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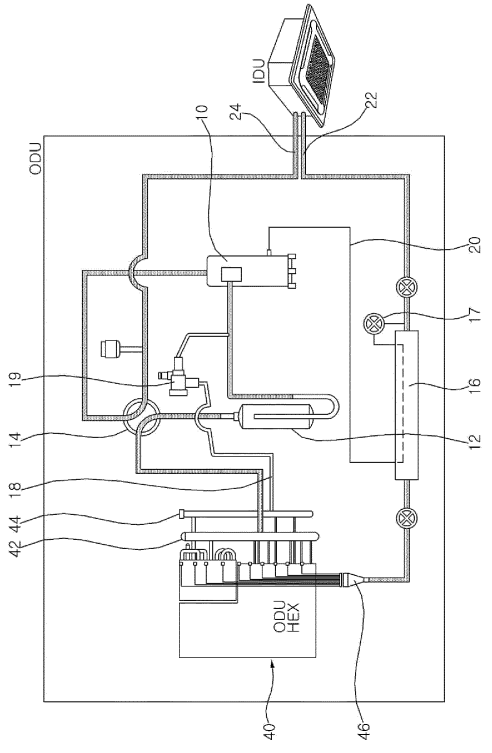
(54) **AIR CONDITIONER**

(57) An air conditioner of an embodiment of the present disclosure includes: a compressor; a first heat exchanger for heat-exchanging a refrigerant flowing from the compressor; a second heat exchanger for heat-exchanging the refrigerant flowing from the compressor; and a switching valve for sending the refrigerant discharged from the compressor to the first heat exchanger or the second heat exchanger. The first heat exchanger includes: a first refrigerant pipe; a second refrigerant pipe connected to the first refrigerant pipe; a third refrigerant pipe connected to the first refrigerant pipe and connected in parallel to the second refrigerant pipe; a connection band connecting the first refrigerant pipe, the second refrigerant pipe, and the third refrigerant pipe; and a separation tube connected to one side of the connection band so that a portion of the refrigerant flowing from the first refrigerant pipe flows. The connection band includes a first connection port connected to the first refrigerant pipe, a first branch port connected to the second refrigerant pipe, and a second branch port connected to the third refrigerant pipe. The separation tube is inserted into an inner side of the connection band by a predetermined length or more.

Fig. 1



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to an air conditioner, and more particularly, to an air conditioner that bypasses a portion of a refrigerant flowing through a heat exchanger to a compressor.

BACKGROUND

[0002] An air conditioner is a device for cooling or heating indoor air using a refrigeration cycle device composed of a compressor, an outdoor heat exchanger, an expansion device, and an indoor heat exchanger.

[0003] Indoor heat exchangers or outdoor heat exchangers allow a refrigerant to flow through a plurality of paths, and exchange heat with other fluids such as air to change the phase of the refrigerant.

[0004] Each of the plurality of paths disposed in a heat exchanger has a relatively long length of the heat exchanger per path, so the degree of freedom of the path is small. When the temperature of an evaporator is very low upon application to a cold region, the density of the refrigerant is small, so the pressure loss of the refrigerant flowing through the heat exchanger may still be severe.

[0005] Korean Patent No. KR 10-2164804 B1 discloses the use of a connection band having a three-port configuration to reduce the pressure loss of a refrigerant flowing through an evaporator. However, even in this structure, there is still an issue in that the pressure loss of the flowing refrigerant may be relatively large when the dryness of the flowing refrigerant increases.

SUMMARY

[0006] An aspect of the present disclosure is directed to providing an air conditioner that improves the heat exchange performance of a heat exchanger used as an evaporator. In other words, an aspect of the present disclosure is directed to providing an air conditioner that improves the heat exchange performance by reducing the flow rate of a refrigerant in two stages.

[0007] Another aspect of the present disclosure is directed to providing an air conditioner that heat exchanges a refrigerant while maintaining low dryness.

[0008] Yet another aspect of the present disclosure is directed to providing an air conditioner that is capable of mass production and improves the heat exchange performance.

[0009] The aspects of the present disclosure are not limited to those mentioned above, and other aspects not mentioned herein will be clearly understood by those skilled in the art from the following description.

[0010] The air conditioner according to an embodiment of the present disclosure includes: a compressor; a first heat exchanger for heat-exchanging a refrigerant flowing from the compressor; a second heat exchanger for heat-exchanging the refrigerant flowing from the compressor; and a switching valve for sending the refrigerant discharged from the compressor to the first heat exchanger or the second heat exchanger.

[0011] The first heat exchanger includes: a first refrigerant pipe; a second refrigerant pipe connected to the first refrigerant pipe; and a third refrigerant pipe connected to the first refrigerant pipe and connected in parallel to the second refrigerant pipe.

[0012] The first heat exchanger includes a connection band connecting the first refrigerant pipe, the second refrigerant pipe, and the third refrigerant pipe.

[0013] The first heat exchanger includes a separation tube connected to one side of the connection band so that a portion of the refrigerant flowing from the first refrigerant pipe flows.

[0014] The connection band includes a first connection port connected to the first refrigerant pipe, a first branch port connected to the second refrigerant pipe, and a second branch port connected to the third refrigerant pipe.

[0015] The separation tube is inserted into an inner side of the connection band by a predetermined length or more.

[0016] The separation tube is inserted into one side of the connection band and extends into an inner side of the first connection port.

[0017] A second connection port into which the separation tube is inserted is disposed in the connection band.

[0018] The separation tube is inserted into an inner side of the first connection port by a predetermined length or more while being inserted into the second connection port.

[0019] The second connection port extends in a direction opposite to the first connection port.

[0020] The separation tube includes a first tube disposed inside the second connection port and a second tube connected to the first tube and extending into an inner side of the first connection port.

[0021] A diameter of the second tube is formed smaller than a diameter of the first connection port.

[0022] The second tube extends along the center of a tube of the first connection port.

[0023] The connection band includes an extension tube connected to the first connection port at one end and connected to each of the first branch port and the second branch port at the other end.

[0024] The extension tube is disposed obliquely to each of the first connection port and the second connection port.

[0025] The first connection port and the second connection port are disposed in opposite directions based on a point where the extension tube is connected.

[0026] The first branch port and the second branch port extend in a direction symmetrical to the extension tube.

[0027] The connection band includes the second connection port into which the separation tube is inserted.

[0028] The first connection port, the second connection port, the first branch port, and the second branch port extend in each different direction from one point.

[0029] The separation tube is connected to the second connection port.

[0030] An end of the separation tube extends past a point where the first branch port and the second branch port are connected to an inner side of the first connection port.

[0031] Each of the first connection port, the first branch port, and the second branch port has a form that is bent downward from a single point.

[0032] The second connection port has a structure that extends upward from the single point.

[0033] The second tube is bent and extends toward the first connection port.

[0034] The second tube extends along the center of a tube of the first connection port.

[0035] The first heat exchanger includes a plurality of heat exchange tube sets including a first refrigerant pipe, a second refrigerant pipe connected to the first refrigerant pipe, and a third refrigerant pipe connected to the first refrigerant pipe and connected in parallel to the second refrigerant pipe.

[0036] The first heat exchanger includes a plurality of connection bands that are disposed in each of the plurality of heat exchange tube sets and are connected to each of the first refrigerant pipe, the second refrigerant pipe, and the third refrigerant pipe so as to supply the refrigerant flowing in the first refrigerant pipe to the second refrigerant pipe and the third refrigerant pipe.

[0037] The first heat exchanger includes a plurality of separation tubes that are connected to each of the plurality of connection bands and separate a gaseous refrigerant from the refrigerant flowing from the first refrigerant pipe.

[0038] The first heat exchanger includes a heat dissipation fin disposed to contact each of the plurality of heat exchange tube sets.

[0039] The first heat exchanger includes a first manifold that combines the refrigerant emitted from the plurality of heat exchange tube sets and sends the same to the compressor, and a second manifold that combines the refrigerant emitted from the plurality of separation tubes and sends the same to the compressor.

[0040] The connection band includes one inlet port and two outlet ports.

[0041] The separation tube extends from an inner side of the connection band in a direction in which the inlet port is disposed.

[0042] The air conditioner includes a bypass pipe that connects the second manifold and the compressor, and a bypass pipe valve that is disposed in the bypass pipe and opens and closes a flow path formed inside the bypass pipe.

[0043] The first heat exchanger includes a connection band that reduces an amount of the refrigerant flowing from the first refrigerant pipe and then distributes the flowing refrigerant to the second refrigerant pipe and the third refrigerant pipe.

[0044] The connection band includes a first connection port connected to the first refrigerant pipe, a first branch port connected to the second refrigerant pipe, a second branch port connected to the third refrigerant pipe, and a second connection port connected to the first connection port so that a portion of the refrigerant before being branched into the first branch port and the second branch port escapes.

[0045] The air conditioner includes a separation tube connected to the second connection port.

[0046] The separation tube has a diameter smaller than an inner circumferential surface of the first connection port and extends into an inner side of the first connection port.

[0047] Specific details of other embodiments are included in the detailed description and drawings.

[0048] According to the air conditioner of an embodiment of the present disclosure, there are one or more of the following benefits.

[0049] First, the heat exchange performance of the heat exchanger is improved by minimizing the pressure loss through a structure in which the amount of a refrigerant flowing through the connection band is sequentially reduced.

[0050] Second, the dryness of the refrigerant flowing through the evaporator is lowered by removing the gaseous refrigerant generated while passing through the evaporator and bypassing the same to the compressor, thereby improving the performance of the heat exchanger.

[0051] Third, in the case of a structure in which each of the branch port and the connection port is connected at one point, the welding point can be omitted, making mass production possible.

[0052] The benefits of the present disclosure are not limited to those mentioned above, and other benefits not mentioned herein will be clearly understood by those skilled in the art from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0053]

FIG. 1 is a system diagram schematically illustrating the configuration of an air conditioner according to an embodiment of the present disclosure.

FIG. 2 is a side view for explaining the configuration of a first heat exchanger according to an embodiment of the present disclosure.

FIG. 3 is a perspective view for explaining the configuration of a first connection band and a separation tube according to a first embodiment of the present disclosure.

FIG. 4 is a sectional side view for explaining the configuration of the connection band and the separation tube of FIG. 3.

FIG. 5 is a table comparing the heat exchange performance of the first connection band and the separation tube in the closed and open states.

FIG. 6 is a graph comparing the pressure loss according to the dryness of a refrigerant.

FIG. 7 is a perspective view for explaining the configuration of a first connection band and a separation tube according to a second embodiment of the present disclosure.

FIG. 8 is a side sectional view for explaining the configuration of the connection band and the separation tube of FIG. 7.

FIG. 9 is a perspective view for explaining the configuration of a first connection band and a separation tube according to a third embodiment of the present disclosure.

FIG. 10 is a sectional side view for explaining the configuration of the connection band and the separation tube of FIG. 9.

FIG. 11 is a perspective view for explaining the configuration of a first connection band and a separation tube according to a fourth embodiment of the present disclosure.

FIG. 12 is a side sectional view for explaining the configuration of the connection band and the separation tube of FIG. 11.

DETAILED DESCRIPTION

[0054] The advantages and features of the present disclosure and methods of achieving them will be apparent from the following exemplary embodiments that will be described in more detail with reference to the accompanying drawings. It should be noted, however, that the present disclosure is not limited to the following exemplary embodiments, and may be implemented in various forms. Accordingly, the exemplary embodiments are provided only to disclose the present disclosure and let those skilled in the art know the category of the present disclosure. In the drawings, embodiments of the present disclosure are not limited to the specific examples provided herein and are exaggerated for clarity. The same reference numerals or the same reference designators denote the same elements throughout the specification.

[0055] Hereinafter, the present disclosure will be described with reference to the drawings for explaining an air conditioner according to embodiments of the present disclosure.

[0056] Referring to FIG. 1, the overall structure of the air conditioner will be described.

[0057] The air conditioner of an embodiment of the present disclosure includes a compressor 10 that compresses a refrigerant. The compressor 10 inhales, compresses, and discharges a gaseous refrigerant.

[0058] The air conditioner includes an accumulator 12 that supplies a gaseous refrigerant to the compressor 10. The accumulator 12 forms a storage space therein and supplies a gaseous refrigerant from among the refrigerants stored in the storage space to the compressor 10.

[0059] The air conditioner includes a first heat exchanger 40 that heat-exchanges the refrigerant discharged and flowing from the compressor 10 with outdoor air. The first heat exchanger 40 may be disposed in an outdoor space. The first heat exchanger 40 may be disposed in an outdoor unit (ODU) that is disposed in the outdoor space.

[0060] The first heat exchanger 40 may bypass a portion of the heat-exchanged refrigerant and send the same to the compressor 10.

[0061] The first heat exchanger 40 may include a plurality of heat exchange tubes 51, 52, 54, 56, 58, and 59 described below. The first heat exchanger 40 may include a first manifold 42 to which each of the plurality of heat exchange tubes is connected, and a second manifold 44 to which each of a plurality of separation tubes 80 separated from the plurality of heat exchange tubes is connected.

[0062] The first manifold 42 may be connected to a switching valve 14. The second manifold 44 may be connected to the compressor 10.

[0063] The first heat exchanger 40 may include a first heat exchanger header 46 to which each of the plurality of heat exchange tubes is connected. The first heat exchanger header 46 may be connected to a liquid pipe 22.

[0064] The air conditioner may include a second heat exchanger (not shown) that heat-exchanges air supplied to indoor space. The second heat exchanger (not shown) may be disposed inside an indoor unit (IDU) disposed in the indoor space.

[0065] The air conditioner may include the switching valve 14 that selectively sends the refrigerant discharged from the compressor 10 to the first heat exchanger 40 or the second heat exchanger (not shown). The switching valve 14 may send the refrigerant discharged from the compressor 10 to the first heat exchanger 40 or the second heat exchanger (not shown) depending on the operating mode of the air conditioner.

[0066] In the cooling mode in which the second heat exchanger (not shown) operates as an evaporator, the switching valve 14 sends the refrigerant discharged from the compressor 10 to the first heat exchanger 40. In the heating mode in which the second heat exchanger (not shown) operates as a condenser, the switching valve 14 sends the refrigerant discharged from the compressor 10 to the second heat exchanger (not shown).

[0067] In the IDU, the second heat exchanger (not shown) and an indoor fan (not shown) that forms air flow to the second heat exchanger (not shown) may be disposed.

[0068] In the ODU, the compressor 10, the first heat exchanger 40, and the switching valve 14 may be disposed.

[0069] The air conditioner includes the liquid pipe 22 and an engine 24 that connect the IDU and the ODU.

[0070] The liquid pipe 22 connects the first heat exchanger 40 and the second heat exchanger (not shown). The liquid pipe 22 connects the ODU and the IDU.

[0071] A supercooler 16 may be disposed in the liquid pipe 22. The supercooler 16 expands a portion of the refrigerant flowing in the liquid pipe 22 and exchanges heat with the refrigerant flowing in the liquid pipe 22. The refrigerant that passes through the supercooler 16 through a supercooling expansion valve 17 may flow to the compressor 10.

[0072] The air conditioner includes a first bypass pipe 18 that sends a portion of the refrigerant heat-exchanged in the first heat exchanger 40 to the compressor 10. The first bypass pipe 18 connects the first heat exchanger 40 and the compressor 10.

[0073] In the first bypass pipe 18, a bypass pipe valve 19 is disposed. The bypass pipe valve 19 opens and closes the first bypass pipe 18. When the first bypass pipe 18 is opened, the gaseous refrigerant separated from the first heat exchanger 40 may flow to the compressor 10.

[0074] The air conditioner includes a second bypass pipe 20 that passes through the supercooler 16 and flows to the compressor 10. The refrigerant that has passed through the supercooling expansion valve 17 and the supercooler 16 may flow to the second bypass pipe 20.

[0075] Each of the first bypass pipe 18 and the second bypass pipe 20 may be connected to the compressor 10. Each of the first bypass pipe 18 and the second bypass pipe 20 may be directly connected to the compressor 10 or may be connected to a pipe connecting the accumulator 12 and the compressor 10.

[0076] Referring to FIG. 2, the first heat exchanger 40 may be disposed with a plurality of heat exchange tubes 51, 52, 54, 56, 58, and 59, connection bands 62 and 70 connecting each of the ends of the plurality of heat exchange tubes, and a heat dissipation fin 60 disposed to contact the plurality of heat exchange tubes 51, 52, 54, 56, 58, and 59.

[0077] The first heat exchanger 40 includes the first manifold 42 connected to one side of each of the plurality of heat exchange tubes, and a heat exchanger header 46 connected to the other side of each of the plurality of heat exchange tubes.

[0078] The first heat exchanger 40 may include the second manifold 44 through which the gaseous refrigerant separated from each of the plurality of heat exchange tubes flows. The second manifold 44 is connected to a separation tube 80 described below.

[0079] The plurality of heat exchange tubes may include a first refrigerant pipe 52, a second refrigerant pipe 54 connected to the first refrigerant pipe 52, and a third refrigerant pipe 56 connected to the first refrigerant pipe 52 and connected in parallel to the second refrigerant pipe. The first refrigerant pipe 52, the second refrigerant pipe 54, and the third refrigerant pipe 56 are disposed in parallel with one another.

[0080] The plurality of heat exchange tubes may include an inlet pipe 51 connected to the first refrigerant pipe 52, and a pair of outlet pipes 58 and 59 connected to each of the second refrigerant pipe 54 and the third refrigerant pipe 56.

[0081] The pair of outlet pipes 58 and 59 includes a first outlet pipe 58 connected to the second refrigerant pipe 54 and a second outlet pipe 59 connected to the third refrigerant pipe 56.

[0082] The inlet pipe 51 and the pair of outlet pipes 58 and 59 are also disposed parallel to the first refrigerant pipe 52, the second refrigerant pipe 54, and the third refrigerant pipe 56.

[0083] The connection bands 62 and 70 may include a first connection band 70 (or 'connection band') including one inlet port 72 (or 'first connection port') and two outlet ports 76 and 78 (or 'two branch ports') and a second connection band 62 including one inlet port and one outlet port.

[0084] The first connection band 70 is connected to the first refrigerant pipe 52 on one side and is connected in parallel to the second refrigerant pipe 54 and the third refrigerant pipe 56 on the other side. The separation tube 80 described below is connected to the first connection band 70.

[0085] The second connection band 62 may connect the inlet pipe 51 and the first refrigerant pipe 52. The second connection band 62 may connect the second refrigerant pipe 54 and the first outlet pipe 58. The second connection band 62 may connect the third refrigerant pipe 56 and the second outlet pipe 59.

[0086] The first heat exchanger 40 may be configured of a plurality of heat exchange tube sets 50a, 50b, 50c, and 50d.

Each of the plurality of heat exchange tube sets 50a, 50b, 50c, and 50d includes the first refrigerant pipe 52, the second refrigerant pipe 54, and the third refrigerant pipe 56. Each of the plurality of heat exchange tube sets 50a, 50b, 50c, and 50d may further include the inlet pipe 51 and the outlet pipes 58 and 59.

[0087] Each of the plurality of heat exchanger tube sets 50a, 50b, 50c, and 50d includes one first connection band 70 and a plurality of second connection bands 62.

[0088] The inlet pipe 51 is connected to the heat exchanger header 46. Each of the pair of outlet pipes 58 and 59 is connected to the first manifold 42.

[0089] When the first heat exchanger 40 is used as an evaporator, a refrigerant may flow as illustrated in FIG. 2. In other words, the refrigerant introduced from the heat exchanger header 46 may sequentially flow through the inlet pipe 51 and the first refrigerant pipe 52. In addition, the refrigerant emitted from the first refrigerant pipe 52 may branch and flow into each of the second refrigerant pipe 54 and the third refrigerant pipe 56. In addition, the refrigerant flowing through the pair of outlet pipes 58 and 59 may flow to the compressor 10 through the first manifold 42.

[0090] Referring to FIGS. 3 and 4, the specific configuration and form of the first connection band 70 of an embodiment of the present disclosure will be described.

[0091] The first connection band 70 includes the first connection port 72 connected to the first refrigerant pipe 52, the first branch port 76 connected to the second refrigerant pipe 54, and the second branch port 78 connected to the third refrigerant pipe 56. The first connection band 70 includes a second connection port 74 connected to the separation tube 80.

[0092] The first connection band 70 further includes an extension tube 75 that separates the first branch port 76 and the second branch port 78 from the first connection port 72.

[0093] The second connection port 74 extends in a direction opposite to the first connection port 72. The first connection port 72 and the second connection port 74 are disposed in opposite directions based on the extension tube 75. The extension tube 75 is disposed obliquely to each of the first connection port 72 and the second connection port 74. The extension tube 75 is disposed perpendicular to each of the first connection port 72 and the second connection port 74.

[0094] The extension tube 75 extends from a circumferential surface of the first connection port 72 or the second connection port 74. The first branch port 76 and the second branch port 78 are respectively connected at the other end of the extension tube 75. The first branch port 76 and the second branch port 78 extend in each different direction based on the extension tube 75. The first branch port 76 and the second branch port 78 are extended in each different direction within the same angle range based on the extension tube 75. Accordingly, the refrigerant flowing through the extension tube 75 may flow to the first branch port 76 and the second branch port 78.

[0095] The first branch port 76 and the second branch port 78 may have a U-shaped tube shape. The extension tube 75 is connected to the center of the first branch port 76 and the second branch port 78 having a U-shaped tube shape.

[0096] The separation tube 80 is connected to the first connection band 70. A portion of the separation tube 80 may be inserted into an inner side of the second connection port 74.

[0097] Referring to FIG. 4, the separation tube 80 includes a first tube 82 extending outside the second connection port 74 and a second tube 84 inserted inside the first connection band 70. The diameter (84D) of the second tube 84 is formed smaller than the diameter (72D) of the first connection port 72.

[0098] The second tube 84 includes a reduction tube 86 extending from the first tube 82 and having a reduced tube diameter, and a maintenance tube 88 extending from the reduction tube 86 and maintaining the reduced tube diameter.

[0099] The second tube 84 extends past the area where the extension tube 75 is disposed to the inside of the first connection port 72. The end of the second tube 84 is disposed inside the first connection port 72.

[0100] An outer circumferential surface of the second tube 84 is disposed to be spaced apart from an inner circumferential surface of the first connection port 72.

[0101] When the first heat exchanger 40 is used as an evaporator, the refrigerant is introduced through the first connection port 72 and emitted through the first branch port 76 and the second branch port 78. When the first heat exchanger 40 is used as an evaporator, the refrigerant flowing through the first heat exchanger 40 may be a two-phase refrigerant mixed with a liquid refrigerant and a gaseous refrigerant.

[0102] Among the two-phase refrigerants flowing through the first connection port 72, the liquid refrigerant may flow along the inner circumferential surface, and the gaseous refrigerant may flow toward the center of a pipe. Among the refrigerants flowing through the first connection port 72, the gaseous refrigerant flowing toward the center of the pipe may flow into the separation tube 80.

[0103] Accordingly, some of the gaseous refrigerant flowing through the first connection port 72 may flow through the separation tube 80, and the remaining refrigerant may flow through the extension tube 75. In other words, the amount of a refrigerant may decrease as the refrigerant flows from the first connection port 72 to the extension tube 75.

[0104] In addition, since the refrigerant flowing through the extension tube 75 dispersedly flows in the first branch port 76 and the second branch port 78, the amount of a refrigerant may decrease. Accordingly, the amount of a refrigerant flowing through the evaporator may decrease, and the pressure loss of the refrigerant may decrease.

[0105] In other words, the amount of a refrigerant flowing through the first connection band 70 may decrease primarily

while flowing from the first connection port 72 to the extension tube, and may decrease secondarily while flowing from the extension tube 75 to the first branch port 76 and the second branch port 78.

[0106] When the first heat exchanger 40 is used as a condenser, the density of the flowing refrigerant is large, so the pressure loss is small, and it may be advantageous to increase the flow rate.

[0107] Referring to FIG. 5, it may be identified that the heating capacity and the heating efficiency are improved when the first connection band 70 is used. In other words, it may be identified that the heating capacity is improved by 7% or more when the separation tube 80 is opened and the gaseous refrigerant escapes through the separation tube 80 compared to the state in which the separation tube 80 is closed. In addition, it may be identified that the heating efficiency is improved by 3.7% or more when the separation tube 80 is opened and the gaseous refrigerant escapes through the separation tube 80 compared to the state in which the separation tube 80 is closed.

[0108] Referring to FIG. 6, it may be identified that the pressure loss increases as the dryness of the refrigerant flowing through the refrigerant pipe increases. In other words, in the case where the refrigerant flowing through the refrigerant pipe is a two-phase refrigerant, the pressure loss increases as the ratio of the gaseous refrigerant increases. Accordingly, as in an embodiment of the present disclosure, by bypassing the gaseous refrigerant of the refrigerant flowing through the first connection band 70, the dryness of the refrigerant flowing through the first heat exchanger 40 may be lowered, thereby lowering the pressure loss of the refrigerant.

[0109] Hereinafter, the first connection band 70 according to a second embodiment of the present disclosure will be described with reference to FIGS. 7 and 8.

[0110] The first connection band 70 according to the second embodiment includes the first connection port 72, the second connection port 74, the first branch port 76, and the second branch port 78.

[0111] The first connection band 70 according to the second embodiment has a structure without a separate extension tube. Accordingly, at the point where the first connection port 72 and the second connection port 74 are connected, the first branch port 76 and the second branch port 78 may be connected.

[0112] Referring to FIG. 7, the first connection port 72, the second connection port 74, the first branch port 76, and the second branch port 78 may have structures extending in each different direction from one point. The first connection port 72, the second connection port 74, the first branch port 76, and the second branch port 78 may be disposed in a cross shape.

[0113] The separation tube 80 is connected to the second connection port 74. Referring to FIG. 8, the separation tube 80 is inserted into the second connection port 74. The separation tube 80 includes the first tube 82 that contacts the inside of the second connection port 74 and the second tube 84 that extends from the first tube 82.

[0114] The second tube 84 may have a structure in which the tube diameter thereof is reduced compared to that of the first tube 82. The end of the second tube 84 may be disposed inside the first connection port 72. Referring to FIG. 8, the end of the separation tube 80 may be inserted into an inner side of the first connection port 72 past the point where the first branch port 76 and the second branch port 78 are connected. The diameter (84D) of the separation tube 80 disposed inside the first connection port 72 may be formed smaller than the inner diameter (72D) of the first connection port 72.

[0115] The separation tube 80 disposed inside the first connection port 72 is disposed to be spaced apart from the inner circumferential surface of the first connection port 72.

[0116] The second connection port 74 may have a structure extending in a direction opposite to the first connection port 72. The structure of the first connection band 70 according to the second embodiment may form an integral structure without a separate welding point other than the portion where the separation tube 80 is connected. Accordingly, there is a benefit of being able to be mass-produced.

[0117] The first branch port 76 and the second branch port 78 extend in opposite directions from the point where the first connection port 72 and the second connection port 74 are connected. The first branch port 76 and the second branch port 78 each extend in the opposite direction with the same angle range based on the first connection port 72. Each of the first branch port 76 and the second branch port 78 may have a bending shape in some sections.

[0118] Some of the gaseous refrigerants flowing through the first connection port 72 may flow through the separation tube 80, and the remaining refrigerants may dispersedly flow in the first branch port 76 and the second branch port 78. In other words, since some of the refrigerants flowing through the first connection port 72 flows through the separation tube 80, the amount of a refrigerant decreases, and simultaneously, the remaining refrigerants flow through the first branch port 76 and the second branch port 78, so the amount of a refrigerant may decrease. Accordingly, the amount of a refrigerant flowing through the evaporator may decrease, and the pressure loss of the refrigerant may decrease.

[0119] Hereinafter, the first connection band 70 according to a third embodiment will be described with reference to FIGS. 8 and 9.

[0120] The first connection band 70 according to the third embodiment also includes the first connection port 72, the second connection port 74, the first branch port 76, and the second branch port 78.

[0121] The first connection band 70 according to the third embodiment has a structure without a separate extension tube. Accordingly, the first branch port 76 and the second branch port 78 may be connected at the point where the first connection port 72 and the second connection port 74 are connected.

[0122] The first connection port 72, the first branch port 76, and the second branch port 78 have a structure that extends in each different direction from one point. Referring to FIG. 9, the first connection port 72, the first branch port 76, and the second branch port 78 may have a shape that is bent downward. The first branch port 76 and the second branch port 78 extend in each different direction within the same angle range based on the first connection port 72. Accordingly, the refrigerant flowing through the first connection port 72 may dispersedly flow in the first branch port 76 and the second branch port 78.

[0123] The second connection port 74 may have a structure that extends upward. The second connection port 74 may extend in a direction different from the direction in which each of the first connection port 72, the first branch port 76, and the second branch port 78 extends, at a point where the first connection port 72, the first branch port 76, and the second branch port 78 are connected to one another.

[0124] The separation tube 80 is inserted into the second connection port 74. The separation tube 80 may have a structure of being inserted into the second connection port 74 and extending into an inner side of the first connection port 72.

[0125] Referring to FIG. 10, the separation tube 80 may include the first tube 82 disposed to contact an inside of the second connection port 74, and the second tube 84 connected to the first tube 82 and extending into the inner side of the first connection port 72.

[0126] Referring to FIG. 10, the second tube 84 may be bent inside the point where the first connection port 72, the first branch port 76, and the second branch port 78 are connected to one another and may extend toward the first connection port 72. The second tube 84 may have a shape in which the tube diameter decreases as moving away from the first tube 82. The second tube 84 may have a structure that extends along the center of the tube diameter of the first connection port 72.

[0127] Hereinafter, the first connection band 70 according to a fourth embodiment will be described with reference to FIGS. 11 and 12.

[0128] The first connection band 70 according to the fourth embodiment also includes the first connection port 72, the second connection port 74, the first branch port 76, and the second branch port 78.

[0129] The first branch port 76 and the second branch port 78 may be configured in a U-shaped tube shape. The first connection port 72 may be connected to the point where the first branch port 76 and the second branch port 78 are connected.

[0130] The first connection port 72 may be connected to the point where the first branch port 76 and the second branch port 78 are connected in a bending shape. The second connection port 74 may have a structure that extends in a direction opposite to the first connection port 72 from the point where the first branch port 76 and the second branch port 78 are connected.

[0131] The separation tube 80 is inserted into the second connection port 74. The end of the separation tube 80 may be disposed inside the first connection port 72.

[0132] Hereinbefore, although preferred embodiments of the present disclosure have been illustrated and described, the present disclosure is not limited to the specific embodiments described above, and it goes without saying that persons having ordinary skills in the technical field to which the present disclosure pertains may implement the present disclosure by various modifications thereof without departing from gist of the present disclosure defined by the claims, and such modifications are not to be construed individually from the technical spirit and scope of the present disclosure.

[Detailed Description of Main Elements]

[0133]

10:	compressor	12:	accumulator
18:	first bypass pipe	19:	bypass pipe valve
40:	first heat exchanger	42:	first manifold
44:	second manifold	51:	inlet pipe
52:	first refrigerant pipe	54:	second refrigerant pipe
56:	third refrigerant pipe	58 and 59:	outlet pipes
60:	heat dissipation fin	62:	second connection band
70:	first connection band	72:	first connection port
74:	second connection port	75:	extension tube
76:	first branch port	78:	second branch port
80:	separation tube	82:	first tube
84:	second tube	86:	reduction tube
88:	maintenance tube		

Claims

1. An air conditioner, comprising:

   a compressor;
   a first heat exchanger for heat-exchanging a refrigerant flowing from the compressor;
   a second heat exchanger for heat-exchanging the refrigerant flowing from the compressor; and
   a switching valve for sending the refrigerant discharged from the compressor to the first heat exchanger or the second heat exchanger, wherein:

      the first heat exchanger comprises:

         a first refrigerant pipe;
         a second refrigerant pipe connected to the first refrigerant pipe;
         a third refrigerant pipe connected to the first refrigerant pipe and connected in parallel to the second refrigerant pipe;
         a connection band connecting the first refrigerant pipe, the second refrigerant pipe, and the third refrigerant pipe; and
         a separation tube connected to one side of the connection band so that a portion of the refrigerant flowing from the first refrigerant pipe flows, the separation tube being inserted into an inner side of the connection band by a predetermined length or more.

2. The air conditioner of claim 1, wherein:

   the connection band comprises a first connection port connected to the first refrigerant pipe, a first branch port connected to the second refrigerant pipe, and a second branch port connected to the third refrigerant pipe; and
   the separation tube is inserted into one side of the connection band and extends into an inner side of the first connection port.

3. The air conditioner of claim 1, or 2, wherein the connection band comprises a first connection port connected to the first refrigerant pipe, a first branch port connected to the second refrigerant pipe, a second branch port connected to the third refrigerant pipe, and a second connection port into which the separation tube is inserted.

4. The air conditioner of claim 3, wherein the separation tube is inserted into an inner side of the first connection port by a predetermined length or more while being inserted into the second connection port.

5. The air conditioner of claim 3, or 4, wherein the second connection port extends in a direction opposite to the first connection port.

6. The air conditioner of claim 3, 4, or 5, wherein:

   the separation tube comprises a first tube disposed inside the second connection port and a second tube connected to the first tube and extending into an inner side of the first connection port; and
   a diameter of the second tube is smaller than a diameter of the first connection port.

7. The air conditioner of claim 6, wherein the second tube extends along the center of a tube of the first connection port.

8. The air conditioner of any one of claims 3 to 7, wherein:

   the connection band further comprises an extension tube connected to the first connection port at one end and connected to each of the first branch port and the second branch port at the other end; and
   the extension tube is disposed obliquely to each of the first connection port and the second connection port.

9. The air conditioner of any one of claims 3 to 8, wherein the first connection port and the second connection port are disposed in opposite directions based on a point where the extension tube is connected.

10. The air conditioner of claim 8, wherein the first branch port and the second branch port extend in a direction symmetrical to the extension tube.

11. The air conditioner of any one of claims 1 to 10, wherein:

the connection band comprises a first connection port connected to the first refrigerant pipe, a first branch port connected to the second refrigerant pipe, a second branch port connected to the third refrigerant pipe, and a second connection port into which the separation tube is inserted; and
the first connection port, the second connection port, the first branch port, and the second branch port extend in each different direction from one point.

12. The air conditioner of claim 11, wherein:

the separation tube is connected to the second connection port; and
an end of the separation tube extends past a point where the first branch port and the second branch port are connected to an inner side of the first connection port.

13. The air conditioner of any one of claims 1 to 12, wherein:

the connection band comprises a first connection port connected to the first refrigerant pipe, a first branch port connected to the second refrigerant pipe, a second branch port connected to the third refrigerant pipe, and a second connection port into which the separation tube is inserted;
each of the first connection port, the first branch port, and the second branch port has a form that is bent downward from a single point; and
the second connection port has a structure that extends upward from the single point.

14. The air conditioner of claim 13, wherein:

the separation tube comprises a first tube disposed to contact an inside of the second connection port and a second tube connected to the first tube and extending into an inner side of the first connection port; and
the second tube is bent and extends toward the first connection port.

15. The air conditioner of claim 14, wherein the second tube extends along the center of a tube of the first connection port.

Fig. 1

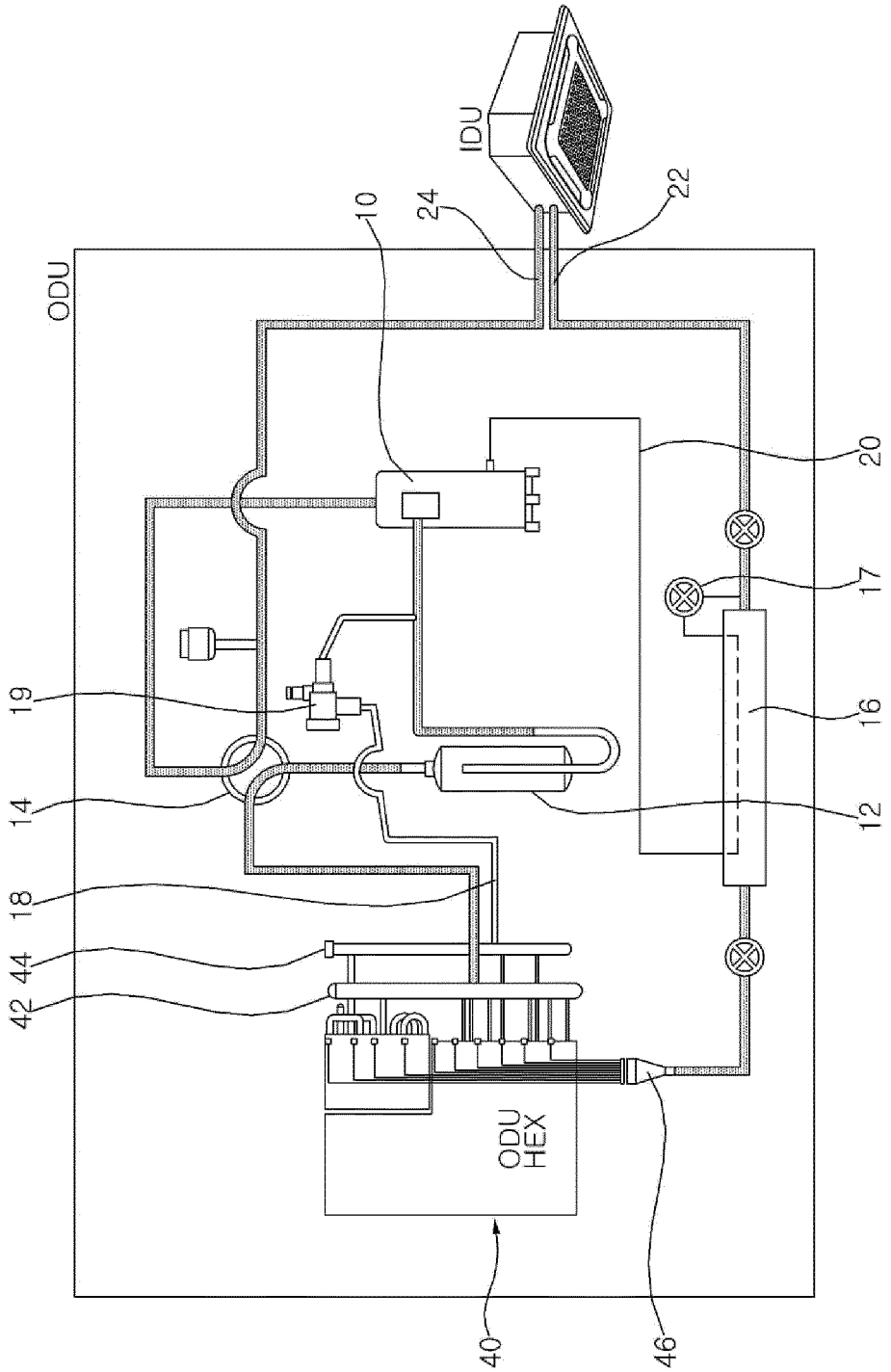


Fig. 2

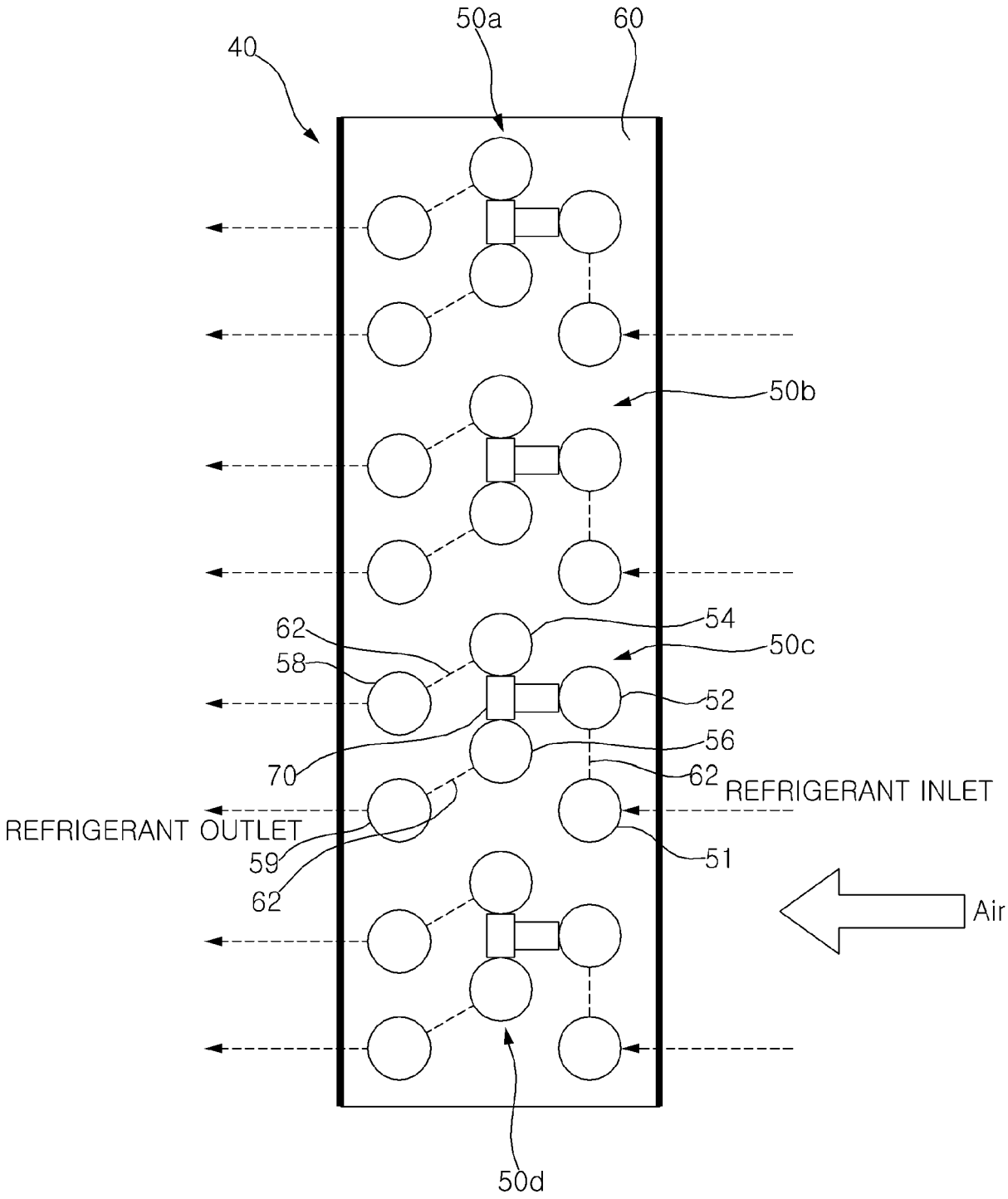

40
50a
60
50b
62
58
54
50c
52
56
70
62
REFRIGERANT INLET
REFRIGERANT OUTLET
59
62
51
Air
50d

Fig. 3

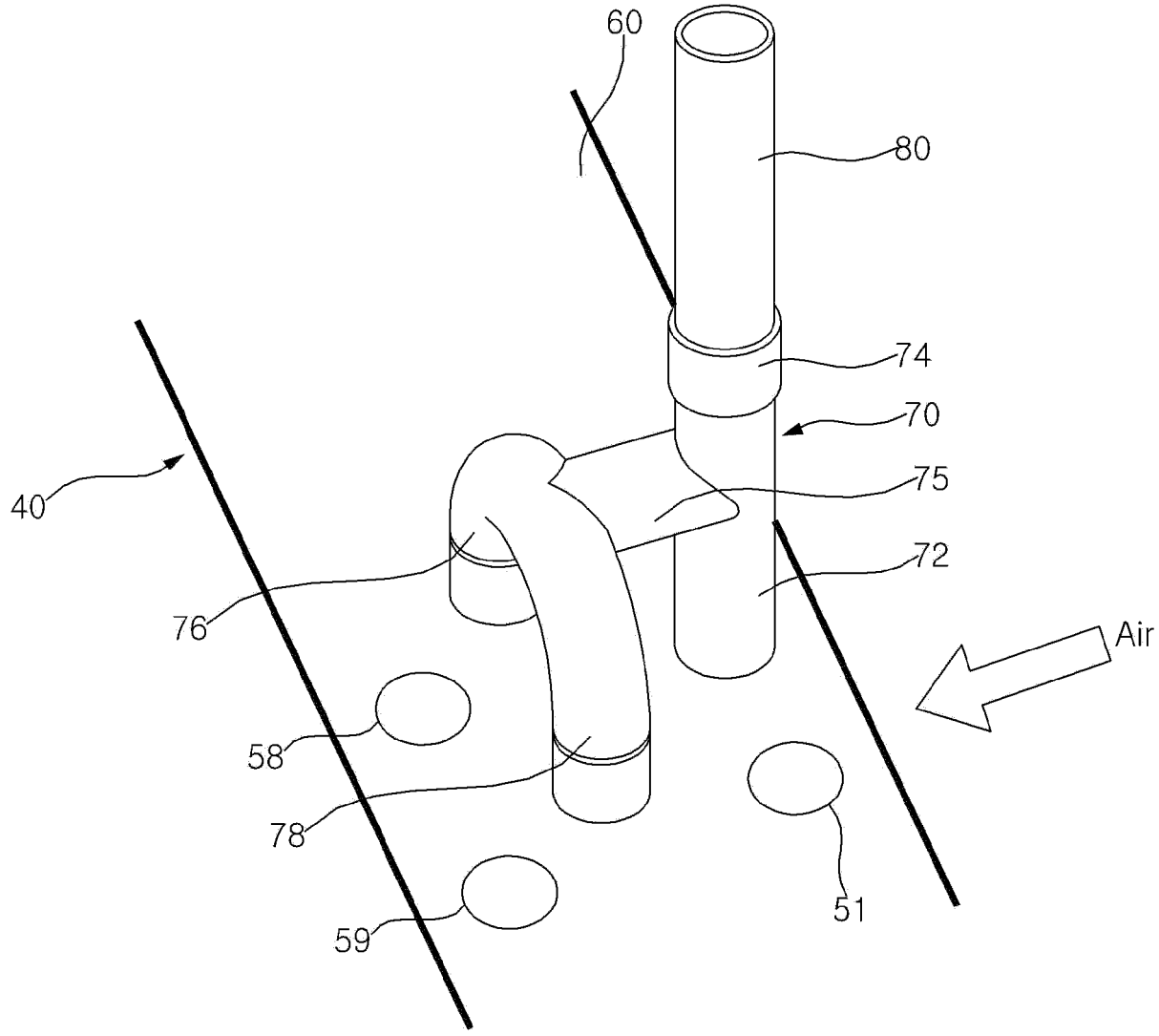


Fig. 4

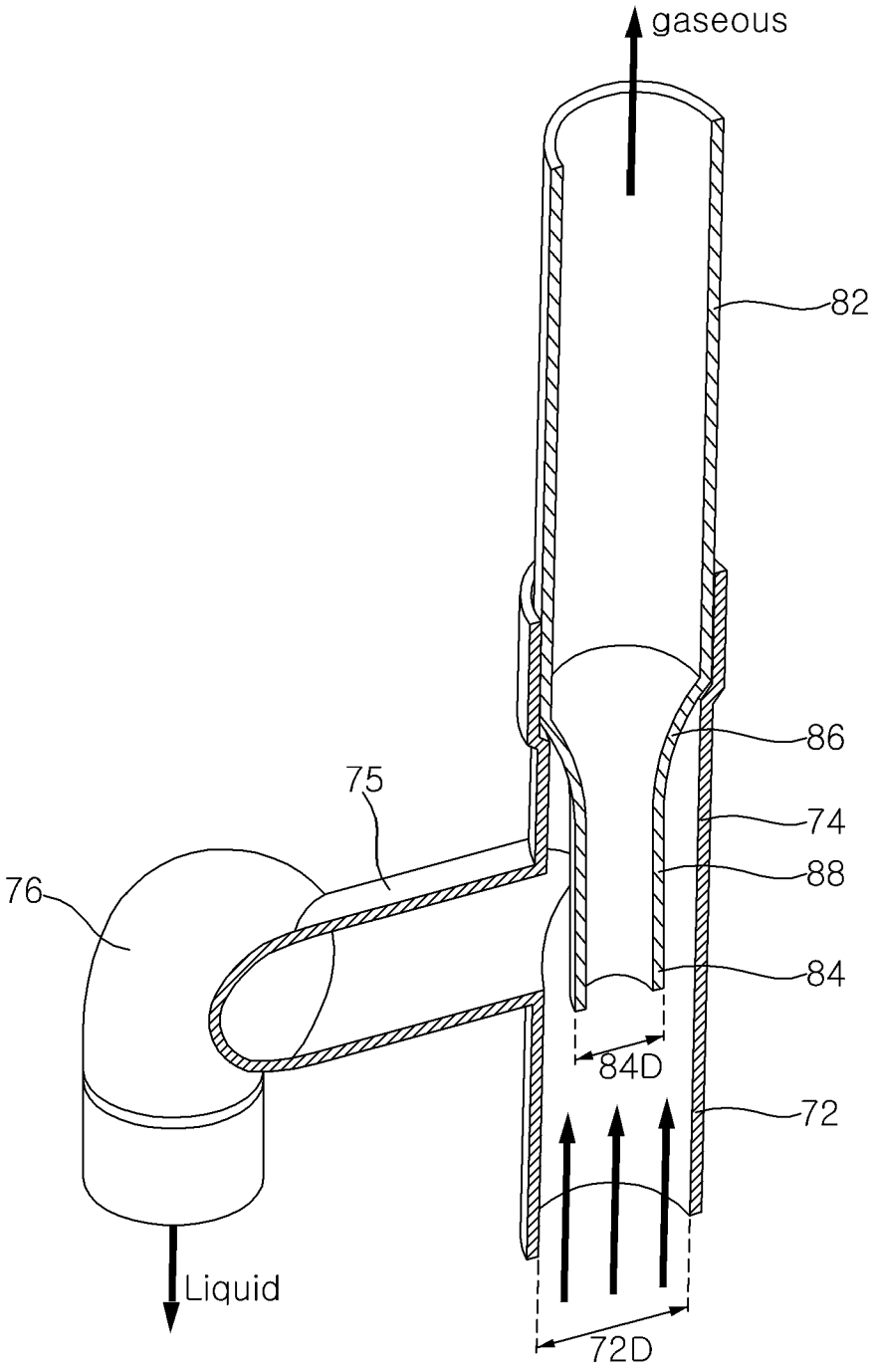


Fig. 5

ITEMS		TEST RESULTS	
		SEPARATION TUBE CLOSED	SEPARATION TUBE OPENING
INDOOR SIDE	DRY-BULB TEMPERATURE [℃]	20.03	20.02
	WET-BULB TEMPERATURE [℃]	15.02	15.03
OUTDOOR SIDE	DRY-BULB TEMPERATURE [℃]	-6.99	-7.00
	WET-BULB TEMPERATURE [℃]	-	-
AIRFLOW[m'/min]		45.58	45.71
HEATING CAPACITY [W]		16 172	17 324
HEATING EFFICIENCY [COP]		2.335	2.423

Fig. 6

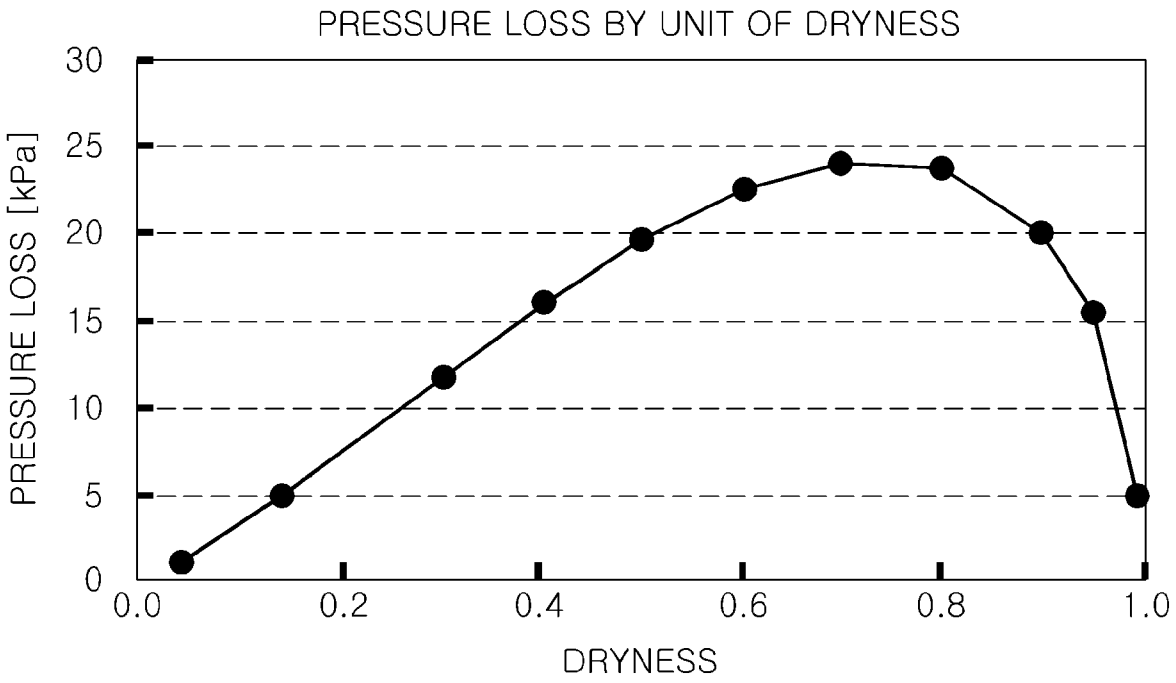

PRESSURE LOSS BY UNIT OF DRYNESS
PRESSURE LOSS [kPa]
30
25
20
15
10
5
0
0.0
0.2
0.4
0.6
0.8
1.0
DRYNESS

Fig. 7

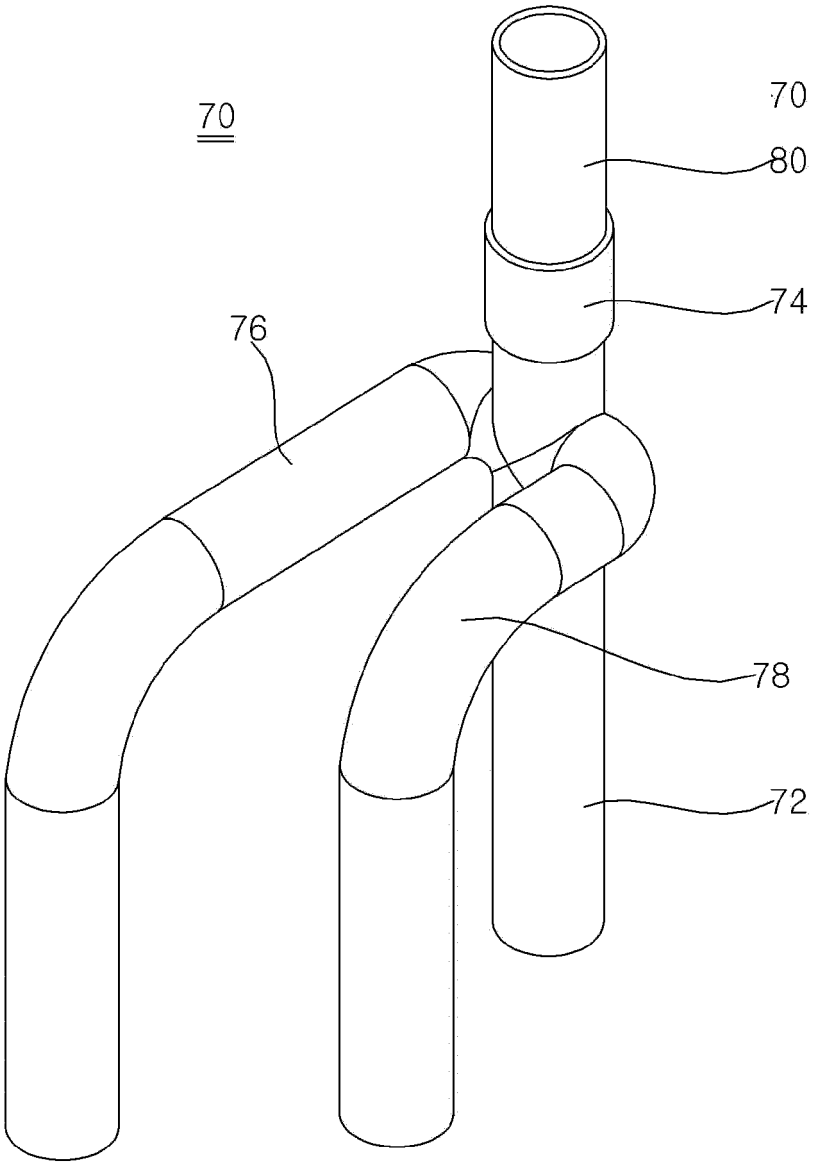


Fig. 8

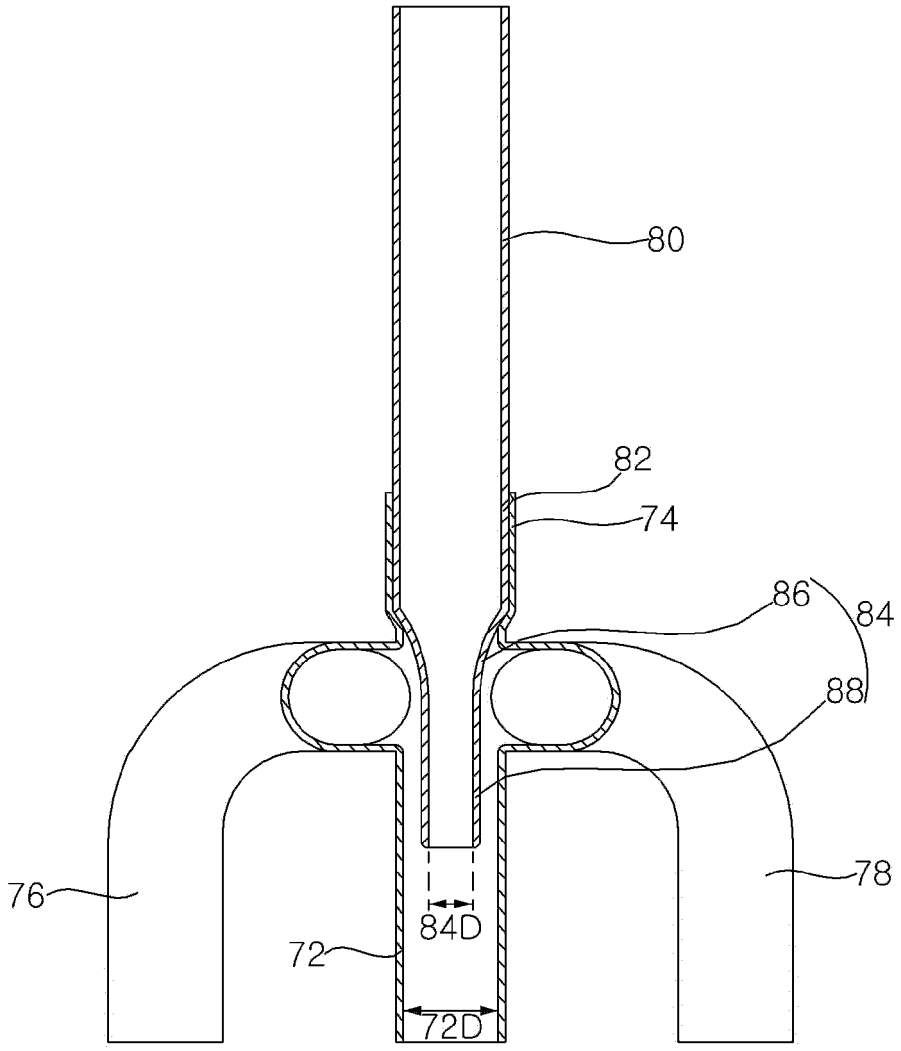


Fig. 9

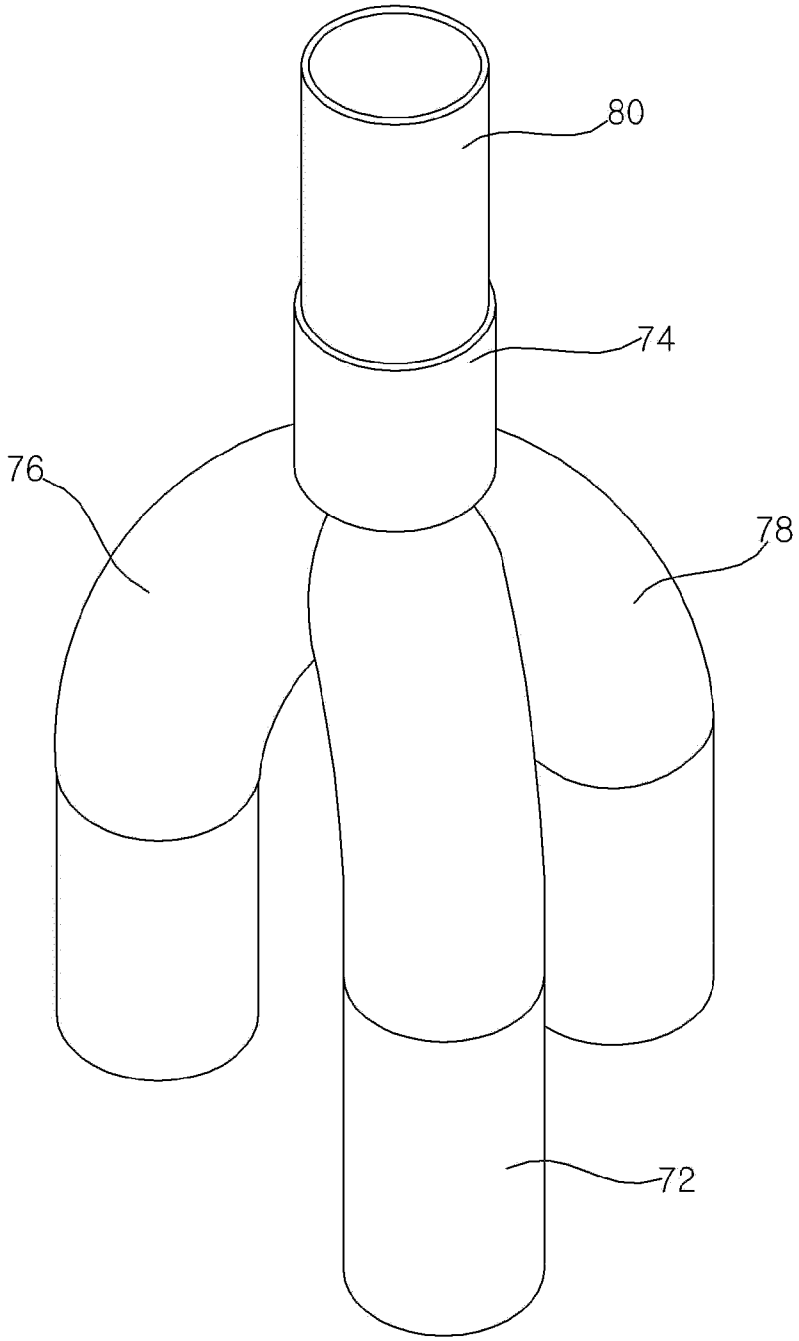


Fig. 10

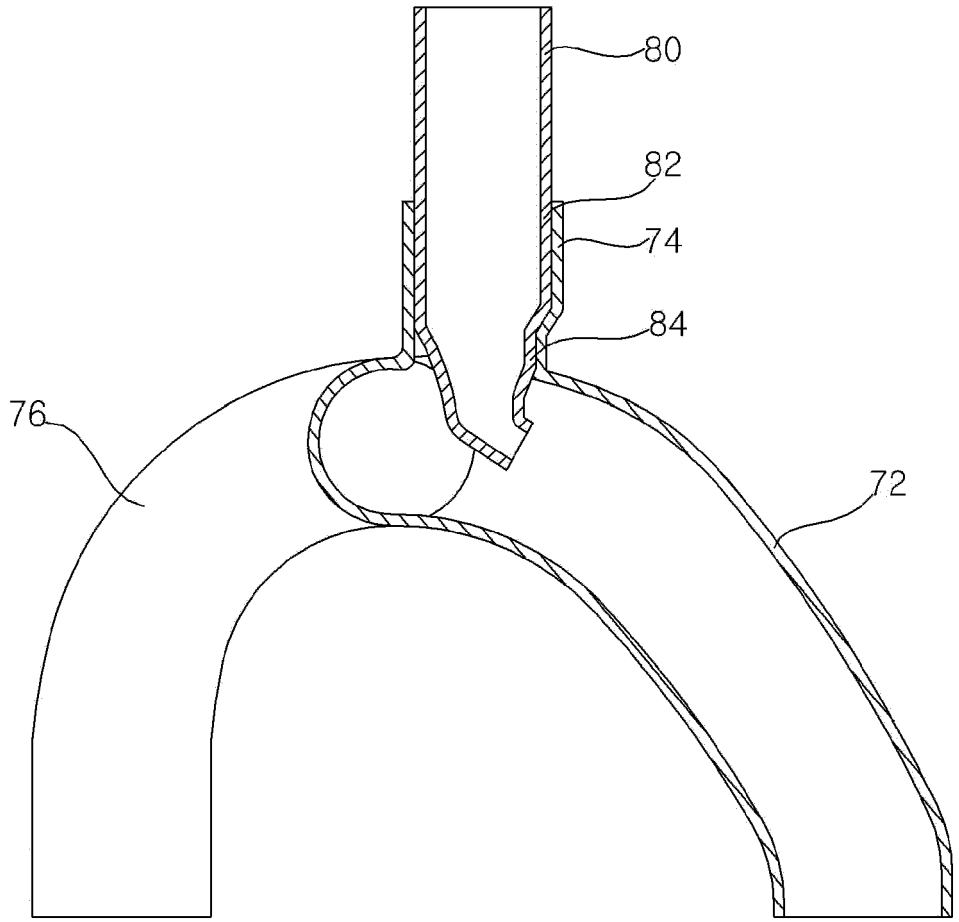


Fig. 11

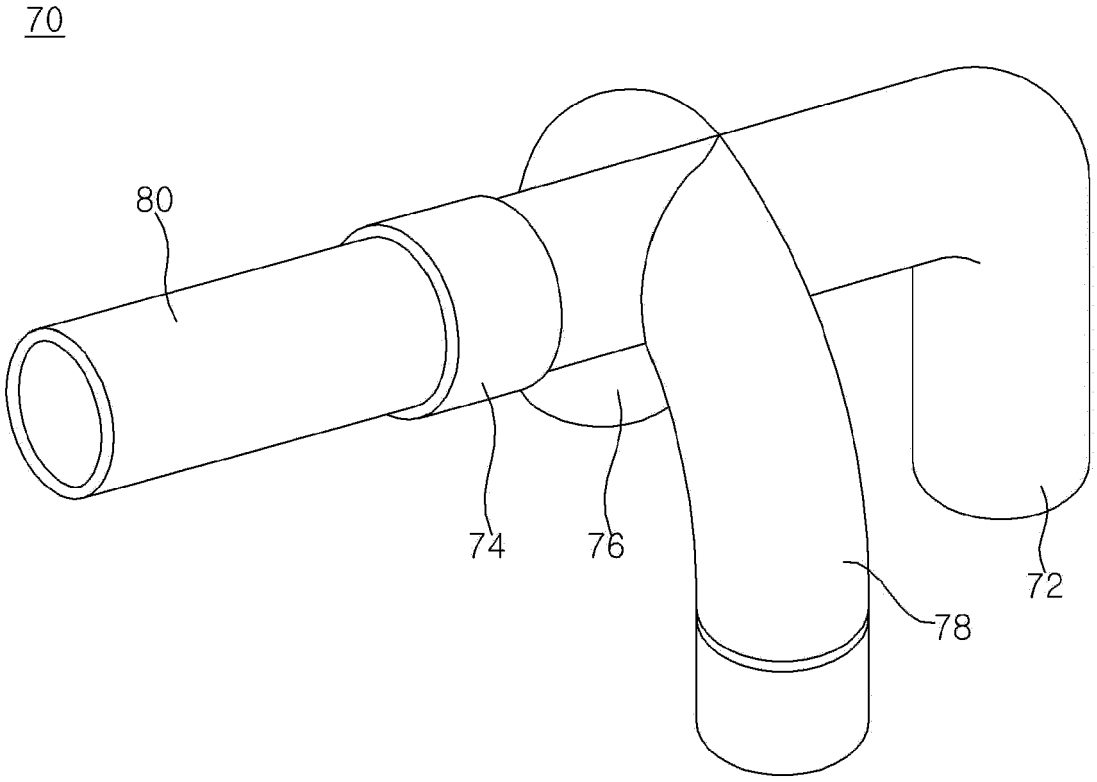
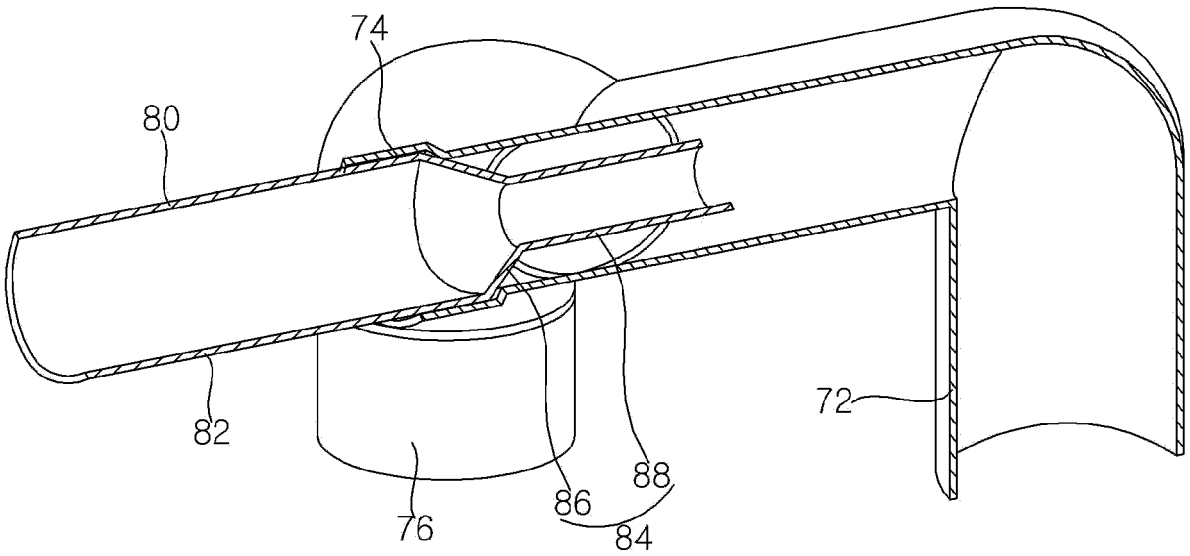


Fig. 12



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Application Number
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Y,D	KR 102 164 804 B1 (LG ELECTRONICS INC [KR]) 13 October 2020 (2020-10-13) * figures 2,3a *	1,3,5, 9-11,13	

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F25B F28F F28D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 March 2025	Lepers, Joachim

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