and a second supporting member 235 which is coupled to the other sides of the plurality of internal tubes 240.

[0091] The first supporting member 231 may include a first supporting body 232 which may have a circular plate shape (not limited thereto), and a plurality of first coupling holes 233 which are formed at the first supporting body 232 and in which one sides of the plurality of internal tubes 240 are inserted. The second supporting member 235 may include a second supporting body 236 which may have a circular plate shape (not limited thereto), and a plurality of second coupling holes 237 which are formed at the second supporting body 236 and in which the other sides of the plurality of internal tubes 240 are inserted.

[0092] The first refrigerant introduced into the supercooling body 210 through the first introduction part 211 may be branched and introduced into the plurality of internal tubes 240. For example, the first refrigerant may be introduced into a space between the cap 210b and the first supporting member 231, and may be branched to the plurality of internal tubes 240.

[0093] The first refrigerant in the plurality of internal tubes 240 may flow toward the first discharge part 215, and may be combined in a space between the second supporting member 235 and the cap 210b. And the combined first refrigerant may be discharged from the subcooler 200 through the first discharge part 215.

[0094] A baffle 250 may be provided inside the supercooling body 210. It is understood that the baffle 250 may support the plurality of internal tubes 240 and prevent the plurality of internal tubes 240 from being shaken,

[0095] A plurality of baffles 250 may be provided. The plurality of baffles 250 may be installed between the first and second supporting members 231 and 235.

[0096] For example, the plurality of baffles 250 may be spaced apart from each other in a lengthwise direction of the plurality of internal tubes 240. The "lengthwise di-

rection" of the plurality of internal tubes 240 is understood to be a direction that the plurality of internal tubes 240 extend, and may also be understood as a direction that the first refrigerant flows, i.e., a direction from the first introduction part 211 toward the first discharge part 215.

[0097] For example, the plurality of baffles 250 may include a first baffle 250a, a second baffle 250b, a third baffle 250c and a fourth baffle 250d which are arranged, in turn, from a side of the first introduction part 211 toward the first discharge part 215. It is understood that the number of the baffles 250 is not limited thereto.

[0098] The plurality of baffles 250a, 250b, 250c and 250d may be provided at alternate positions inside the supercooling body 210. For example, referring to FIG. 5, a part of the baffles based on the flow of the first refrigerant from the side of the first introduction part 211 toward the first discharge part 215, e.g., the first and third baffles 250a and 250c may be located at an upper side of a center of the supercooling body 210, and the second and fourth baffles 250b and 250d may be located at a lower side of the center of the supercooling body 210 relative to the first and third baffles 250a and 250c. In other words, the first and third baffles 250a and 250c may support upper portions of the plurality of internal tubes 240, and the second and fourth baffles 250b and 250d may support lower portions of the plurality of internal tubes 240.

[0099] By such an arrangement of the plurality of baffles 250a, 250b, 250c and 250d, the second refrigerant may alternately flow through an internal lower space and an internal upper space of the supercooling body 210.

[0100] For example, the second refrigerant introduced into the supercooling body 210 through the second introduction part 223 flows through a space between the first and second supporting members 231 and 235. Because the plurality of baffles 250a, 250b, 250c and 250d serve as blocking parts to restrict the flow of the second refrigerant, the second refrigerant may avoid the plurality of baffles 250a, 250b, 250c and 250d, and thus a flowing direction thereof may be changed.

[0101] As illustrated in FIG. 5, the second refrigerant may alternately flow upward and downward while flowing from the second introduction part 223 toward the second discharge part 225. In this process, the second refrigerant may exchange heat with the first refrigerant in the plurality of internal tubes 240, and may evenly exchange heat with the plurality of internal tubes 240 while alternately flowing upward and downward.

[0102] The second refrigerant may be depressurized in the supercooling expansion device 221, and thus may be in a two-phase state. Therefore, a gas refrigerant and a liquid refrigerant may be appropriately mixed due to the alternate flow thereof, and thus heat-exchange efficiency with the first refrigerant may be improved.

[0103] FIG. 6 is a perspective view illustrating a configuration of the baffle according to the embodiment of the present disclosure, FIG. 7 is a front view illustrating the configuration of the baffle according to the embodiment of the present disclosure, and FIG. 8 is a cross-

sectional view illustrating an internal configuration of the subcooler according to the embodiment of the present disclosure.

[0104] Referring to FIGS. 6, 7, and 8, the baffle 250 according to the embodiment of the present disclosure may have an approximately semicircular shape (not limited thereto). For example, the baffle 250 may include a baffle body 251 which may have an arc-shaped outer circumferential surface 252. The outer circumferential surface 252 may be coupled to an inner circumferential surface of the supercooling body 210. The baffle body 251 may serve as a blocking part to restrict the flow of the second refrigerant.

[0105] A through-hole 255 through which a part of the plurality of internal tubes 240 pass may be formed at the baffle 250. The through-hole 255 may have a circular shape corresponding to an outer circumferential surface of a part of the plurality of internal tubes 240. A plurality of through-holes 255 may be provided. It is understood that the invention does not limit the through-hole 255 to any particular shape.

[0106] The baffle 250 may include a supporting groove 253 which is spaced apart from the through-hole 255 so as to support the other part of the plurality of internal tubes 240. The supporting groove 253 may be formed by recessing at least a part of the baffle body 251. For example, the supporting groove 253 may have an arc shape. It is understood that the invention does not limit the supporting groove 253 to any particular shape.

[0107] When imaginary radial lines which connect both ends of the supporting groove 253 from a center C of the supporting groove 253 are defined, an angle of the radial lines, i.e., a central angle θ of the arc may be 180 degrees or more. And the center of the supporting groove 253 and the center of the supercooling body 210 may be concentrically formed.

[0108] A plurality of supporting grooves 253 may be provided. The baffle 250 may include a groove connection part 254 to connect one of the plurality of supporting grooves 253 with the other one of the plurality of supporting grooves 253. The groove connection part 254 may form a part of the baffle body 251, and may connect an end of one supporting groove 253 with an end of another supporting groove 253.

[0109] A reference line A1 which bisects the baffle 250 is defined. The baffle 250 may have a symmetrical shape with respect to the reference line A1. The baffle 250 may include a reference point 256 which is defined as a point at which the reference line A1 intersects the outer circumferential surface 252.

[0110] The plurality of internal tubes 240 may be arranged in a multistage configuration in the supercooling body 210. For example, the plurality of internal tubes 240 may include a first row pipe part 241 which is provided at a lower portion inside the supercooling body 210, a second row pipe part 243 which is provided to be spaced apart upward from the first row pipe part 241, and a third row pipe part 245 which is provided to be spaced apart

upward from the second row pipe part 243.

[0111] For example, as illustrated in FIG. 7, pipes forming the first row pipe part 241, pipes forming the second row pipe part 243, and pipes forming the third row pipe part 245, are arranged at the same heights, respectively. Here, the height may be understood as a distance in a direction that the reference line A1 extends from a first reference line $\ell 1$ which is in contact with the reference point 256 when it is assumed that the reference point 256 is a starting point.

[0112] A second reference line $\ell 2$ which passes centers of the pipes forming the first row pipe part 241, a third reference line $\ell 3$ which passes centers of the pipes forming the second row pipe part 243, and a fourth reference line $\ell 4$ which passes centers of the pipes forming the third row pipe part 245 may be defined.

[0113] A distance between the first row pipe part 241 and the second row pipe part 243 may be substantially the same as a distance between the second row pipe part 243 and the third row pipe part 245. A distance between the pipes forming each of the first to third row pipe parts 241, 243 and 245 may also be substantially the same. Therefore, the plurality of internal tubes 240 may be evenly disposed inside the supercooling body 210.

[0114] A height of the baffle 250, i.e., a height of the groove connection part 254, may be formed to be $1/2$ or more of a diameter of the supercooling body 210. If the height of the baffle 250 is $1/2$ or less of the diameter of the supercooling body 210, a supporting force of the plurality of internal tubes 240, in particular, a supporting force of the second row pipe part 243 decreases, and thus it is restricted from preventing vibration of the internal tubes 240.

[0115] To prevent this, the height of the baffle 250 according to the embodiment, i.e., the height H of the groove connection part 254, may be formed higher than a height H1 corresponding to $1/2$ of the diameter of the supercooling body 210.

[0116] Meanwhile, the baffle 250 may be formed to support the first and second row pipe parts 241 and 243 and also to be spaced apart from the third row pipe part 245. That is, the baffle 250 may be formed at a height which does not support the internal tube 240 located at the highest position, i.e., the pipes of the third row pipe part 245.

[0117] As described above, because the baffle 250 serves as the blocking part to restrict the flow of the second refrigerant, when the the baffle 250 has a very large cross section or is disposed to completely divide an internal space of the supercooling body 210, flow performance of the second refrigerant may be decreased.

[0118] For example, when the baffle 250 is formed at a height to support the pipes of the third row pipe part 245, the flowing space 218 may be too small. It is understood that the flowing space 218 may be a space of an external space of the internal tubes 240 which is not blocked by the baffle 250 and in which the second refrigerant flows.

[0119] For example, to effectively support the third row pipe part 245, the baffle 250 should be located higher than a height of a center of the third row pipe part 245. However, in this case, the flowing space 218 may be too small, and thus the flow performance of the second refrigerant may be decreased. Accordingly, the height H of the baffle 250 should be formed equal to or lower than a height H3 corresponding to a lower end of the third row pipe part 245.

[0120] Meanwhile, the height H of the baffle 250 may be formed equal to or lower than a height H2 corresponding to an upper end of the second row pipe part 243. However, when the height H of the baffle 250 is formed higher than the height H2, an upper end of the baffle 250 is located too close to the third row pipe part 245, and thus the third row pipe part 245 may be shaken while the second refrigerant flows, and thus a noise may be generated due to contact between the third row pipe part 245 and the baffle 250.

[0121] When the height H of the baffle 250 is equal to the height H2, the upper end of the baffle 250 is formed at a position which is in contact with the second row pipe part 243. However, in this case, it is relatively difficult to machine the baffle 250 or the supporting groove 253.

[0122] Therefore, according to an embodiment of the invention, the height H of the baffle 250 is formed lower than the height H2. The height H of the baffle 250 may be formed higher than the height H1 and lower than the height H2. It is understood that height H1 is referred to as a first height, and height H2 is referred to as a second height.

[0123] Meanwhile, the groove connection part 254 may be spaced apart from the third row pipe part 245 by a value corresponding to a distance d1 between the adjacent internal tubes 240. For example, when an imaginary concentric circle P1 which has a radius r set from the center of the pipe of the third row pipe part 245 and is in contact with the pipe of the second row pipe part 243 is defined, the groove connection part 254 may be provided at a position which is in contact with the imaginary concentric circle P1.

[0124] The height H of the baffle 250 or the groove connection part 254 may be formed higher than the first height H1 and lower than the second height H2. In other words, the height H of the baffle 250 or the groove connection part 254 may be formed higher than the height H1 which is $1/2$ or more of the diameter of the supercooling body 210 and lower than the height H2 of the internal tubes 240 supported by the supporting groove 253, i.e., the upper end of the second row pipe part 243.

[0125] By such structure, the baffle 250 may effectively support the plurality of internal tubes 240, vibration of the internal tubes 240 may be prevented, the noise due to the vibration may be prevented, and the flow performance of the second refrigerant and heat exchanging efficiency may be improved.

[0126] According to the embodiment, because the plurality of internal tubes are provided at the subcooler, and

thus the heat exchanging between the main refrigerant and the branched refrigerant can be performed, the supercooling of the refrigerant condensed in the condenser can be more efficiently performed.

[0127] Moreover, because the baffle which supports at least a part of the plurality of internal tubes is provided, the vibration of the internal tubes and the noise due to the vibration can be prevented.

[0128] Moreover, because the through-hole through which a part of the refrigerant pipe passes and the supporting groove which supports a part of an outer circumferential surface of the refrigerant pipe are provided at the baffle, the internal tubes can be effectively supported. Additionally, because the baffle is not located at the space between the plurality of internal tubes, noise generated due to the contact between the baffle and the internal tubes can be prevented.

[0129] Moreover, because an optimal height value or range of the groove connection part can be proposed in one direction from the symmetric reference point of the baffle, the refrigerant can more smoothly flow, and noise due to the flow of the refrigerant can be reduced.

[0130] Moreover, because the plurality of baffles can be alternately arranged, corresponding to a flowing direction of the refrigerant in the subcooler, at one side and the other side based on a center of the subcooler, the heat exchanging between the main flow in the plurality of internal tubes and the branched flow in the supercooling body can be more efficiently performed.

Claims

1. A subcooler (200), comprising:

a supercooling body (210) to receive a first refrigerant passed through a condenser and a second refrigerant branched from the first refrigerant;
a plurality of internal tubes (240) provided inside the supercooling body (210) and through which the first refrigerant flows;
a flow path (220) through which the second refrigerant flows, the flow path (220) being a space external to the internal tubes (240) in the supercooling body (210); and
a baffle (250) to support at least one of the internal tubes (240),

wherein the baffle (250) comprises:

a baffle body (251) having an outer circumferential surface that is coupled to the supercooling body (210),
a through-hole (255) formed at the baffle body (251) and through which a first internal tube of the internal tubes (240) passes, and
a support groove (253) to support a second in-

ternal tube of the internal tubes (240).

2. The subcooler of claim 1, wherein the support groove (253) is a recessed portion of the baffle body (251).
3. The subcooler of claim 2, wherein a plurality of support grooves (253) are provided, and the baffle body (251) comprises a groove connection part (254) that connects a first support groove of the support grooves with a second support groove of the support grooves.
4. The subcooler of claim 3, wherein at least one of the support grooves (253) is formed having an arc shape, and a central angle (θ) of the arc is at least 180 degrees.
5. The subcooler of any one of claims 1 to 4, wherein the supercooling body (210) is formed having a cylindrical shape, and an outer circumferential surface of the baffle body (251) is coupled to an inner circumferential surface of the supercooling body (210).
6. The subcooler of claim 5, wherein the baffle (250) is shaped so that it is symmetric about a vertical reference line (A1), the outer circumferential surface of the baffle body (251) comprises a reference point (256) that lies on the reference line (A1) at the intersection of the reference line (A1) with the outer circumferential surface of the baffle body (251), and a height (H) of the groove connection part (254) is above a height (H1) corresponding to 1/2 of a diameter of the supercooling body (250), whereby the height (H) of the groove connection part (254) is measured from the reference point (256) in a direction that the reference line (A1) extends from the reference point (256).
7. The subcooler of claim 6, wherein the height (H) of the groove connection part (254) is less than a height (H2) of an upper end of the other internal tube measured from the reference point (256) in the direction that the reference line (A1) extends from the reference point (256).
8. The subcooler of any one of claims 1 to 7, wherein the plurality of internal tubes (240) comprises:
 - a first row pipe part (241) in which a first plurality of pipes are arranged;
 - a second row pipe part (243) that is spaced apart from the first row pipe part and in which a second plurality of pipes are arranged; and
 - a third row pipe part (245) that is spaced apart from the second row pipe part and in which a third plurality of pipes are arranged.
9. The subcooler of claim 8, wherein the first row pipe

part (241) is coupled with the through-hole (255) of the baffle, the second row pipe part (243) is supported by the supporting groove (253) of the baffle, and the third row pipe part (245) is spaced apart from the baffle (250).

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10. The subcooler of claim 9, wherein the groove connection part (254) is provided at a position that forms a tangent with an imaginary concentric circle (P1), whereby the imaginary concentric circle (P1) has a radius (r) that is set apart from a center of the third row pipe part (245) and forms a tangent to the second row pipe part (243). 10
11. The subcooler of any one of claims 1 to 10, wherein a plurality of baffles (250a, 250b, 250c, 250d) are provided, the baffles being provided at an internal upper portion or an internal lower portion of the external tube with respect to a refrigerant flow direction. 15
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12. The subcooler of any one of claims 1 to 10, wherein a plurality of baffles (250a, 250b, 250c, 250d) are provided, the baffles being alternately disposed at an internal upper portion and an internal lower portion of the external tube with respect to a refrigerant flow direction. 25
13. The subcooler of claim 1, wherein the baffle (250) comprises: 30
an outer circumferential surface being supported by an inner circumferential surface of the supercooling body (210),
and a reference point which is a point on the outer circumferential surface that intersects a vertical reference line (A1) which symmetrically bisects the baffle (250), whereby a height (H) of the baffle in a direction corresponding to the reference line (A1) is greater than a height (H1) corresponding to 1/2 of a diameter of the first internal tube and less than a height (H2) of an upper end of the second internal tube. 35
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14. An air conditioner including the subcooler of any one of claims 1 to 13. 45

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Fig. 1

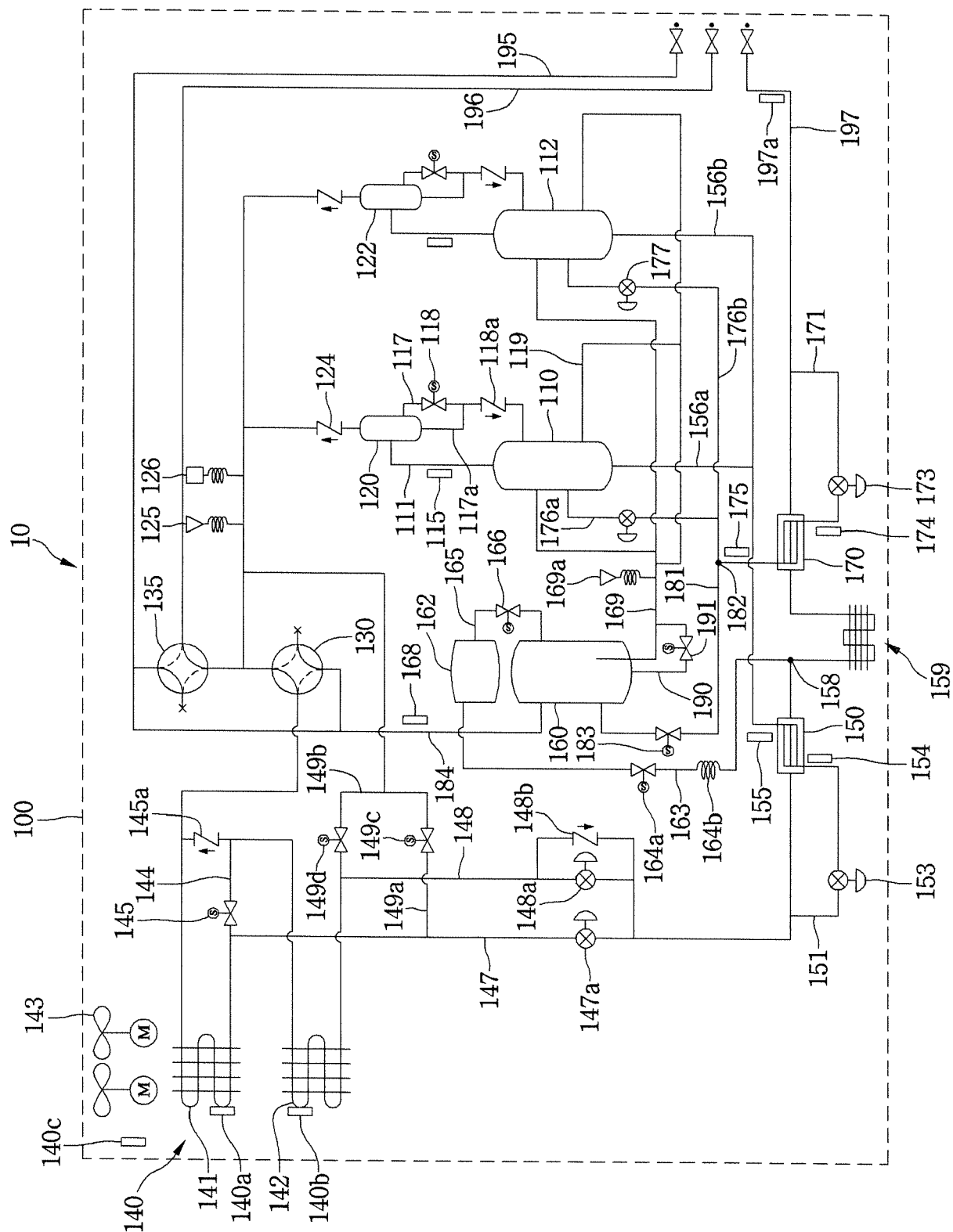


Fig. 2

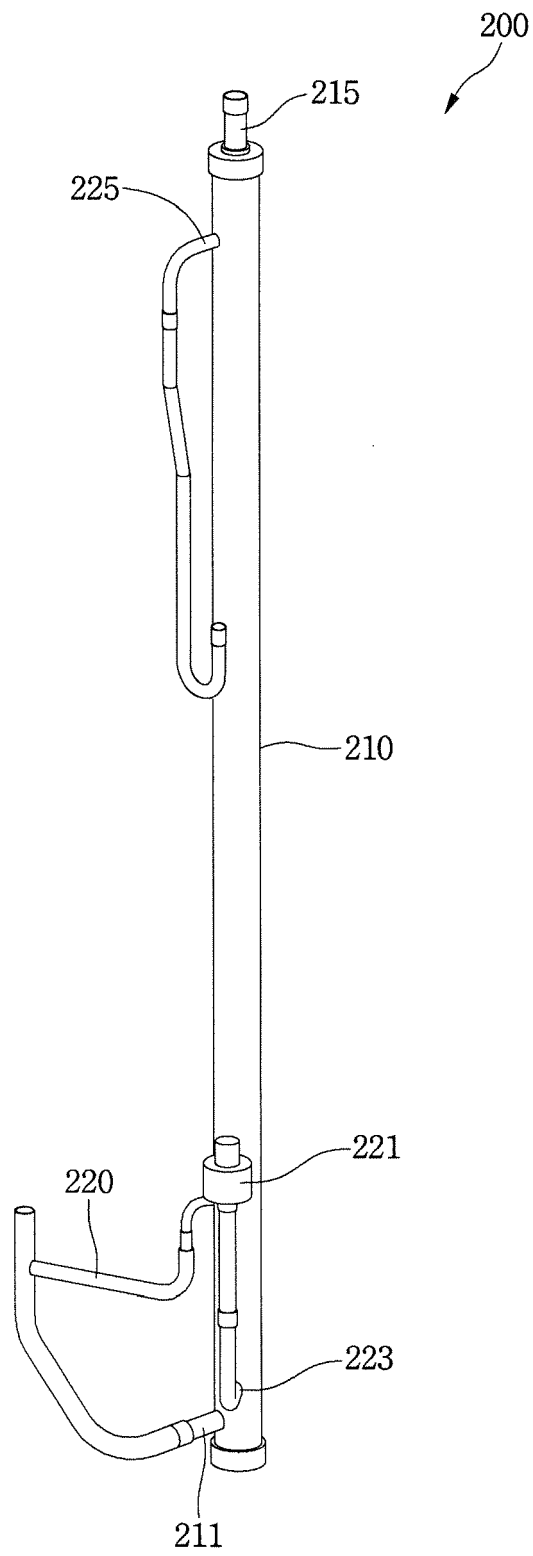


Fig. 3

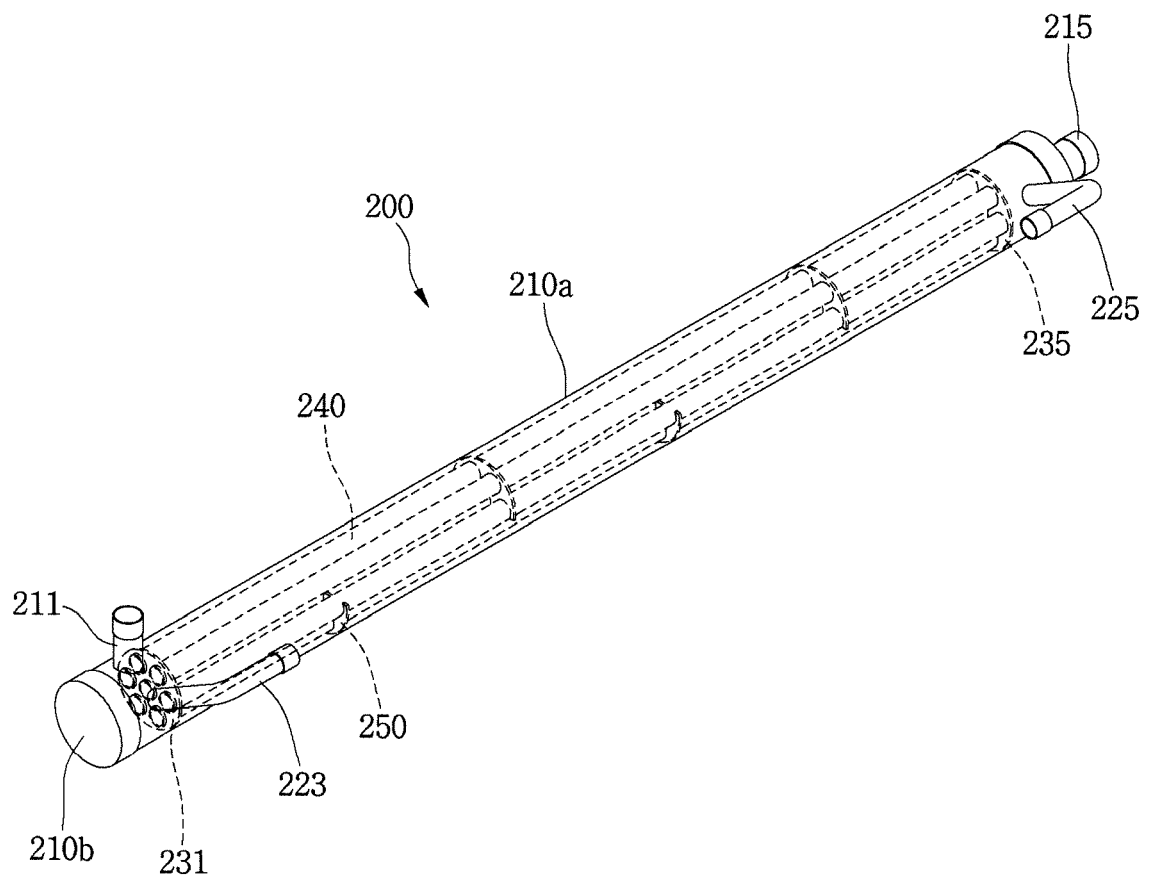


Fig. 4

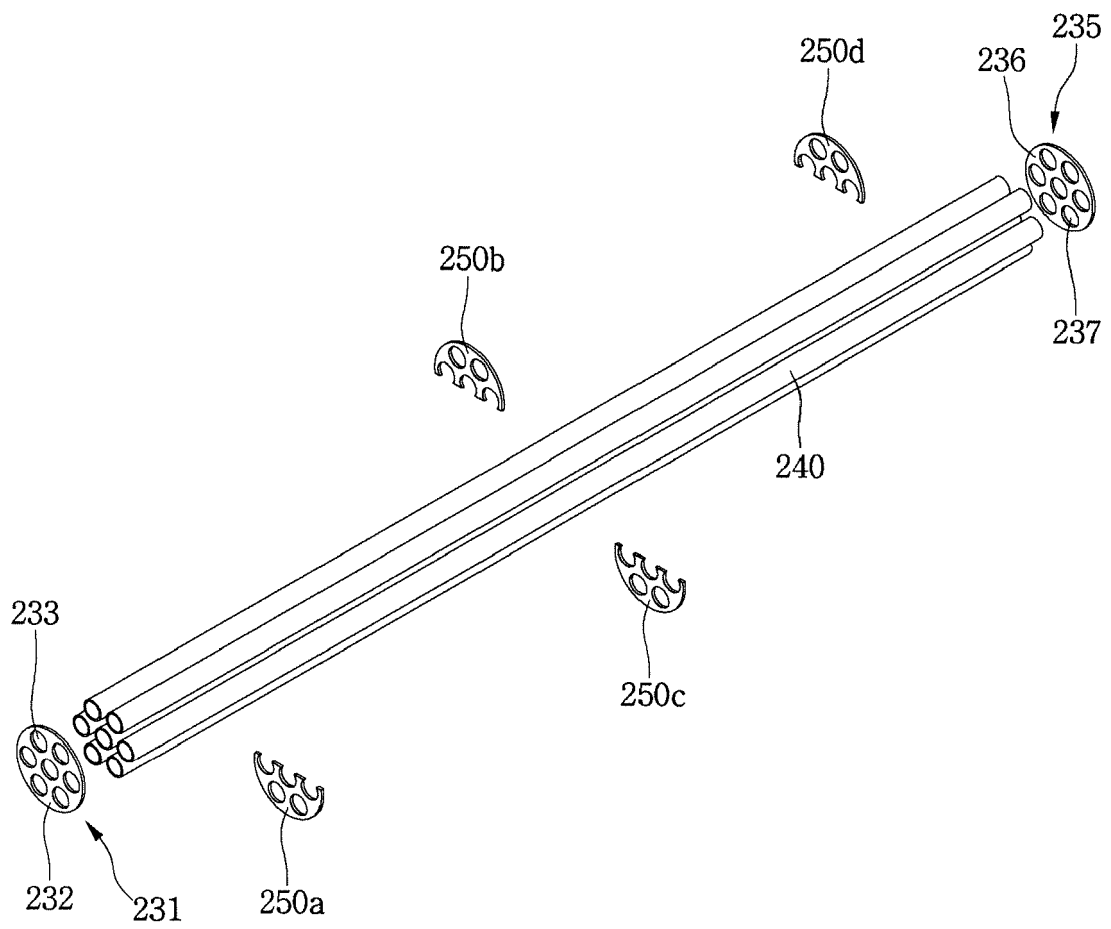


Fig. 5

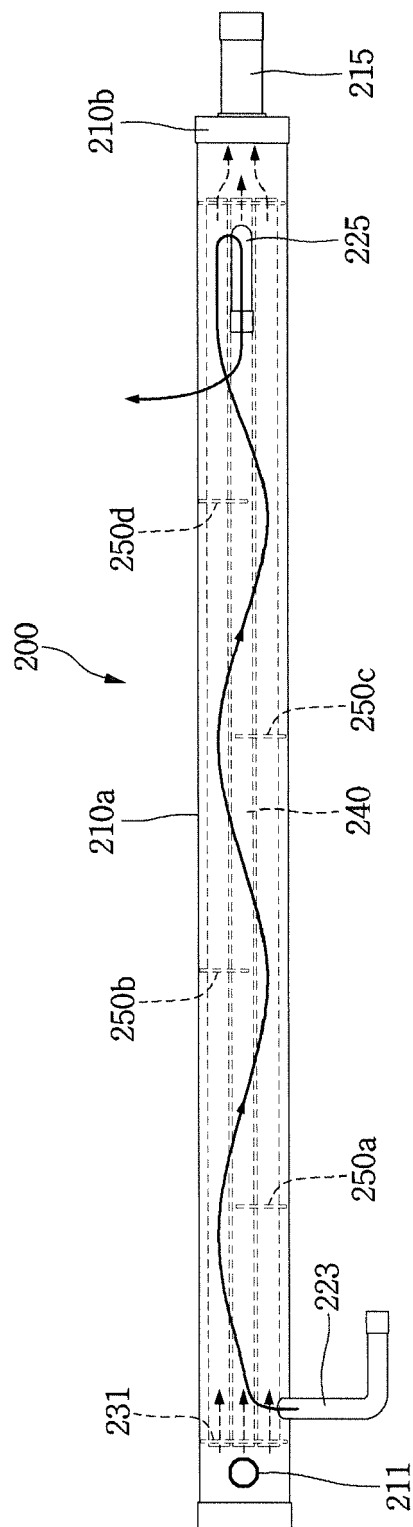


Fig. 6

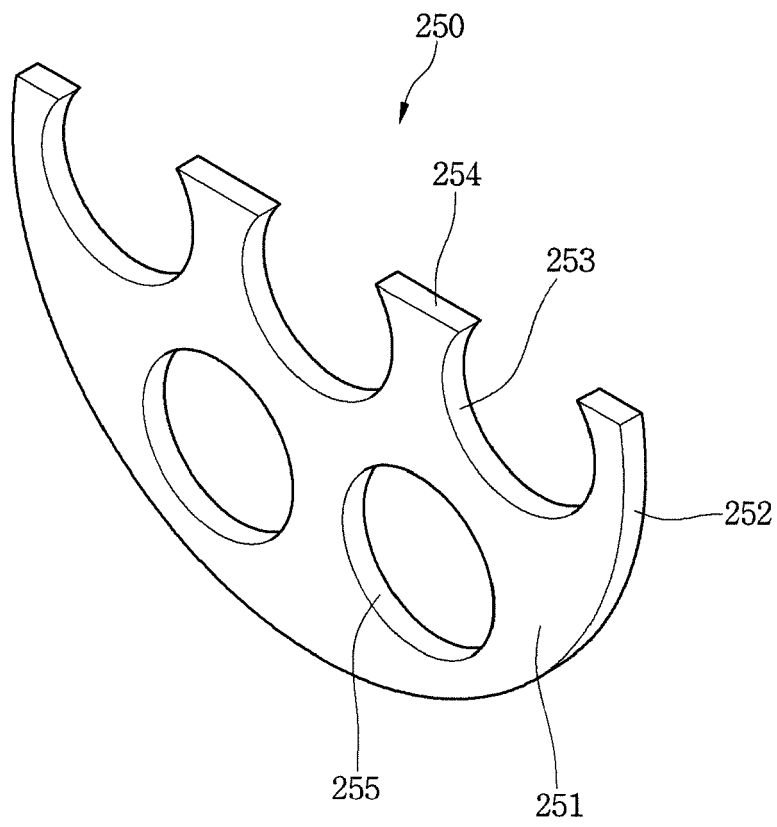


Fig. 7

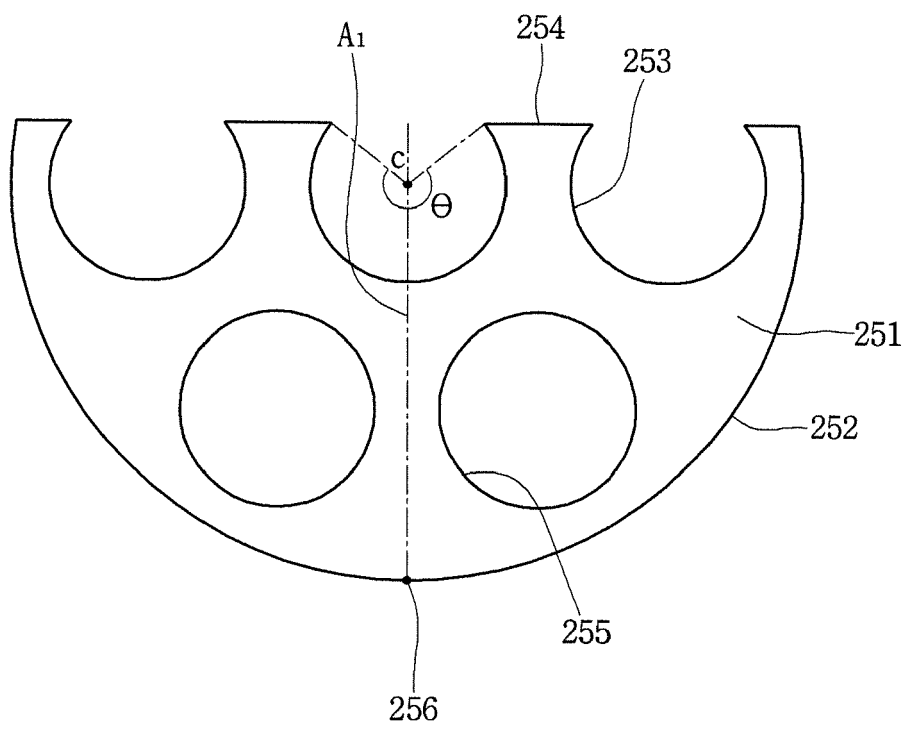
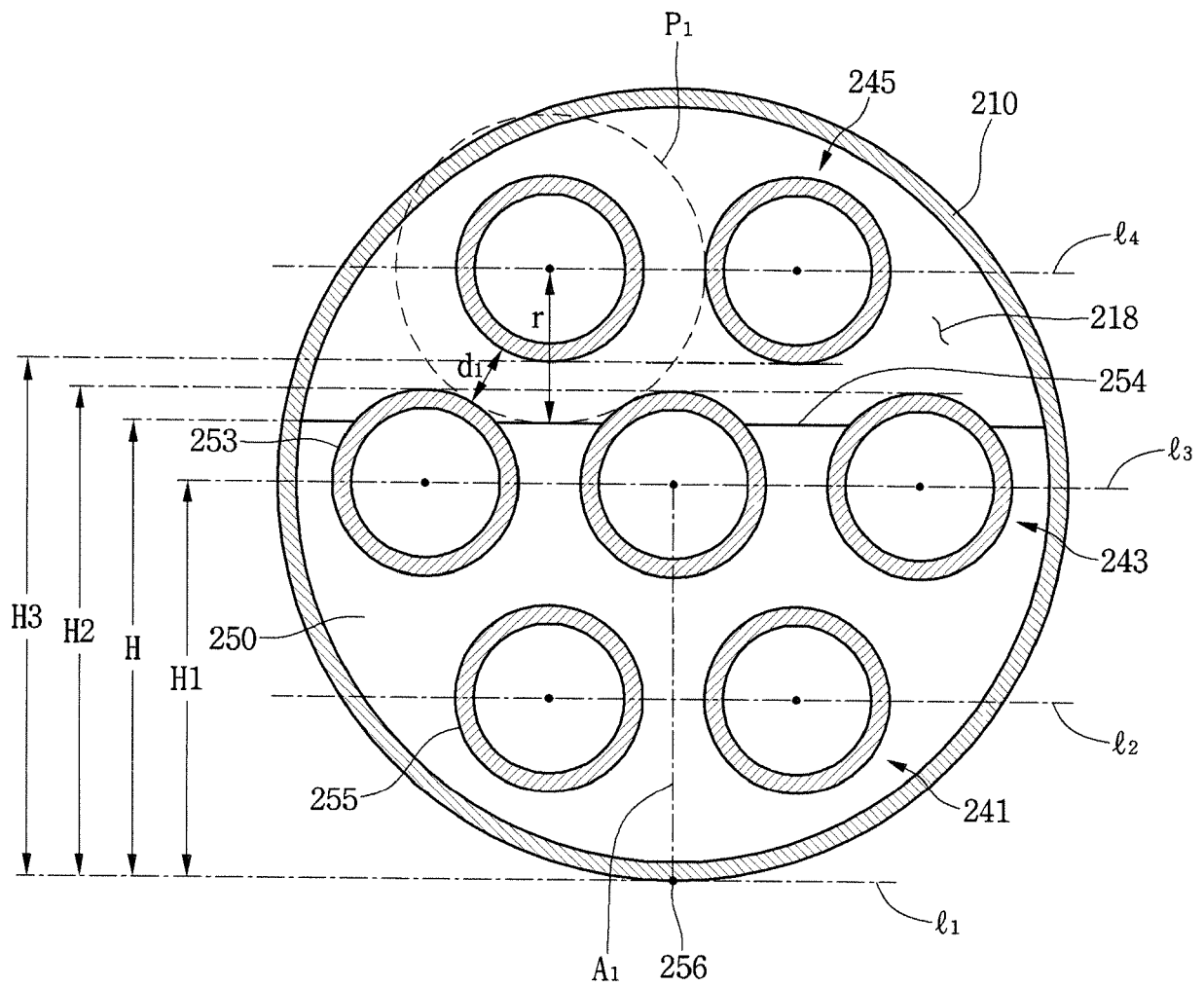


Fig. 8





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Application Number
EP 16 16 5548

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 September 2016	Examiner Axters, Michael
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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07-09-2016

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