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Description

BACKGROUND

[0001] The present disclosure relates to an air conditioner.

[0002] Air conditioners are used to maintain indoor air at predetermined states according to desired purposes and preferences. For example, air conditioners are used to keep indoor air cool in summer and warm in winter. In addition, air conditioners are used to adjust the humidity of indoor air for providing pleasant and clean environments.

[0003] In the refrigeration cycle of an air conditioner, a refrigerant may be compressed, condensed, expanded, and evaporated for operation in cooling or heating mode.

[0004] Air conditioners can be classified into: split air conditioners in which indoor and outdoor units are separated; and one-boy air conditioners in which indoor and outdoor units are integrated.

[0005] An outdoor unit includes an outdoor heat exchanger for heat exchange with outdoor air, and an indoor unit includes an indoor heat exchanger for heat exchange with indoor air. Some air conditioners can be switched between cooling mode and heating mode.

[0006] If an air conditioner is operated in cooling mode, an outdoor heat exchanger functions as a condenser, and an indoor heat exchanger functions as an evaporator. On the other hand, if an air conditioner is operated in heating mode, an outdoor heat exchanger functions as an evaporator, and an indoor heat exchanger functions as a condenser.

[0007] A super cooler may be additional included in an air conditioner for supercooling a refrigerant condensed by a condenser before the refrigerant is expanded. In such a super cooler, heat is exchanged between a main stream of refrigerant circulating in a refrigeration cycle and a branch stream of the refrigerant separated from the main stream and expanded. The main stream of the refrigerant can be super-cooled through heat exchange with the branch stream.

[0008] In a super cooler of the related art, main and branch streams of refrigerant flow through spiral tubes, and heat is exchanged through the spiral tubes that make contact with each other.

[0009] In the case, however, heat exchange areas of the main and branch streams of the refrigerant are limited due to the spiral structure of the spiral tubes, and thus heat exchanger efficiency between the main and branch streams of the refrigerant is decreased. That is, the main stream of the refrigerant may not be sufficiently super-cooled. An example of the related art can be also found in EP1662213 which discloses an air conditioner according to the preamble of claim 1.

SUMMARY

[0010] Embodiments provide an air conditioner in which a refrigerant can be heat exchanged, in particular super-cooled, to improving refrigeration cycle efficiency.

[0011] Embodiments also provide an air conditioner in which a refrigerant is super-cooled after being condensed or is super-heated before being compressed by a compressor so as to improve refrigeration cycle efficiency.

[0012] In one embodiment, an air conditioner includes a compressor configured to compress a refrigerant, a condenser configured to condense the compressed refrigerant, an additional heat exchanger, such as a super cooling device, configured to heat exchange, in particular to super-cool, the refrigerant after the refrigerant passes through the condenser, and an evaporator configured to evaporate the refrigerant after the refrigerant passes through the additional heat exchanger, such as the super cooling device, wherein the additional heat exchanger, such as the super cooling device, includes: a first flow passage disposed in the additional heat exchanger, such as the super cooling device, to guide the refrigerant coming from the condenser toward the evaporator; and a second flow passage located in the additional heat exchanger, such as the super cooling device, for exchanging heat with the first flow passage and guiding the refrigerant toward the compressor, wherein one of the first and second flow passage includes: a distribution part configured to divide a flow of the refrigerant; and an inner tube connected to the distribution part, wherein a stream of the refrigerant flowing in the first flow passage exchanges heat with a stream of the refrigerant flowing in the second flow passage while using an outer surface area of the inner tube as a heat exchange area.

[0013] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other advantages will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 is a block diagram illustrating an air conditioner according to an exemplary embodiment.

Fig. 2 is a perspective view illustrating a super cooling device according to the exemplary embodiment.

Fig. 3 is an exploded perspective view illustrating the super cooling device according to the exemplary embodiment.

Fig. 4 is a sectional view taken along line I-I' of Fig. 2.

Fig. 5 is a sectional view taken along line II-II' of Fig. 2.

Fig. 6 is a block diagram illustrating an air conditioner according to the invention.

Fig. 7 is a perspective view illustrating a super cooling device according to the invention.

Fig. 8 is an exploded perspective view illustrating the super cooling device according to the invention.

Fig. 9 is a sectional view taken along line I-I' of Fig. 7.

Fig. 10 is a sectional view taken along line II-II' of Fig. 7.

Fig. 11 is a sectional view taken along line II-II' of Fig. 7.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0015] Hereinafter, embodiments will now be described with reference to the accompanying drawings. However, the scope set forth in the present disclosure are not limited to the embodiments. Those of ordinary skill in the art will easily propose other embodiments within the scope.

[0016] Fig. 1 is a block diagram illustrating an air conditioner 1 according to an exemplary embodiment.

[0017] Referring to Fig. 1, in the air conditioner 1 of the embodiment, a refrigerant is circulated according to a refrigeration cycle. The air conditioner 1 may be operated in cooling mode or heating mode according to the circulation direction of the refrigerant.

[0018] For operation in heating mode, the air conditioner 1 includes: a compressor 10 configured to compress the refrigerant; a gas-liquid separator 40 configured to separate a liquefied portion from the refrigerant when the refrigerant is sucked into the compressor 10; an indoor heat exchanger 20 at which the refrigerant compressed by the compressor 10 exchanges heat with indoor air; an outdoor expansion device 38 configured to expand the refrigerant condensed at the indoor heat exchanger 20; an outdoor heat exchanger 30 at which the refrigerant expanded at the outdoor expansion device 38 exchanges heat with outdoor air; a four-way valve 50 configured to control the circulation direction of the refrigerant discharged from the compressor 10; and refrigerant pipes 60 connecting the above-list components for guiding the refrigerant.

[0019] The compressor 10 comprises an inlet port 11, an injection port 12 distinct from the inlet port 11, and an outlet port 13. The inlet port 11 of the compressor 10 is connected to the four-way valve 50 through the gas-liquid separator 40 and the outlet port 13 of the compressor 10 is connected to the four-way valve 50.

[0020] Blower fans 25 and 35 are disposed beside the indoor heat exchanger 20 and the outdoor heat exchanger 30, respectively, so as to blow a fluid (air) to the indoor heat exchanger 20 and the outdoor heat exchanger 30 so that the air exchanges heat with the refrigerant. The blower fans 25 and 35 include indoor and outdoor fans, respectively.

[0021] In cooling mode, the refrigerant is circulated in a direction opposition to a direction in which the refrigerant is circulated in heating mode. The circulation direction of the refrigerant is controlled by the four-way valve 50. That is, in cooling mode, the refrigerant passes through the compressor 10 and the outdoor heat exchanger 30 and is expanded at an indoor expansion device 28. Then, the refrigerant exchanges heat with indoor air at the indoor heat exchanger 20.

[0022] A super cooling device 100 (super cooler), as an additional heat exchanger, is disposed between the outdoor heat exchanger 30 and the indoor heat exchanger 20, so as to super-cool the refrigerant condensed at the outdoor heat exchanger 30 when the air conditioner 1 is operated in cooling mode.

[0023] The refrigerant pipes 60 include: a main inlet part 71 through which a main stream of the refrigerant flows into the super cooling device 100; and a main outlet part 72 through which the super-cooled main stream of the refrigerant is discharged from the super cooling device 100. The main stream of the refrigerant flowing in the refrigerant pipes 60 may be referred to as a first refrigerant.

[0024] The air conditioner 1 includes an injection passage 150. At least a portion of the first refrigerant flowing in the refrigerant pipes 60 branches off to the injection passage 150, and the portion of the first refrigerant is injected to the compressor 10. The injection passage 150 branches off from the refrigerant pipes 60 and is connected to the super cooling device 100. The portion branching off from the first refrigerant may be referred to as a second refrigerant.

[0025] The injection passage 150 includes an injection inlet part 151 to guide the portion branching off from the first refrigerant (second refrigerant) to the super cooling device 100. The injection inlet part 151 is at a position different from a position where the main inlet part 71 is disposed.

[0026] The injection passage 150 further includes an injection outlet part 152 directly connected to the injection port 12 of the compressor 10. The portion of the first refrigerant introduced into the super cooling device 100 through the injection inlet part 151 is discharged from the super cooling device 100 through the injection outlet part 152. The injection outlet part 152 is disposed at a position different from a position where the main outlet part 72 is disposed. The portion of the first refrigerant discharged through the injection outlet part 152 is injected to the compressor 10.

[0027] As described above, at least a portion of the first refrigerant flowing in the refrigerant pipes 60 is guided to the super cooling device 100 and then to the compressor 10. Therefore, more refrigerant can be circulated through the compressor 10 or a refrigerant system.

[0028] The injection passage 150 includes an injection expansion device 155 for expanding the second refrigerant. As the second refrigerant passes through the injection expansion device 155, the temperature and pressure of the second refrigerant are reduced lower than those of the first refrigerant, and the second refrigerant exchanges heat with the first refrigerant at the super cooling device 100 so that the first refrigerant can be super-cooled.

[0029] The first refrigerant super-cooled at the super cooling device 100 is expanded while passing through the indoor expansion device 28 so that the first refrigerant can evaporate at the indoor heat exchanger 20.

[0030] An explanation has been given of the circulation of the refrigerant in the super cooling device 100 when the air conditioner 1 is operated in cooling mode. If the air conditioner 1 is operated in heating mode by adjusting the four-way valve 50, the refrigerant is circulated in a direction opposite to the direction in cooling mode.

[0031] In detail, the refrigerant condensed at the indoor heat exchanger 20 is introduced into the super cooling device 100 through the main outlet part 72 and is discharged from the super cooling device 100 through the main inlet part 71. The refrigerant (first refrigerant) discharged from the super cooling device 100 is expanded at the outdoor expansion device 38 and is evaporated at the outdoor heat exchanger 30.

[0032] At this time, a portion (second refrigerant) of the first refrigerant discharged through the main inlet part 71 branches off to the injection passage 150 and is expanded at the injection expansion device 155. Then, the second refrigerant is introduced into the super cooling device 100. In the super cooling device 100, the first refrigerant and the second refrigerant exchange heat with each other. During the heat exchange, the first refrigerant is supercooled, and the second refrigerant is evaporated and injected into the compressor 10.

[0033] Hereinafter, the structure of the super cooling device 100 will be described in detail with reference to the accompanying drawings.

[0034] Fig. 2 is an exploded perspective view illustrating the super cooling device 100 according to the first embodiment; Fig. 3 is an exploded perspective view illustrating the super cooling device 100 according to the first embodiment; Fig. 4 is a sectional view taken along line I-I' of Fig. 2; and Fig. 5 is a sectional view taken along line II-II' of Fig. 2.

[0035] Referring to Figs. 2 to 5, the super cooling device 100 of the exemplary embodiment includes a super cooling main body 110. The super cooling main body 110 forms a flow space 111 for the first and second refrigerants. The super cooling main body 110 may be a hollow pipe.

[0036] The super cooling device 100 includes the main inlet part 71 and the main outlet part 72. The main inlet part 71 is disposed at a side of the super cooling main body 110 to guide the first refrigerant into the super cooling main body 110 in cooling mode. The main outlet part 72 is disposed at the other side of the super cooling main body 110 to guide the first refrigerant away from the super cooling main body 110 in cooling mode. The main inlet part 71 may be disposed at an end of the super cooling main body 110, and the main outlet part 72 may be disposed at the other end of the super cooling main body 110.

[0037] The super cooling device 100 includes the injection inlet part 151 and the injection outlet part 152. The injection inlet part 151 is disposed at a side of the outer surface of the super cooling main body 110 to guide the second refrigerant into the super cooling main body 110. The injection outlet part 152 is disposed at the other side of the outer surface of the super cooling main body 110 to guide the second refrigerant away from the super cooling main body 110.

[0038] Since refrigerant is introduced into the super cooling main body 110 through the main inlet part 71 and the injection inlet part 151, the main inlet part 71 and the injection inlet part 151 may be referred to as a first inlet part and a second inlet part, respectively. Since refrigerant is discharged from the super cooling main body 110 through the main outlet part 72 and the injection outlet part 152, the main outlet part 72 and the injection outlet part 152 may be referred to as a first outlet part and a second outlet part, respectively.

[0039] A distribution part 120 is disposed between the main inlet part 71 and the super cooling main body 110. The first refrigerant introduced through the main inlet part 71 is distributed to a plurality of passages (flow passages) through the distribution part 120. The distribution part 120 is disposed between the main inlet part 71 and refrigerant tubes 130.

[0040] The main inlet part 71 is coupled to a side of the distribution part 120, and the super cooling main body 110 is coupled to the other side of the distribution part 120. The distribution part 120 has a hollow pipe shape.

[0041] In detail, the distribution part 120 includes an inlet coupling part 121 and a first shield part 122. The inlet coupling part 121 is coupled to the main inlet part 71, and the first shield part 122 includes a plurality of first tube coupling portions 123. After the second refrigerant is introduced into the super cooling main body 110, the first shield part 122 prevents an outflow (leakage) of the second refrigerant.

[0042] The first tube coupling portions 123 have a hole shape so that the refrigerant tubes 130 can be coupled to the first tube coupling portions 123.

[0043] The refrigerant tubes 130 are disposed in the super cooling main body 110, and the first refrigerant is distributed to the refrigerant tubes 130 through the distribution part 120. For example, some of the refrigerant tubes 130 may be cylindrical capillary tubes. Since the refrigerant tubes 130 are disposed inside the super cooling main body 110, the refrigerant tubes 130 may be referred to as inner tubes.

[0044] The refrigerant tubes 130 may extend in the length direction of the super cooling main body 110 in a state where the refrigerant tubes 130 are spaced apart from each other and from the super cooling main body 110. As described above, the refrigerant tubes 130 are coupled to the first tube coupling portions 123 to guide the first refrigerant from one side to the other side of the super cooling main body 110.

[0045] A joining part 125 is disposed between the super cooling main body 110 and the main outlet part 72 so that streams of the first refrigerant flowing in the refrigerant tubes 130 can join at the joining part 125. The refrigerant tubes 130 are coupled to a side of the joining part 125, and the main outlet part 72 is coupled to the other side of the joining part 125. The joining part 125

has a hollow pipe shape.

[0046] In detail, the joining part 125 includes a second shield part 126 and an outlet coupling part 128. The second shield part 126 includes a plurality of second tube coupling portions 127, and the outlet coupling part 128 is coupled to the main outlet part 72.

[0047] After the second refrigerant is introduced into the super cooling main body 110, the second shield part 126 prevents an outflow (leakage) of the second refrigerant. That is, the first shield part 122 shields ends of the refrigerant tubes 130, and the second shield part 126 shields the other ends of the refrigerant tubes 130, so as to prevent the second refrigerant from mixing with the first refrigerant.

[0048] The second tube coupling portions 127 have a hole shape so that the refrigerant tubes 130 can be coupled to the second tube coupling portions 127. The first tube coupling portions 123 are coupled to ends of the refrigerant tubes 130, and the second tube coupling portions 127 are coupled to the other ends of the refrigerant tubes 130.

[0049] If streams of the first refrigerant are introduced into the joining part 125 through the second tube coupling portions 127, the streams of the first refrigerant can be mixed with each other owning to an increased flow space. The first refrigerant may include a super-cooled portion (saturated portion) and a two-phase state portion. In this case, the first refrigerant may flow with less flow loss owing to the mixing at the joining part 125.

[0050] The super cooling main body 110 includes a first coupling part 112 to which the injection inlet part 151 is coupled and a second coupling part 113 to which the injection outlet part 152 is coupled. The injection inlet part 151 and the injection outlet part 152 may extend from the first coupling part 112 and the second coupling part 113 in the same direction or different directions (not shown).

[0051] The second refrigerant introduced through the injection inlet part 151 exchanges heat with the first refrigerant while flowing in the super cooling main body 110. Then, the second refrigerant is discharged from the super cooling main body 110 through the injection outlet part 152.

[0052] The super cooling main body 110 includes a first flow passage 141 through which the first refrigerant flows and a second flow passage 142 through which the second refrigerant flows.

[0053] The first refrigerant flows from the main inlet part 71 to the main outlet part 72 along the first flow passage 141, and the second refrigerant flows from the injection inlet part 151 to the injection outlet part 152 along the second flow passage 142.

[0054] The first flow passage 141 includes the inner spaces of the refrigerant tubes 130, and the second flow passage 142 includes the outer space of the refrigerant tubes 130.

[0055] An end of the second flow passage 142 is defined by the first shield part 122, and the other end of the second flow passage 142 is defined by the second shield part 126. That is, flows of the second refrigerant is blocked by the first shield part 122 and the second shield part 126, and thus the second refrigerant can be prevented from flowing into the distribution part 120 or the joining part 125.

[0056] As shown in Fig. 4, the first refrigerant flows in a direction from the distribution part 120 to the joining part 125, and the second refrigerant flows in a direction from the injection inlet part 151 to the injection outlet part 152. Unlike the flows of the first and second refrigerants shown in Fig. 4, the second refrigerant may flow in a direction opposite to a direction in which the first refrigerant flows according to the positions of the injection inlet part 151 and the injection outlet part 152.

[0057] As described above, the super cooling main body 110 includes a plurality of refrigerant flow passages. That is, in the super cooling main body 110, the first flow passage 141 is defined by the refrigerant tubes 130, and the second flow passage 142 of the super cooling main body 110 is defined by the rest space of the super cooling main body 110. Therefore, more area can be used for heat exchange. The first and second refrigerants may exchange heat with each other at areas corresponding to whole outer surface areas of the refrigerant tubes 130.

[0058] In addition, the first flow passage 141 may include a narrow tube such as a capillary tube to increase the flow velocity (thermal flow rate) of the first refrigerant for increasing the heat transfer coefficient and heat transfer efficiency of the first flow passage 141.

[0059] Furthermore, since the first refrigerant flows in the refrigerant tubes 130 in a condensed state and the second refrigerant flows along the outsides of the refrigerant tubes 130 in a two-phase state, the first and second refrigerants can flow with less flow loss. That is, if the second refrigerant flows in the refrigerant tubes 130, a liquid-phase portion of the second refrigerant may flow in some of the refrigerant tubes 130, and a gas-phase portion of the second refrigerant may flow in the other refrigerant tubes 130. In this case, the second refrigerant may flow with relatively high flow loss as compared with the case where the two-phase second refrigerant flows in a mixed state along the outsides of the refrigerant tubes 130.

[0060] The flow velocity and heat exchange efficiency of the first and second refrigerants can be increased by reducing flow loss as described above.

[0061] Hereinafter, a second embodiment will be described. The second embodiment is different from the first embodiment in that supercooling is possible by a refrigerant to be introduced into a compressor. In the following description, the difference will be mainly explained, and the same elements as those of the first embodiment will be denoted by the same reference numbers.

[0062] Fig. 6 is a block diagram illustrating an air conditioner 1 according to the invention.

[0063] Referring to Fig. 6, in the current embodiment,

a super cooling device 200 (super cooler) is disposed between an outdoor heat exchanger 30 and an indoor heat exchanger 20, so as to super-cool a refrigerant condensed at the outdoor heat exchanger 30 when the air conditioner 1 is operated in cooling mode.

[0064] The air conditioner 1 includes an injection passage 150. At least a portion of a first refrigerant flowing in refrigerant pipes 60 branches off to the injection passage 150, and the portion (second refrigerant) is injected to a compressor 10. The injection passage 150 branches off from the refrigerant pipes 60 and is connected to the super cooling device 200. As described in the first embodiment, the injection passage 150 includes an injection inlet part 151, an injection outlet part 152, and an injection expansion device 155.

[0065] The air conditioner 1 includes a super heating inlet part 261 and a super heating outlet part 262. The refrigerant evaporated at the indoor heat exchanger 20 is introduced into the super cooling device 200 through the super heating inlet part 261. The refrigerant introduced into the super cooling device 200 through the super heating inlet part 261 is discharged to a gas-liquid separator 40 through super heating outlet part 262 after the refrigerant exchanges heat with the first refrigerant. The refrigerant flowing from the super heating inlet part 261 to the super heating outlet part 262 along the super cooling device 200 will be referred to as a third refrigerant.

[0066] That is, unlike the air conditioner 1 of the first embodiment, the air conditioner 1 of the current embodiment further includes the super heating inlet part 261 and the super heating outlet part 262 so that the first and third refrigerants can exchange heat with each other.

[0067] If the air conditioner 1 is operated in heating mode, the directions of refrigerant streams may be reversed so that the first and second refrigerants may exchange heat with each other. This is the same as described in the first embodiment. As described above, according to the current embodiment, the third refrigerant evaporated at the outdoor heat exchanger 30 is introduced into the super cooling device 200 through the super heating inlet part 261. Then, the third refrigerant exchanges heat with the first refrigerant and is then discharged from the super cooling device 200 to the gas-liquid separator 40 through the super heating outlet part 262.

[0068] Hereinafter, the structure of the super cooling device 200 will be described in detail with reference to the accompanying drawings.

[0069] Fig. 7 is an exploded perspective view illustrating the super cooling device 200 according to the invention; Fig. 8 is an exploded perspective view illustrating the super cooling device 200 according to the invention; Fig. 9 is a sectional view taken along line I-I' of Fig. 7; Fig. 10 is a sectional view taken along line II-II' of Fig. 7; and Fig. 11 is a sectional view taken along line III-III' of Fig. 7.

[0070] Referring to Figs. 7 to 11, the super cooling device 200 of the invention includes a super cooling main body 210. The super cooling main body 210 forms first and second flow spaces 212a and 212b for the first to third refrigerants. The super cooling main body 210 may be constituted by hollow pipes.

[0071] The super cooling main body 210 includes a first main body 211 defining a first heat exchange region (or first tube region) and a second main body 215 defining a second heat exchange region (or second tube region). The first flow space 212a is formed in the first main body 211. The first and second refrigerants flow in the first flow space 212a. The second flow space 212b is formed in the second main body 215. The first and third refrigerants flow in the second flow space 212b.

[0072] The first main body 211 includes a plurality of first refrigerant tubes 231. The first refrigerant flows in the first refrigerant tubes 231. The second main body 215 includes a plurality of second refrigerant tubes 232. The first refrigerant flows in the second refrigerant tubes 232. For example, the first and second refrigerant tubes 231 and 232 may be capillary tubes.

[0073] The first and second refrigerants exchange heat with each other in the first heat exchange region (or first tube region). The first and third refrigerants exchange heat with each other in the second heat exchange region (or second tube region).

[0074] According to the operation mode of the air conditioner 1, the first refrigerant flows sequentially in the first refrigerant tubes 231 and the second refrigerant tubes 232. For example, when the air conditioner 1 is operated in cooling mode, the first refrigerant flows sequentially in the first refrigerant tubes 231 and the second refrigerant tubes 232, and when the air conditioner 1 is operated in heating mode, the first refrigerant flows sequentially in the second refrigerant tubes 232 and the first refrigerant tubes 231.

[0075] The super cooling device 200 includes a main inlet part 71 and a main outlet part 72. The main inlet part 71 is disposed at a side of the first main body 211 to guide the first refrigerant into the first main body 211 in cooling mode. The main outlet part 72 is disposed at a side of the second main body 215 to guide the first refrigerant away from the second main body 215 in cooling mode.

[0076] The super cooling device 200 includes the injection inlet part 151 and the injection outlet part 152. The injection inlet part 151 is disposed at a side of the outer surface of the first main body 211 to guide the second refrigerant into the first main body 211. The injection outlet part 152 is disposed at the other side of the outer surface of the super cooling main body 211 to guide the second refrigerant away from first main body 211.

[0077] The super cooling device 200 includes the super heating inlet part 261 and the super heating outlet part 262. The super heating inlet part 261 is disposed at a side of the outer surface of the second main body 215 to guide the third refrigerant into the second main body 215. The super heating outlet part 262 is disposed at the other side of the outer surface of the second main body 215 to guide the third refrigerant away from second main

body 215.

[0078] Since refrigerant is introduced into the super cooling main body 210 through the main inlet part 71, the injection inlet part 151, and the super heating inlet part 261, the main inlet part 71, the injection inlet part 151, and the super heating inlet part 261 may be referred to as a first inlet part, a second inlet part, and a third inlet part, respectively. Since refrigerant is discharged from the super cooling main body 210 through the main outlet part 72, the injection outlet part 152, and the super heating outlet part 262, the main outlet part 72, the injection outlet part 152, and the super heating outlet part 262 may be referred to as a first outlet part, a second outlet part, and a third outlet part, respectively.

[0079] A distribution part 220 is disposed between the main inlet part 71 and the first main body 211. The first refrigerant introduced through the main inlet part 71 is distributed to a plurality of passages (flow passages) through the distribution part 220. The distribution part 220 is disposed between the main inlet part 71 and the first refrigerant tubes 231.

[0080] The main inlet part 71 is coupled to a side of the distribution part 220, and the first main body 211 is coupled to the other side of the distribution part 220. The distribution part 220 has a hollow pipe shape.

[0081] In detail, the distribution part 220 includes an inlet coupling part 221 and a first shield part 222. The inlet coupling part 221 is coupled to the main inlet part 71, and the first shield part 222 includes a plurality of first tube coupling portions 223. After the second refrigerant is introduced into the first main body 211, the first shield part 222 prevents an outflow (leakage) of the second refrigerant. The first tube coupling portions 223 have a hole shape so that the first refrigerant tubes 231 can be coupled to the first tube coupling portions 223.

[0082] The first refrigerant tubes 231 extend in the length direction of the first main body 211 in a state where the first refrigerant tubes 231 are spaced apart from each other. The first refrigerant tubes 231 are coupled to the first tube coupling portions 223 to guide the first refrigerant from one side to the other side of the first main body 211.

[0083] Partition parts 225 and 240 are disposed between the first refrigerant tubes 231 and the second refrigerant tubes 232 to define the first heat exchange region and the second heat exchange region. The partition parts 225 and 240 may be hollow pipes.

[0084] The partition parts 225 and 240 include a first partition part 225 coupled to the first refrigerant tubes 231. The distribution part 220 is coupled to ends of the first refrigerant tubes 231, and the first partition part 225 is coupled to the other ends of the first refrigerant tubes 231.

[0085] The first partition part 225 includes a second shield part 226. The second shield part 226 includes a plurality of second tube coupling portions 227. The second shield part 226 prevents the second refrigerant flowing around the first refrigerant tubes 231 from flowing (leaking) to the outside of the first main body 211. That is, the first shield part 222 shields ends of the first refrigerant tubes 231, and the second shield part 226 shields the other ends of the first refrigerant tubes 231, so as to prevent the second refrigerant from mixing with the first and third refrigerants.

[0086] The first refrigerant tubes 231 are coupled to the second tube coupling portions 227. The first refrigerant introduced into the first refrigerant tubes 231 through the tube coupling portions 223 is guided into the first partition part 225 through the second tube coupling portions 227. The first partition part 225 forms a joining space so that streams of the first refrigerant guided from the first refrigerant tubes 231 into the first partition part 225 can be mixed in the first partition part 225.

[0087] The partition parts 225 and 240 include a second partition part 240 coupled to the second refrigerant tubes 232. The second partition part 240 may be coupled to a side of the first partition part 225.

[0088] The second partition part 240 includes a third shield part 241. The third shield part 241 includes a plurality of third tube coupling portions 242. The third shield part 241 prevents the third refrigerant flowing around the second refrigerant tubes 232 from flowing (leaking) to the outside of the second main body 215.

[0089] The second refrigerant tubes 232 are coupled to the third tube coupling portions 242. The first refrigerant introduced into the first partition part 225 through the second tube coupling portions 227 is distributed to the second refrigerant tubes 232 through the third tube coupling portions 242 of the second partition part 240.

[0090] That is, streams of the first refrigerant flowing in the first refrigerant tubes 231 are guided to the first partition part 225 and the second partition part 240 where the streams join together and mix uniformly with each other. The first refrigerant may include a super-cooled portion (saturated portion) and a two-phase state portion. In this case, the first refrigerant may flow with less flow loss owing to the owing to the mixing at the first partition part 225 and the second partition part 240.

[0091] In the current embodiment, the first and second partition parts 225 and 240 are provided as separate parts. However, the first and second partition parts 225 and 240 may be provided in one piece.

[0092] A joining part 245 is disposed between the second main body 215 and the main outlet part 72 so that streams of the first refrigerant flowing in the second refrigerant tubes 232 can join at the joining part 245. The second refrigerant tubes 232 are coupled to a side of the joining part 245, and the main outlet part 72 is coupled to the other side of the joining part 245. The joining part 245 has a hollow pipe shape.

[0093] In detail, the joining part 245 includes a fourth shield part 246 and an outlet coupling part 248. The fourth shield part 246 includes a plurality of fourth tube coupling portions 247, and the outlet coupling part 248 is coupled to the main outlet part 72.

[0094] After the third refrigerant is introduced into the

second main body 215, the fourth shield part 246 prevents an outflow (leakage) of the third refrigerant. That is, the third shield part 241 shields ends of the second refrigerant tubes 232, and the fourth shield part 246 shields the other ends of the second refrigerant tubes 232, so as to prevent the third refrigerant from mixing with the first and second refrigerants.

[0095] The fourth tube coupling portions 247 have a hole shape so that the second refrigerant tubes 232 can be coupled to the fourth tube coupling portions 247. That is, the third tube coupling portions 242 are coupled to ends of the second refrigerant tubes 232, and the fourth tube coupling portions 247 are coupled to the other ends of the second refrigerant tubes 232.

[0096] Streams of the first refrigerant introduced into the joining part 245 through the fourth tube coupling portions 247 can be mixed with each other owning to an increased flow space. The first refrigerant may include a super-cooled portion (saturated portion) and a two-phase state portion. In this case, the first refrigerant may flow with less flow loss owing to the owing to the mixing at the joining part 245.

[0097] The first main body 211 includes a first coupling part 213 to which the injection inlet part 151 is coupled and a second coupling part 214 to which the injection outlet part 152 is coupled. The injection inlet part 151 and the injection outlet part 152 may extend from the first coupling part 213 and the second coupling part 214 in the same direction or different directions (not shown).

[0098] The second refrigerant introduced through the injection inlet part 151 exchanges heat with the first refrigerant while flowing in the first main body 211. Then, the second refrigerant is discharged from the first main body 211 through the injection outlet part 152.

[0099] The second main body 215 includes a third coupling part 217 to which the super heating inlet part 261 is coupled and a fourth coupling part 218 to which the super heating outlet part 262 is coupled. The super heating inlet part 261 and the super heating outlet part 262 may extend from the third coupling part 217 and the fourth coupling part 218 in the same direction or different directions (not shown).

[0100] The third refrigerant introduced through the super heating inlet part 261 exchanges heat with the first refrigerant while flowing in the second main body 215. Then, the third refrigerant is discharged from the second main body 215 through the super heating outlet part 262.

[0101] The super cooling main body 210 includes a first flow passage 271 through which the first refrigerant flows, a second flow passage 272 through which the second refrigerant flows, and a third flow passage 273 through which the third refrigerant flows.

[0102] In detail, the first refrigerant flows from the main inlet part 71 to the main outlet part 72 along the first flow passage 271. The first flow passage 271 includes the inner spaces of the first refrigerant tubes 231 and the second refrigerant tubes 232.

[0103] The second refrigerant flows from the injection inlet part 151 to the injection outlet part 152 along the second flow passage 272. The second flow passage 272 includes the outer space of the first refrigerant tubes 231 surrounded by the first main body 211.

[0104] The third refrigerant flows from the super heating inlet part 261 to the super heating outlet part 262 along the third flow passage 273. The third flow passage 273 includes the outer space of the second refrigerant tubes 232 surrounded by the second main body 215.

[0105] An end of the second flow passage 272 is defined by the first shield part 222, and the other end of the second flow passage 272 is defined by the second shield part 226. An end of the third flow passage 273 is defined by the third shield part 241, and the other end of the third flow passage 273 is defined by the fourth shield part 246.

[0106] As described above, the super cooling main body 210 includes a plurality of refrigerant flow passages: the first flow passage 271 defined in the first refrigerant tubes 231 and the second refrigerant tubes 232; and the second and third refrigerant flow passages 272 and 273 defined outside the first refrigerant tubes 231 and the second refrigerant tubes 232. Therefore, more area can be used for heat exchange. The first and second refrigerants may exchange heat with each other at areas corresponding to outer surface areas of the first refrigerant tubes 231, and the first and third refrigerants may exchange heat with each other at ears corresponding to outer surface areas of the second refrigerant tubes 232.

[0107] An exemplary operation of the air conditioner 1 of the current embodiment will now be explained.

[0108] As the compressor 10 is operated, the injection expansion device 155 is opened to expand the second refrigerant flowing in the injection passage 150, and the expanded second refrigerant is introduced into the first main body 211 through the injection inlet part 151.

[0109] The first refrigerant is introduced into the first refrigerant tubes 231 through the main inlet part 71. While the first refrigerant flows in the first refrigerant tubes 231 and the second refrigerant flows around the first refrigerant tubes 231, the first and second refrigerants exchange heat with each other. Then, the first refrigerant is super-cooled, and the second refrigerant is evaporated.

[0110] The third refrigerant evaporated at an evaporator is introduced into the second main body 215 through the super heating inlet part 261. The first refrigerant super-cooled by heat exchange with the second refrigerant is introduced into the second refrigerant tubes 232 through the first and second partition parts 225 and 240. Then, while the first refrigerant flows in the second refrigerant tubes 232 and the third refrigerant flows around the second refrigerant tubes 232, the first and third refrigerants exchange heat with each other. As a result, the first refrigerant is secondarily super-cooled, and the third refrigerant is super-heated. Next, the first refrigerant is discharged from the super cooling device 200. Then, the first refrigerant may be expanded at an indoor expansion device 28 or an outdoor expansion device 38 and

evaporated at an evaporator.

[0111] In the explanation, the air conditioner 1 is operated in cooling mode, and thus the first refrigerant exchanges heat with the second refrigerant and then with the third refrigerant. However, if the air conditioner 1 is operated in heating mode, the first refrigerant exchanges heat with the third refrigerant and then with the second refrigerant.

[0112] In this way, a refrigerant condensed at a condenser can be super-cooled through two heat exchange steps. Therefore, the refrigerant can be evaporated more easily and injected into the compressor 10 for increasing the amount of the refrigerant. In addition, since the refrigerant can be super-heated before the refrigerant is sucked into the compressor 10. Therefore, the efficiency of the air conditioner 1 can be improved.

[0113] If the refrigerant is not injected into the compressor 10, the injection expansion device 155 is closed, and the second refrigerant may not flow.

[0114] However, in the super cooling device 200, the first refrigerant can exchange heat with the third refrigerant passed through an evaporator for supercooling the first refrigerant and superheating the third refrigerant although refrigerant is not injected into the compressor 10.

[0115] Furthermore, in the embodiment, the first flow passage 271 may include a narrow tube such as a capillary tube to increase the flow velocity (thermal flow rate) of the first refrigerant for increasing the heat transfer coefficient and heat transfer efficiency of the first flow passage 271.

[0116] In addition, since the first refrigerant flows in the first and second refrigerant tubes 231 and 232 in a condensed state and the second and third refrigerants flow along the outsides of the first and second refrigerant tubes 130 in a two-phase state, the first to third refrigerants can flow with less flow loss. That is, if the second and third refrigerant flow in the first and second refrigerant tubes 231 and 232, liquid-phase portions of the second and third refrigerants may flow in some of the first and second refrigerant tubes 231 and 232, and gas-phase portions of the second and third refrigerants may flow in the other refrigerant tubes 231 and 232. In this case, the second and third refrigerants may flow with relatively high flow loss as compared with the case where the two-phase second and third refrigerants flow in a mixed state along the outsides of the first and second refrigerant tubes 231 and 232.

[0117] The flow velocity and heat exchange efficiency of the first to third refrigerants can be increased by reducing flow loss as described above.

[0118] According to the embodiments, the refrigerant tubes are disposed in the super cooling device, and heat is exchanged between the first and second refrigerants flowing in and outside the tubes. Therefore, heat exchange areas can be increased.

[0119] In addition, the refrigerant tubes are disposed in the super cooling device, and heat is exchanged between the first refrigerant flowing in the refrigerant tubes and the second and third refrigerants flowing around the tubes. Therefore, heat exchange areas can be increased.

[0120] Owing to the increase heat exchange areas, the efficiency of supercooling can be increased for improving the refrigeration cycle efficiency of the air conditioner.

[0121] In addition, since the second refrigerant is introduced (injected) into the compressor after the second refrigerant passes through the super cooling device, the amount of refrigerant flowing through the compressor can be increased. Therefore, the heating capacity of the air conditioner can be increased.

[0122] In addition, a third refrigerant to be supplied to the compressor can be super-heated by heat exchange at the super cooling device, and thus the evaporation pressure of the third refrigerant can be increased to improve the refrigeration cycle efficiency of the air conditioner.

[0123] In addition, although a second refrigerant is not injected into the compressor, since first and third refrigerants can exchange heat with each other, the first refrigerant can be super-cooled.

[0124] Furthermore, since two or more heat exchange steps can be performed in the super cooling device having a simple structure, the air conditioner can be compact.

[0125] According to the embodiments, the refrigerant tubes are disposed in the super cooling device, and heat is exchanged between refrigerants flowing in and outside the tubes. Therefore, heat exchange areas can be increased. Thus, the air conditioner can be applied to various industrial fields.

[0126] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

1. An air conditioner (1) comprising a compressor (10) configured to compress a refrigerant, a condenser configured to condense the compressed refrigerant, an additional heat exchanger, such as a super cooling device (100, 200), configured to heat exchange with, in particular to super-cool, the refrigerant after the refrigerant passes through the condenser, and an evaporator configured to evaporate the refrigerant after the refrigerant passes through the additional heat exchanger, such as the super cooling device (100, 200),

wherein the additional heat exchanger, such as the super cooling device (100, 200), comprises:

a first flow passage (141, 271) disposed in the additional heat exchanger, such as the super cooling device (100, 200), to guide the refrigerant coming from the condenser toward the evaporator;
a second flow passage (142, 272) located in the additional heat exchanger, such as the super cooling device (100, 200), for exchanging heat with the first flow passage (141, 271) and guiding the refrigerant toward the compressor (10);
wherein one of the first (141, 271) and second (142, 272) flow passage comprises a distribution part (120, 220) configured to divide a flow of the refrigerant and a plurality of inner tubes (130) connected to the distribution part (120, 220),
characterised in that a third flow passage (273) is located in the additional heat exchanger, such as the super cooling device (100, 200), for exchanging heat with the first flow passage (141,271) and guiding the refrigerant passing through the evaporator toward the compressor (10), and **in that** the additional heat exchanger further comprises a main body (110, 210) comprising a first main body (211) having a first heat exchange region in which the first (141, 271) and second (142, 272) flow passages are disposed, a second main body (215) having a second heat exchange region in which the first (141, 271) and third (273) flow passages are disposed and a partition part (225, 240) disposed between the first main body (211) and the second main body (215), and **in that**
the refrigerant in the first flow passage (141, 271) flows sequentially in the first (211) and the second (215) main bodies to exchange heat with the refrigerant in the second (142, 272) and third (273) flow passages.

2. The air conditioner (1) according to claim 1, wherein the inner tubes (130) are spaced apart from each other and from the main body (110, 210) so that a whole outer surface of each inner tube (130) corresponds to a heat exchange area of said inner tube.

3. The air conditioner (1) according to claim 1, wherein at least one of the plurality of inner tubes (130) is a cylindrical capillary tube that extends in a length direction of the main body (110, 210).

4. The air conditioner (1) according to claim 1, wherein the distribution part (120, 220) and the plurality of inner tubes (130) constitute the first flow passage (141, 271), and the second flow passage (142, 272) is located outside the plurality of tubes.

5. The air conditioner (1) according to claim 1, further comprising an expansion device (155) disposed at an exit side of the additional heat exchanger, such as the super cooling device (100, 200), for decreasing a pressure of the refrigerant,
wherein the main body (110, 210) comprises:

a first inlet part (71) at an exit side of the condenser; and
a first outlet part (72) disposed at an inlet side of the expansion device to discharge the refrigerant introduced into the main body (110, 210) through the first inlet part (71).

6. The air conditioner (1) according to claim 5, wherein the first main body (211) further comprises:

a second inlet part (151) through which at least a portion of the refrigerant passing through the condenser is introduced into the main body (110, 210); and
a second outlet part (152) disposed at an inlet side of the compressor (10) to discharge the refrigerant introduced into the main body (110, 210) through the second inlet part (151).

7. The air conditioner (1) according to claim 6, wherein the compressor (10) comprises an inlet port (11) and an injection port (12) distinct from the inlet port (11), wherein the second inlet part (151) is arranged to introduce said at least a portion of the refrigerant in the second flow passage (142, 272), and the second outlet part (152) is arranged to discharge said at least a portion of the refrigerant from the second flow passage (142, 272), the second outlet part (152) being directly connected to the injection port of the compressor.

8. The air conditioner (1) according to claim 1, further comprising:

a joining part (145, 245) in which streams of the refrigerant joins after passing through the plurality of inner tubes (130); and
a shield part (122, 126, 222, 226, 241) disposed at the distribution part (120, 220) or the joining part (125, 245) to prevent the refrigerant flowing in the second flow passage (142, 272) from leaking from the additional heat exchanger, such as the super cooling device (100, 200), the shield part comprising a tube coupling portion (123, 127, 223, 227) to which the plurality of inner tubes (130) are coupled.

9. The air conditioner (1) according to claim 1, wherein the second main body (210) comprises:

a third inlet part (261) through which the refrig-

erant passing through the evaporator is introduced into the main body (110, 210); and
a third outlet part (262) disposed at an inlet side of the compressor (10) to discharge the refrigerant introduced into the main body (110, 210) through the third inlet part (261).

10. The air conditioner (1) according to claim 1, wherein the partition part (225, 240) comprises:

a shield part (122, 126, 222, 226, 241, 246) configured to prevent a stream of the refrigerant flowing in the second flow passage (142, 272) from mixing with a stream of the refrigerant flowing in the third flow passage (273); and
a tube coupling portion (123, 127, 223, 227, 242, 247) disposed at the shield part (122, 126, 222, 226, 241, 246) for coupling with the plurality of inner tubes (130).

11. The air conditioner (1) according to claim 1, wherein the main body (110, 210) comprises first (231) and second (232) refrigerant tubes in which the first flow passage is defined, and
wherein the second flow passage (142, 272) is located around the first refrigerant tube (231), and the third flow passage (273) is located around the second refrigerant tube (232).

Patentansprüche

1. Klimaanlage (1), aufweisend
einen Verdichter (10) zum Verdichten eines Kältemittels,
einen Kondensator zum Kondensieren des verdichteten Kältemittels,
einen zusätzlichen Wärmetauscher, beispielsweise eine superkühlende Vorrichtung (100, 200) zum Austauschen von Wärme mit dem Kältemittel, insbesondere zum Superkühlen des Kältemittels, nachdem das Kältemittel den Kondensator durchströmt hat, und
einen Verdampfer zum Verdampfen des Kältemittels, nachdem das Kältemittel den zusätzlichen Wärmetauscher, beispielsweise die superkühlende Vorrichtung (100, 200) durchströmt hat,
wobei der zusätzliche Wärmetauscher, beispielsweise die superkühlende Vorrichtung, (100, 200) aufweist:

einen ersten Stromkanal (141, 271), der in dem zusätzlichen Wärmetauscher, beispielsweise der superkühlenden Vorrichtung (100, 200) angeordnet ist, um das aus dem Kondensator kommende Kältemittel zum Verdampfer zu führen;
einen zweiten Stromkanal (142, 272), der in dem zusätzlichen Wärmetauscher, beispielsweise der superkühlenden Vorrichtung (100, 200) angeordnet ist, um Wärme mit dem ersten Stromkanal (141, 271) auszutauschen und Kältemittel zu dem Verdichter (10) zu führen;
wobei der erste (141, 271) oder der zweite (142, 272) Stromkanal einen Verzweigungsabschnitt (120, 220), der konfiguriert ist, einen Strom des Kältemittels zu teilen, und mehrere mit dem Verzweigungsabschnitt (120, 220) verbundene Innenrohre (130) aufweist,
dadurch gekennzeichnet, dass ein dritter Stromkanal (273) in dem zusätzlichen Wärmetauscher, beispielsweise der superkühlende Vorrichtung, (100, 200) angeordnet ist, um Wärme mit dem ersten Stromkanal (141, 271) auszutauschen und das durch den Verdampfer geströmte Kältemittel zu dem Verdichter (10) zu führen,
und dadurch, dass der zusätzliche Wärmetauscher ferner einen Hauptkörper (110, 210) aufweist, der aufweist:

einen ersten Hauptkörper (211) mit einem ersten Wärmetauschbereich, in welchem der erste (141, 271) und zweite (142, 272) Stromkanal angeordnet sind,
einen zweiten Hauptkörper (215) mit einem zweiten Wärmetauschbereich, in welchem der erste (141, 271) und dritte (273) Stromkanal angeordnet sind, und
einen zwischen dem ersten Hauptkörper (211) und dem zweiten Hauptkörper (215) angeordneten Trennungsabschnitt (225, 240),
und dadurch, dass das Kältemittel in dem erste Stromkanal (141, 271) sequentiell in dem ersten (211) und dem zweiten (215) Hauptkörper strömt, um Wärme mit dem Kältemittel in dem zweiten (142, 272) und dritten (273) Stromkanal auszutauschen.

2. Klimaanlage (1) nach Anspruch 1, wobei die Innenrohre (130) voneinander und von dem Hauptkörper (110, 210) beabstandet sind, so dass eine gesamte Außenfläche jedes Innenrohrs (130) einer Wärmeaustauschfläche des Innenrohrs entspricht.

3. Klimaanlage (1) nach Anspruch 1, wobei mindestens eines der mehreren Innenrohre (130) ein zylindrisches Kapillarrohr ist, das sich in einer Längenrichtung des Hauptkörpers (110, 210) erstreckt.

4. Klimaanlage (1) nach Anspruch 1, wobei der Verzweigungsabschnitt (120, 220) und die mehreren Innenrohre (130) den ersten Stromkanal (141, 271) bilden und der zweite Stromkanal (142, 272) sich außerhalb der mehreren Rohre befindet.

5. Klimaanlage (1) nach Anspruch 1, ferner aufweisend eine an einer Ausgangsseite des zusätzlichen Wärmetauschers, beispielsweise der superkühlenden Vorrichtung (100, 200) angeordnete Expansionsvorrichtung (155) zum Erniedrigen eines Drucks des Kältemittels,
wobei der Hauptkörper (110, 210) aufweist:

einen ersten Einlassabschnitt (71) an einer Ausgangsseite des Kondensators; und
einen an einer Einlassseite der Expansionsvorrichtung angeordneten ersten Auslassabschnitt (72), um das durch den ersten Einlassabschnitt (71) in den Hauptkörper (110, 210) eingeströmte Kältemittel ausströmen zu lassen.

6. Klimaanlage (1) nach Anspruch 5, wobei der erste Hauptkörper (211) ferner aufweist:

einen zweiten Einlassabschnitt (151), durch welchen mindestens ein Teil des durch den Kondensator geströmten Kältemittels in den Hauptkörper (110, 210) einströmt; und
einen an einer Einlassseite des Verdichters (10) angeordneten zweiten Auslassabschnitt (152), um das durch den zweiten Einlassabschnitt (151) in den Hauptkörper (110, 210) eingeströmte Kältemittel ausströmen zu lassen.

7. Klimaanlage (1) nach Anspruch 6, wobei der Verdichter (10) eine Einlassöffnung (11) und eine von der Einlassöffnung (11) separate Injektionsöffnung (12) aufweist, wobei der zweite Einlassabschnitt (151) konfiguriert ist, den mindestens einen Teil des Kältemittels in den zweiten Stromkanal (142, 272) einströmen zu lassen, und der zweite Auslassabschnitt (152) konfiguriert ist, den mindestens einen Teil des Kältemittels aus dem zweiten Stromkanal (142, 272) ausströmen zu lassen, wobei der zweite Auslassabschnitt (152) direkt mit der Injektionsöffnung des Verdichters verbunden ist.

8. Klimaanlage (1) nach Anspruch 1, ferner aufweisend:

einen Vereinigungsabschnitt (145, 245), in welchem Ströme des Kältemittels sich vereinigen, nachdem sie die mehreren Innenrohre (130) durchströmt haben; und
einen Schildabschnitt (122, 126, 222, 226, 241), der an dem Verzweigungsabschnitt (120, 220) oder dem Vereinigungsabschnitt (125, 245) angeordnet ist, um zu verhindern, dass Kältemittel, das in dem zweiten Stromkanal (142, 272) strömt, aus dem zusätzlichen Wärmetauscher, beispielsweise der superkühlenden Vorrichtung (100, 200) entweicht, wobei der Schildabschnitt einen Rohrkopplungsabschnitt (123, 127, 223, 227) aufweist, mit welchem die mehreren Innenrohre (130) gekoppelt sind.

9. Klimaanlage (1) nach Anspruch 1, wobei der zweite Hauptkörper (210) aufweist:

einen dritten Einlassabschnitt (261), durch welchen das durch den Verdampfer geströmte Kältemittel in den Hauptkörper (110, 210) einströmt; und
einen an der Einlassseite des Verdichters (10) angeordneten dritten Auslassabschnitt (262), um das durch den dritten Einlassabschnitt (261) in den Hauptkörper (110, 210) eingeströmte Kältemittel ausströmen zu lassen.

10. Klimaanlage (1) nach Anspruch 1, wobei der Trennungsabschnitt (225, 240) aufweist:

einen Schildabschnitt (122, 126, 222, 226, 241, 246), der konfiguriert ist, zu verhindern, dass ein Strom des in dem zweiten Stromkanal (142, 272) strömenden Kältemittels sich mit einem Strom des in dem dritten Stromkanal (273) strömenden Kältemittels mischt; und
einen an dem Schildabschnitt (122, 126, 222, 226, 241, 246) angeordneten Rohrkopplungsabschnitt (123, 127, 223, 227, 242, 247) zum Ankoppeln der mehreren Innenrohre (130).

11. Klimaanlage (1) nach Anspruch 1, wobei der Hauptkörper (110, 210) ein erstes (231) und zweites (232) Kältemittelrohr aufweist, in welchen der erste Stromkanal definiert ist, und
wobei der zweite Stromkanal (142, 272) um das erste Kältemittelrohr (231) herum angeordnet ist und der dritte Stromkanal (273) um das zweite Kältemittelrohr (232) herum angeordnet ist.

Revendications

1. Climatiseur (1) comprenant un compresseur (10) configuré pour comprimer un fluide frigorigène, un condenseur configuré pour condenser le fluide frigorigène comprimé, un échangeur de chaleur supplémentaire, tel qu'un dispositif de surrefroidissement (100, 200), configuré pour échanger de la chaleur avec, en particulier pour surrefroidir, le fluide frigorigène après que le fluide frigorigène passe à travers le condenseur, et un évaporateur configuré pour évaporer le fluide frigorigène après que le fluide frigorigène passe à travers l'échangeur de chaleur supplémentaire, tel que le dispositif de surrefroidissement (100, 200),
dans lequel l'échangeur de chaleur supplémentaire, tel que le dispositif de surrefroidissement (100, 200), comprend :

un premier passage d'écoulement (141, 271) disposé dans l'échangeur de chaleur supplémentaire, tel que le dispositif de surrefroidissement (100, 200), pour guider le fluide frigorigène provenant du condenseur vers l'évaporateur ;
un deuxième passage d'écoulement (142, 272) situé dans l'échangeur de chaleur supplémentaire, tel que le dispositif de surrefroidissement (100, 200), pour échanger de la chaleur avec le premier passage d'écoulement (141, 271) et guider le fluide frigorigène vers le compresseur (10) ;
dans lequel l'un des premier (141, 271) et deuxième (142, 272) passages d'écoulement comprend une partie de distribution (120, 220) configurée pour diviser un écoulement du fluide frigorigène et une pluralité de tubes intérieurs (130) raccordés à la partie de distribution (120, 220),
caractérisé en ce qu'un troisième passage d'écoulement (273) est situé dans l'échangeur de chaleur supplémentaire, tel que le dispositif de surrefroidissement (100, 200), pour échanger de la chaleur avec le premier passage d'écoulement (141, 271) et guider le fluide frigorigène passant à travers l'évaporateur vers le compresseur (10), et **en ce que** l'échangeur de chaleur supplémentaire comprend en outre un corps principal (110, 210) comprenant un premier corps principal (211) ayant une première région d'échange de chaleur dans laquelle les premier (141, 271) et deuxième (142, 272) passages d'écoulement sont disposés, un second corps principal (215) ayant une seconde région d'échange de chaleur dans laquelle les premier (141, 271) et troisième (273) passages d'écoulement sont disposés et une partie de division (225, 240) disposée entre le premier corps principal (211) et le second corps principal (215), et **en ce que**
le fluide frigorigène dans le premier passage d'écoulement (141, 271) s'écoule séquentiellement dans les premier (211) et second (215) corps principaux pour échanger de la chaleur avec le fluide frigorigène dans les deuxième (142, 272) et troisième (273) passages d'écoulement.

2. Climatiseur (1) selon la revendication 1, dans lequel les tubes intérieurs (130) sont espacés les uns des autres et du corps principal (110, 210) de sorte qu'une surface extérieure entière de chaque tube intérieur (130) corresponde à une zone d'échange de chaleur dudit tube intérieur.

3. Climatiseur (1) selon la revendication 1, dans lequel au moins l'un de la pluralité de tubes intérieurs (130) est un tube capillaire cylindrique qui s'étend dans un sens de la longueur du corps principal (110, 210).

4. Climatiseur (1) selon la revendication 1, dans lequel la partie de distribution (120, 220) et la pluralité de tubes intérieurs (130) constituent le premier passage d'écoulement (141, 271), et le deuxième passage d'écoulement (142, 272) est situé à l'extérieur de la pluralité de tubes.

5. Climatiseur (1) selon la revendication 1, comprenant en outre un dispositif de détente (155) disposé d'un côté sortie de l'échangeur de chaleur supplémentaire, tel que le dispositif de surrefroidissement (100, 200), pour diminuer une pression du fluide frigorigène,
dans lequel le corps principal (110, 210) comprend :

une première partie d'admission (71) d'un côté sortie du condenseur ; et
une première partie de refoulement (72) disposée d'un côté admission du dispositif de détente pour refouler le fluide frigorigène introduit dans le corps principal (110, 210) à travers la première partie d'admission (71).

6. Climatiseur (1) selon la revendication 5, dans lequel le premier corps principal (211) comprend en outre :

une deuxième partie d'admission (151) à travers laquelle au moins une portion du fluide frigorigène passant à travers le condenseur est introduite dans le corps principal (110, 210) ; et
une deuxième partie de refoulement (152) disposée d'un côté admission du compresseur (10) pour refouler le fluide frigorigène introduit dans le corps principal (110, 210) à travers la deuxième partie d'admission (151).

7. Climatiseur (1) selon la revendication 6, dans lequel le compresseur (10) comprend un orifice d'admission (11) et un orifice d'injection (12) distinct de l'orifice d'admission (11), dans lequel la deuxième partie d'admission (151) est conçue pour introduire ladite au moins une portion du fluide frigorigène dans le deuxième passage d'écoulement (142, 272), et la deuxième partie de refoulement (152) est conçue pour refouler ladite au moins une portion du fluide frigorigène depuis le deuxième passage d'écoulement (142, 272), la deuxième partie de refoulement (152) étant raccordée directement à l'orifice d'injection du compresseur.

8. Climatiseur (1) selon la revendication 1, comprenant en outre :

une partie de jonction (145, 245) dans laquelle des flux du fluide frigorigène se joignent après être passés à travers la pluralité de tubes inté-

rieurs (130) ; et
une partie de protection (122, 126, 222, 226, 241) disposée au niveau de la partie de distribution (120, 220) ou de la partie de jonction (125, 245) pour empêcher une fuite du fluide frigorigène s'écoulant dans le deuxième passage d'écoulement (142, 272) depuis l'échangeur de chaleur supplémentaire, tel que le dispositif de surrefroidissement (100, 200), la partie de protection comprenant une portion d'accouplement de tube (123, 127, 223, 227) à laquelle est accouplée la pluralité de tubes intérieurs (130).

9. Climatiseur (1) selon la revendication 1, dans lequel le second corps principal (210) comprend :

une troisième partie d'admission (261) à travers lequel le fluide frigorigène passant à travers l'évaporateur est introduit dans le corps principal (110, 210) ; et
une troisième partie de refoulement (262) disposée d'un côté admission du compresseur (10) pour refouler le fluide frigorigène introduit dans le corps principal (110, 210) à travers la troisième partie d'admission (261).

10. Climatiseur (1) selon la revendication 1, dans lequel la partie de division (225, 240) comprend :

une partie de protection (122, 126, 222, 226, 241, 246) configurée pour empêcher un flux du fluide frigorigène s'écoulant dans le deuxième passage d'écoulement (142, 272) de se mélanger à un flux du fluide frigorigène s'écoulant dans le troisième passage d'écoulement (273) ; et
une portion d'accouplement de tube (123, 127, 223, 227, 242, 247) disposée au niveau de la partie de protection (122, 126, 222, 226, 241, 246) pour s'accoupler à la pluralité de tubes intérieurs (130).

11. Climatiseur (1) selon la revendication 1, dans lequel le corps principal (110, 210) comprend des premier (231) et second (232) tubes de fluide frigorigène dans lesquels est défini le premier passage d'écoulement, et
dans lequel le deuxième passage d'écoulement (142, 272) est situé autour du premier tube de fluide frigorigène (231), et le troisième passage d'écoulement (273) est situé autour du second tube de fluide frigorigène (232).

Fig. 1

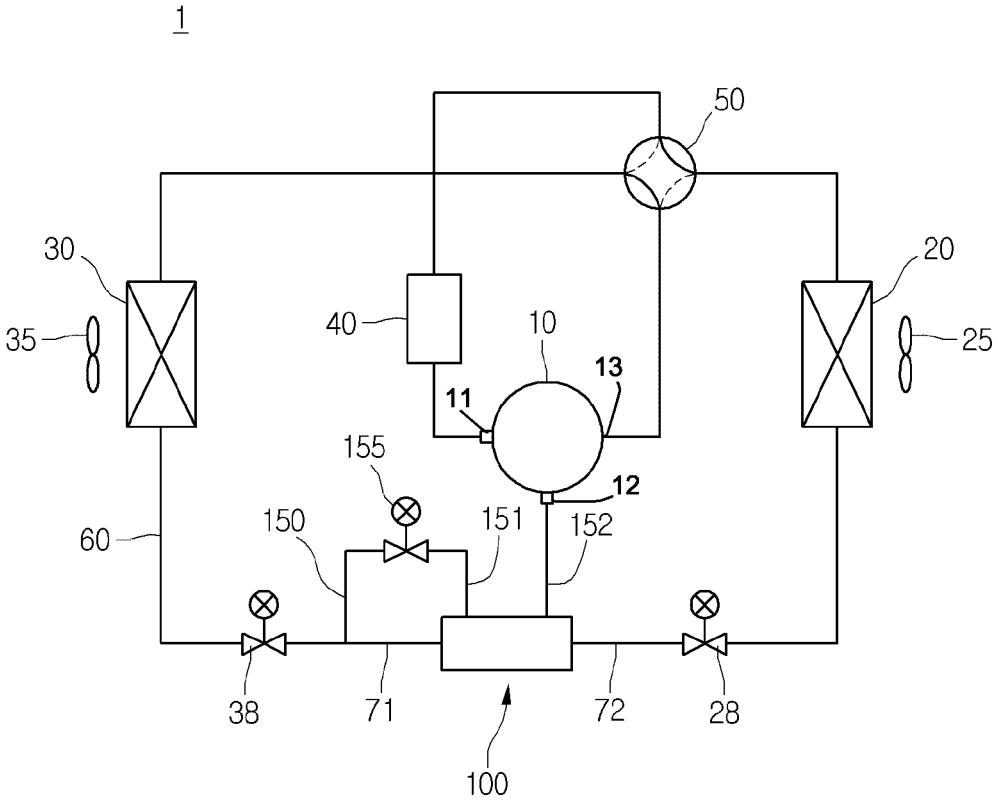


Fig. 2

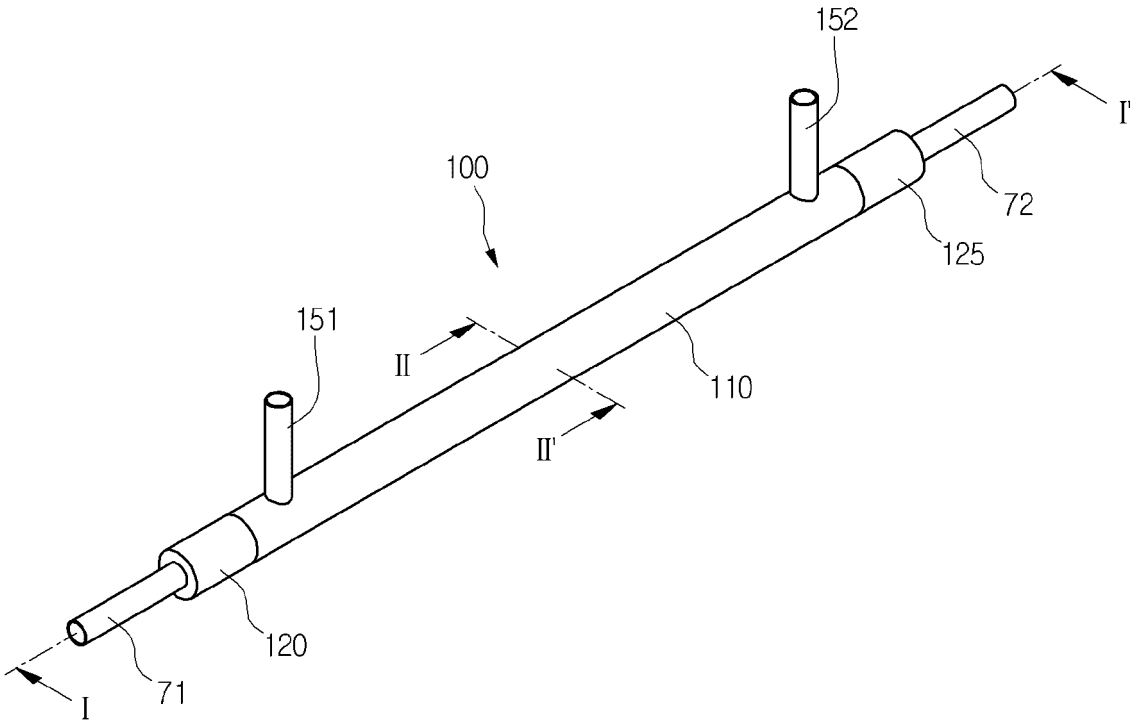


Fig. 3

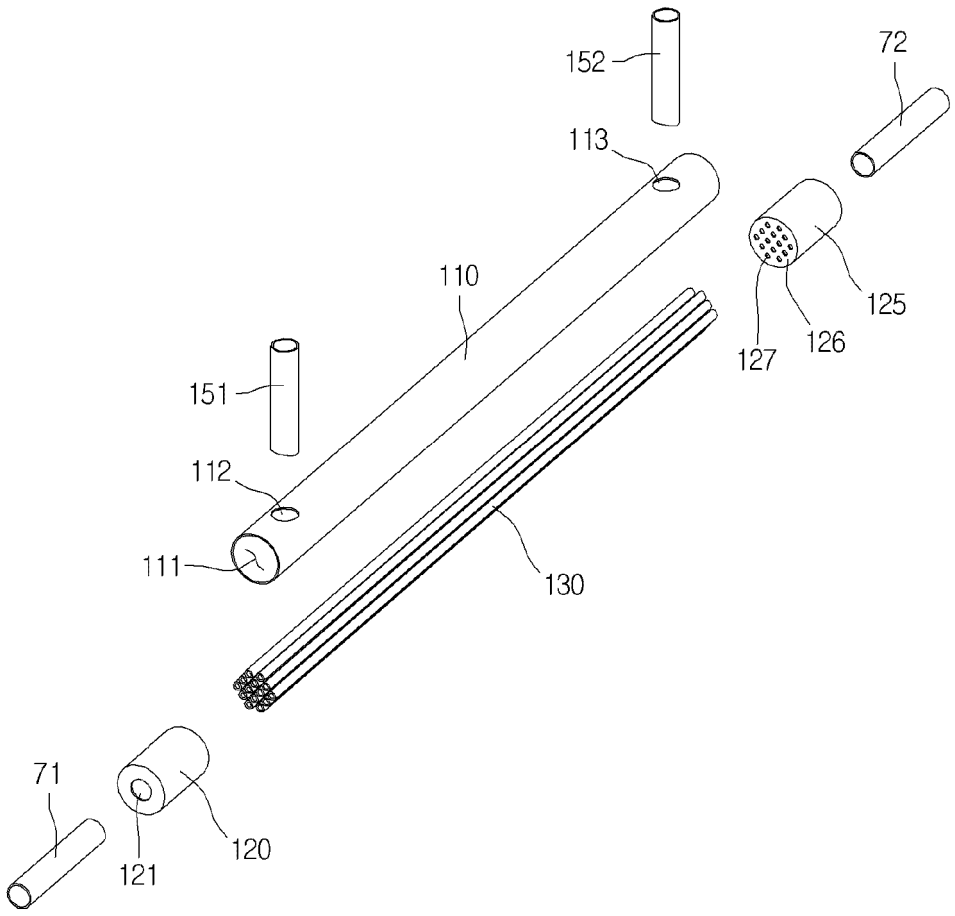


Fig. 4

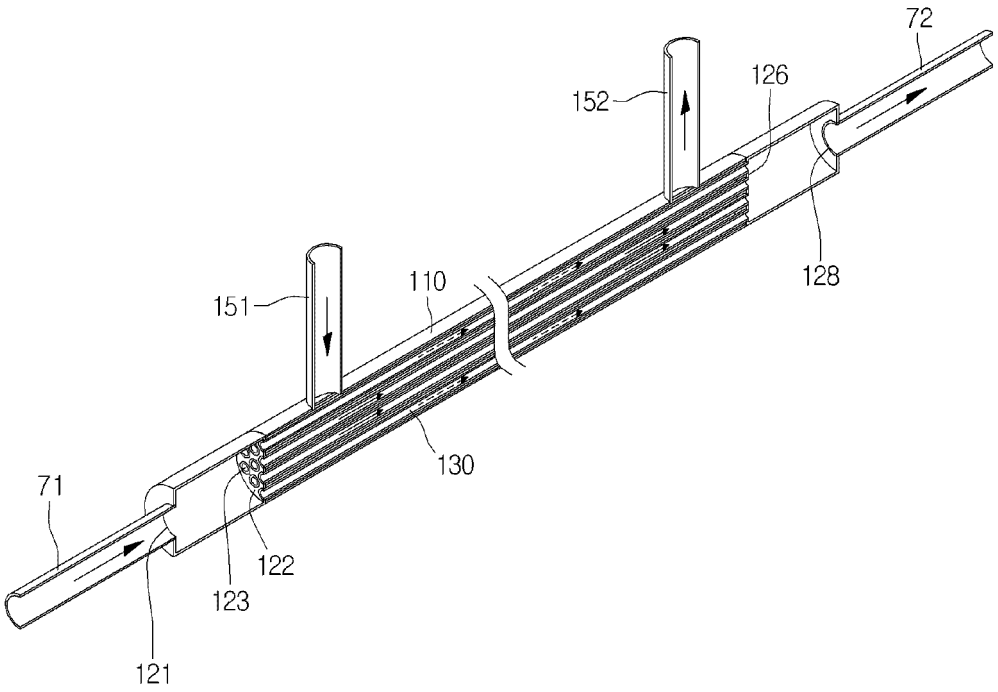


Fig. 5

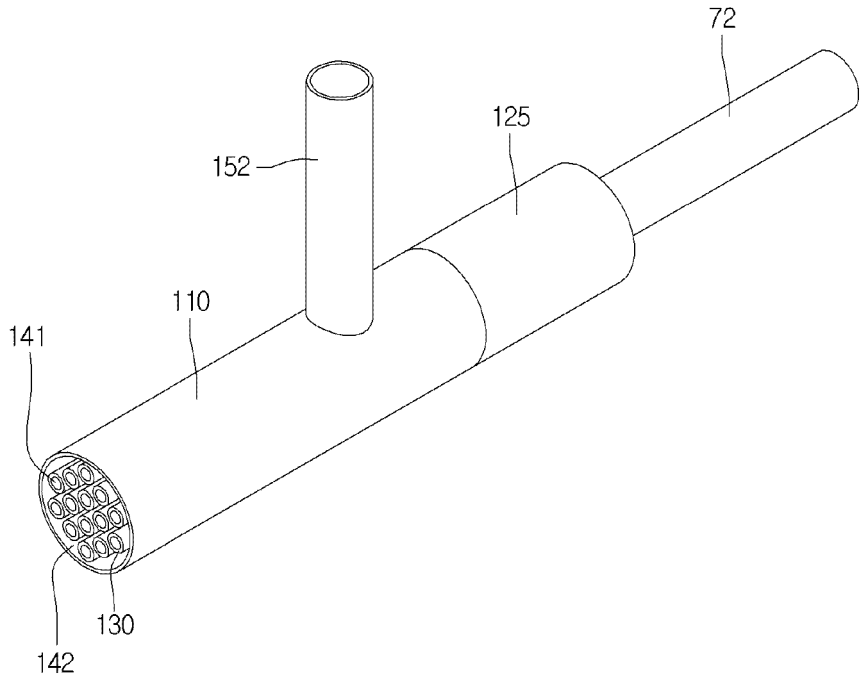


Fig. 6

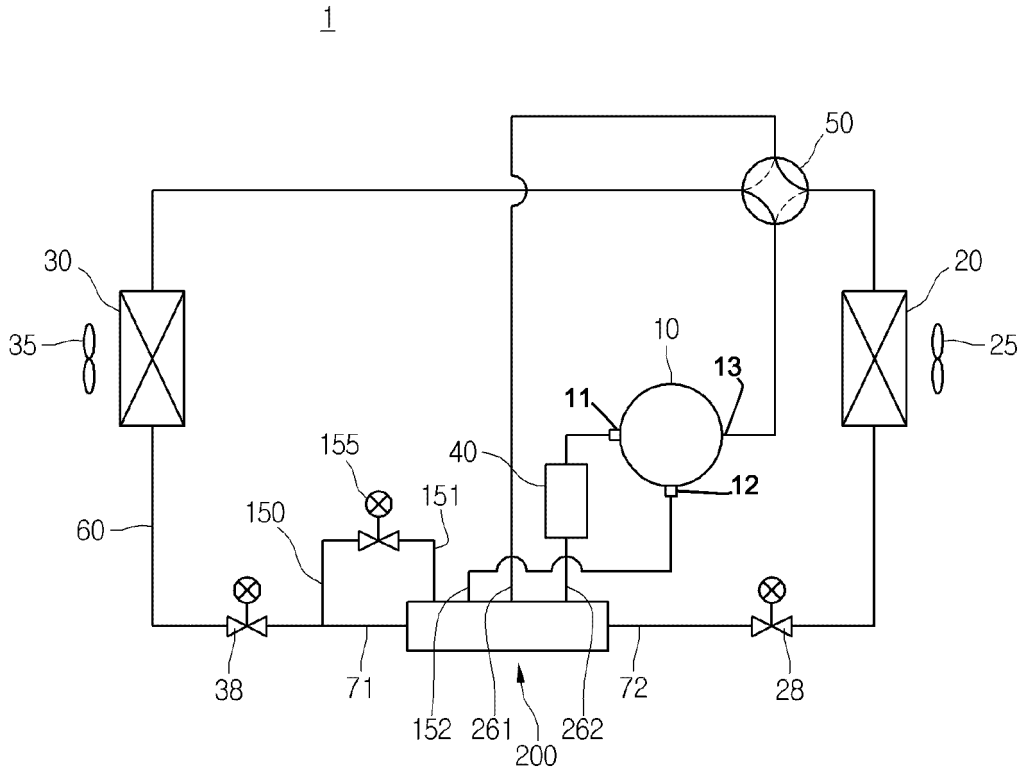

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Fig. 7

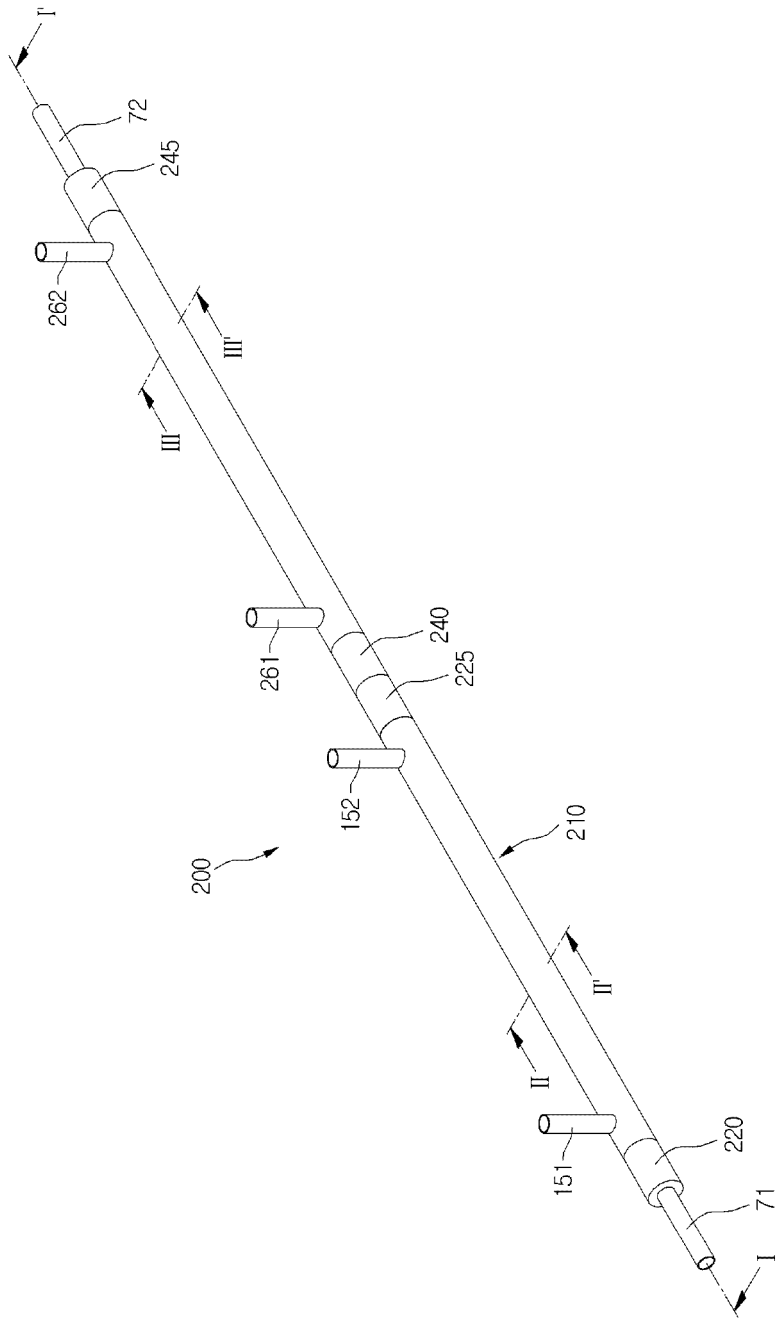


Fig. 8

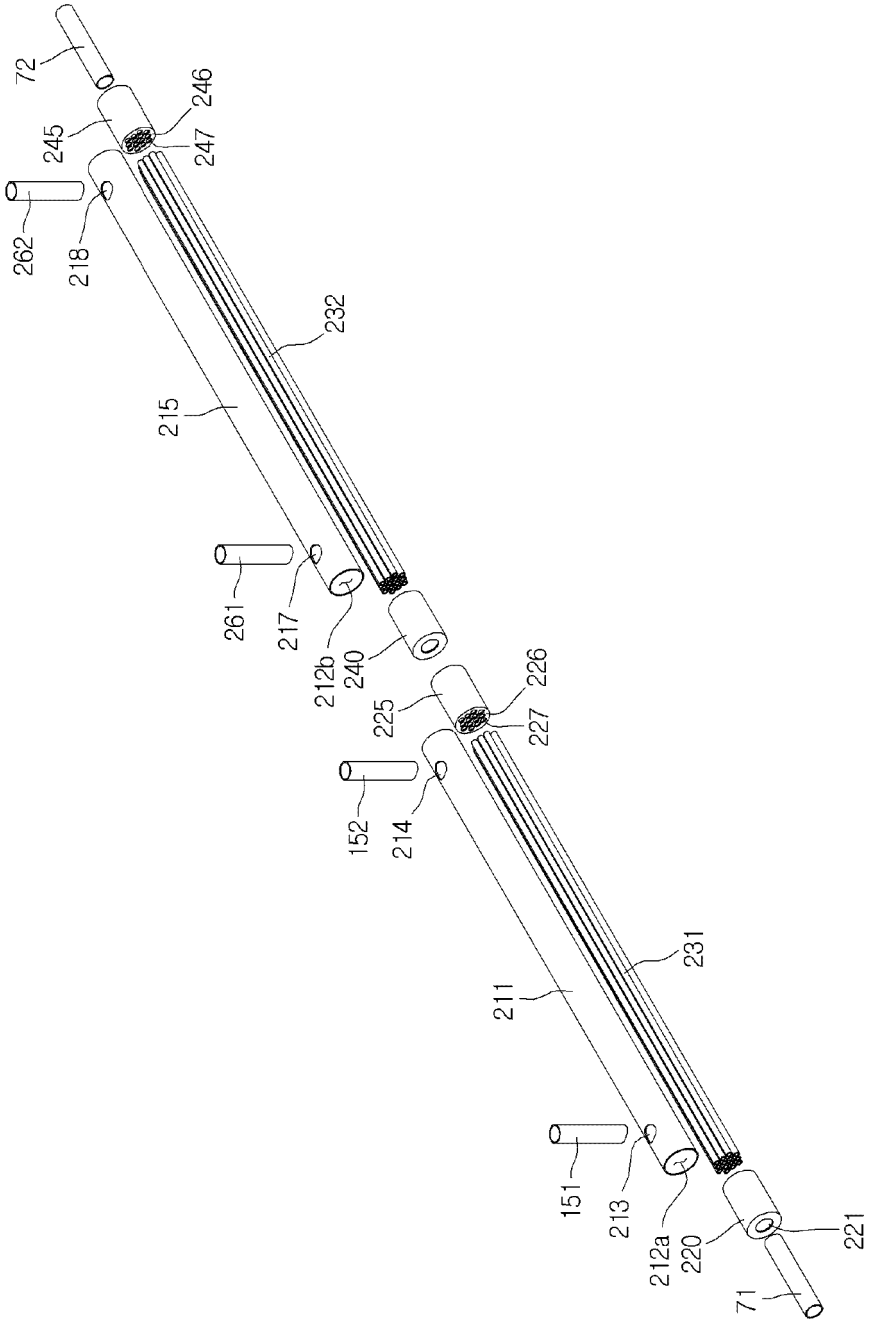

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Fig. 9

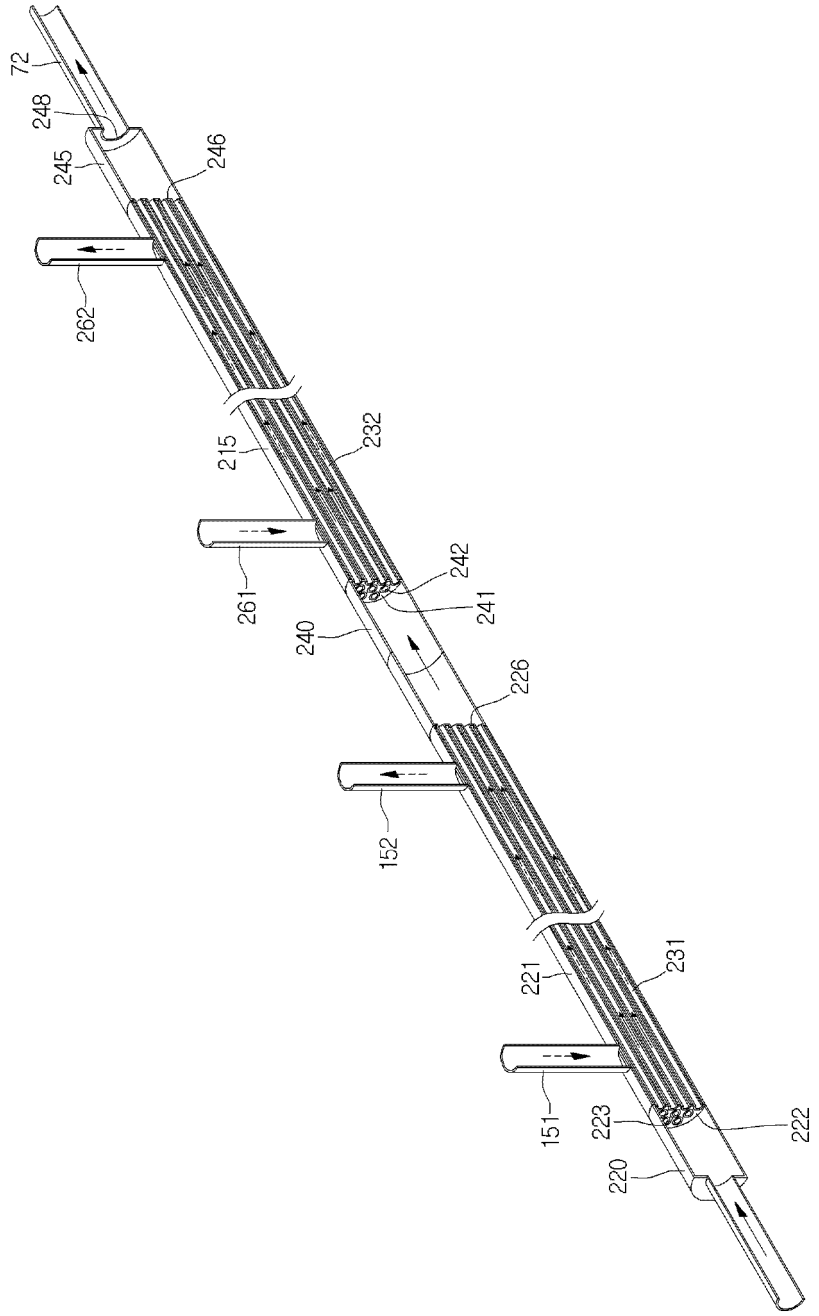

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Fig. 10

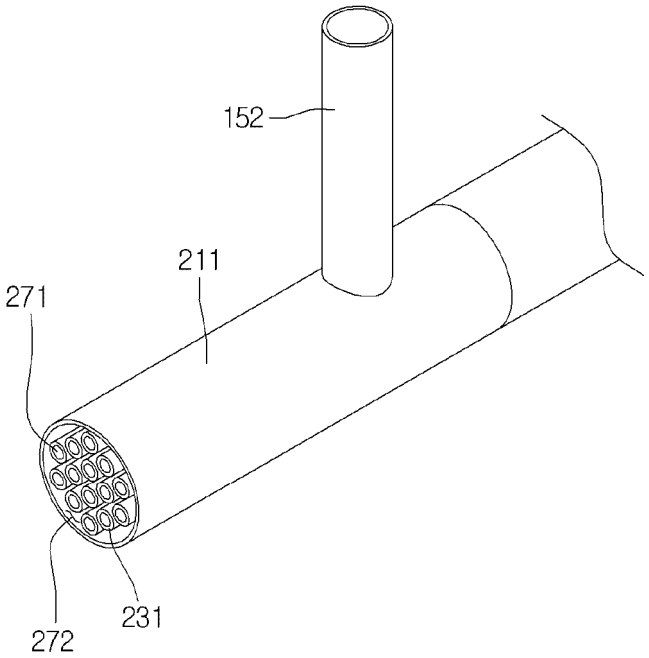
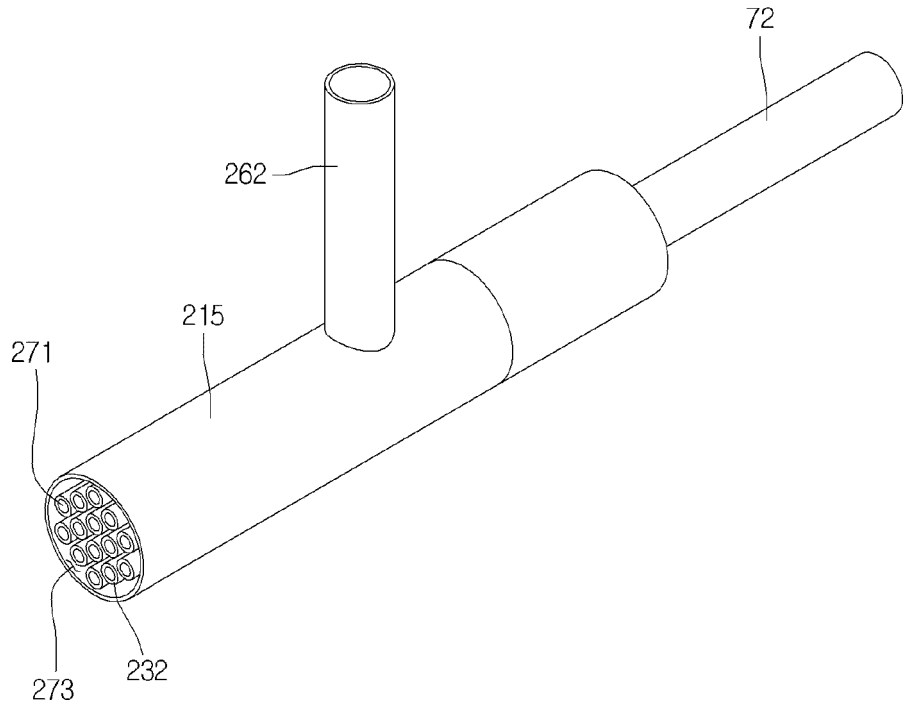


Fig. 11



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1662213 A **[0009]**