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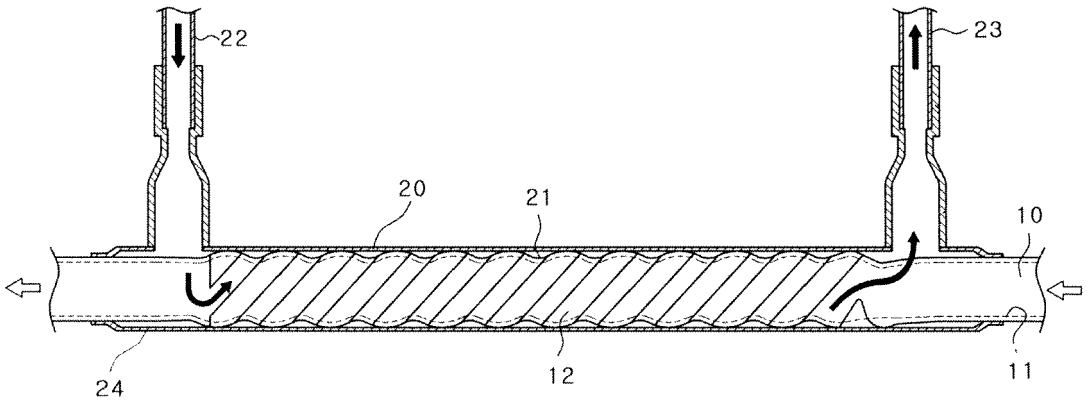
(54) Double tube type heat exchange pipe

(57) A double tube type heat exchange pipe, in which a gas or liquid coolant passes through a flow path hole (101) to cool an inner tube (100), the gas or liquid coolant supplied through through-holes (201) of an outer tube (200) being collected in a first collecting groove formed in an inner tube (100), the gas and liquid coolant being guided to a spiral groove (102) of the inner tube (100) and continuously collides with a plurality of protrusions (103) to undergo heat exchange and be cooled, and the cooled gas and liquid coolant being collected in a second collecting groove (104b) of the inner tube (100) to be discharged to the outside via the through-hole (201) of the outer tube (200).

FIG. 1



EP 2 551 622 A2

Description

BACKGROUND

1. Field of the Invention

[0001] The present invention relates to a double tube type heat exchange pipe, and more particularly, to a double tube type heat exchange pipe having an inner tube with a spiral groove, through which a gas and a liquid pass, so that the gas and liquid continuously collide with a plurality of protrusions to be cooled by heat exchange, and the cooled gas and liquid are collected in a second collecting groove to be discharged through through-holes.

2. Discussion of Related Art

[0002] In general, an air-conditioning apparatus used in a vehicle is configured to cool the inside of the vehicle in summertime, heat it in wintertime, or defrost a windshield in the rain or in wintertime, securing front and rear fields of vision of a driver.

[0003] The air-conditioning apparatus includes both a heating system and a cooling system to selectively introduce outdoor air or indoor air to be heated or cooled and blown into the vehicle, cooling, heating or ventilating the inside of the vehicle.

[0004] Here, the air-conditioning apparatus includes a double tube type internal heat exchanger configured to cool the air supplied into the vehicle. FIG. 1 is a cross-sectional view showing the double tube type internal heat exchanger.

[0005] The double tube type internal heat exchanger includes an inner tube 10 having a low-pressure flow path 11 formed therein and a spiral portion 12 formed at an outer surface thereof which accommodates high-pressure flow, and an outer tube 20 coupled to an outer circumferential surface of the inner tube 10 in a double tube structure to form a high-pressure flow path 21 whose both ends are coupled at their outer circumferential surfaces to inlet/outlet pipes 22 and 23 configured to supply and discharge a gas.

[0006] Here, coolant passes through the low-pressure flow path 11 of the inner tube 10 to cool the inner tube 10, and a gas passes through the high-pressure flow path 21 formed by the spiral portion 12 of the inner tube 10 to heat-exchange with the inner tube 10 so that the gas is cooled and supplied into the vehicle.

[0007] In addition, the outer circumferential surface of the outer tube 20 has the same diameter as the diameter of the inner tube 10, and enlarged portions 24 increased to a certain extent are formed at both ends of the outer circumferential surface of the outer tube 20 to which the inlet/outlet pipes 22 and 23 are coupled.

[0008] Further, any one of the enlarged portions 24 of the outer tube 20 collects a certain amount of gas such that the gas supplied through the inlet pipe 22 is continuously supplied to the high-pressure flow path 21, and the other one collects a certain amount of gas such that the gas cooled by the heat exchange is continuously discharged through the outlet pipe 23.

[0009] However, a structure in which the enlarged portions 24 are formed at the outer tube 20 to collect the gas such that the gas is continuously supplied from the inlet pipe 22 and discharged to the outlet pipe 23 is problematic in that the enlarged portions 24 should be formed at a specific section of the outer tube 20. In addition, formation of the enlarged portions 24 increases a volume of the outer tube 20, and increases manufacturing costs and manufacturing time.

SUMMARY OF THE INVENTION

[0010] In order to solve the above problems, it is an objective of the present invention to provide a double tube type heat exchange pipe, in which a gas or liquid coolant passes through a flow path hole to cool an inner tube, the gas or liquid coolant supplied through through-holes of an outer tube is collected at a first collecting groove formed in the inner tube, the gas or liquid coolant passes through a spiral groove of the inner tube to continuously collide with a plurality of protrusions to be cooled by heat exchange, and the cooled gas or liquid coolant is collected at a second collecting groove of the inner tube to be discharged through the through-holes of the outer tube.

[0011] It is another objective of the present invention to provide a double tube type heat exchange pipe having an outer tube with through-holes of smaller diameters than widths of first and second collecting grooves of an inner tube so that a gas or liquid coolant is continuously supplied or discharged through through-holes of the outer tube.

[0012] In order to accomplish these objectives, the present invention is directed to a double tube type heat exchange pipe including: a hollow inner tube having a flow path hole through which a gas or liquid coolant passes, an annular spiral groove formed at an outer surface thereof in a longitudinal direction at predetermined intervals, a plurality of protrusions protruding along the spiral groove, and first and second collecting grooves formed at both ends of the spiral groove and in which the gas or liquid coolant is collected; and a hollow outer tube adhered to an outer surface of the inner tube and having through-holes formed at both ends of an outer circumferential surface thereof and in communication with the first and second collecting grooves of the inner tube.

[0013] In the double tube type heat exchange pipe in accordance with the present invention, the through-holes of the outer tube may have diameters smaller than widths of the first and second collecting grooves of the inner tube.

[0014] In the double tube type heat exchange pipe in accordance with the present invention, a plurality of protrusions may protrude from outer surfaces of the first and

second collecting grooves.

[0015] In the double tube type heat exchange pipe in accordance with the present invention, the inner tube may be formed of any one of aluminum, copper and a copper alloy.

[0016] In the double tube type heat exchange pipe in accordance with the present invention, the first and second collecting grooves may have any one of a hemispherical shape, an oval shape, and a polygonal shape.

[0017] In the double tube type heat exchange pipe in accordance with the present invention, the protrusions may have any one of a circular shape, a hemispherical shape, an oval shape, and a polygonal shape.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The above and other objects, features and advantages of the present invention will become more apparent to those of ordinary skill in the art by describing in detail example embodiments thereof with reference to the attached drawings, in which:

FIG. 1 is a cross-sectional view showing a conventional double tube type internal heat exchanger;

FIG. 2 is a schematic view showing a state in which a double tube type heat exchange pipe in accordance with the present invention is installed in a cooling apparatus for a vehicle;

FIG. 3 is a perspective view showing the double tube type heat exchange pipe in accordance with the present invention;

FIG. 4 is an exploded perspective view showing the double tube type heat exchange pipe in accordance with the present invention; and

FIG. 5 is a side cross-sectional view showing a state in which the double tube type heat exchange pipe in accordance with the present invention is used.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

[0019] Hereinafter, example embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[0020] FIG. 2 is a schematic view showing a state in which a double tube type heat exchange pipe in accordance with the present invention is installed in a cooling apparatus for a vehicle, FIG. 3 is a perspective view showing the double tube type heat exchange pipe in accordance with the present invention, FIG. 4 is an exploded perspective view showing the double tube type heat exchange pipe in accordance with the present invention, and FIG. 5 is a side cross-sectional view showing a state in which the double tube type heat exchange pipe in accordance with the present invention is used.

[0021] A hollow inner tube 100 includes a flow path hole 101 through which a gas or liquid coolant passes, an annular spiral groove 102 formed in an outer surface thereof in a longitudinal direction at predetermined intervals, a plurality of protrusions 103 protruding along the spiral groove 102, and first and second collecting grooves 104a and 104b formed at both ends of the spiral groove 102 to collect the gas or liquid coolant.

[0022] The gas or liquid coolant passes through the flow path hole 101 of the inner tube 100 to be cooled.

[0023] The inner tube 100 collects the gas or liquid coolant supplied from the outside to the first collecting groove 104a to continuously supply the gas or liquid coolant to the spiral groove 102, and collects the cooled gas or liquid coolant in the second collecting groove 104b to continuously discharge the gas or liquid coolant to the outside.

[0024] Widths of the first and second collecting grooves 104a and 104b may be larger than diameters of through-holes 201 of an outer tube 200.

[0025] The first and second collecting grooves 104a and 104b may have any one of a hemispherical shape, an oval shape, and a polygonal shape.

[0026] A plurality of protrusions 103' protrude from outer surfaces of the first and second collecting grooves 104a and 104b so that the gas or liquid coolant collected in the first collecting groove 104a continuously collides with the protrusions 103' to undergo heat exchange and be supplied to the spiral groove 102 to improve cooling efficiency, and the cooled gas or liquid coolant collected in the second collecting groove 104b collides with the protrusions 103' in the second collecting groove 104b to be continuously cooled and discharged to the outside.

[0027] The gas or liquid coolant passes through the spiral groove 102 of the inner tube 100 and collides with the plurality of protrusions 103 formed along the spiral groove 102 to be rapidly cooled.

[0028] As an interval within the spiral groove 102 of the inner tube 100 is reduced, a rate of a temperature change of the gas or liquid coolant cooled via the spiral groove 102 increases, and as the interval between the spiral groove 102 is increased, the variation speed of the gas or liquid coolant decreases.

[0029] The interval and angle of the spiral groove 102 can be manufactured according to selection of a user.

[0030] In the inner tube 100, a cooling rate of the gas or liquid coolant varies according to the number of protrusions 103 and 103' undergoing heat exchange with the gas, and the number of protrusions 103 and 103' can be adjusted and manufactured according to selection of a user.

[0031] The protrusions 103 and 103' of the inner tube 100 may have any one of a circular shape, a hemispherical shape, an oval shape, and a polygonal shape.

[0032] The inner tube 100 is formed of any one of aluminum, copper and a copper alloy.

[0033] The inner tube 100 may be formed of a copper material having good thermal conductivity, and may be manufactured of a non-metallic material according to selection of a user.

[0034] The outer tube 200, which is hollow, is adhered

to an outer surface of the inner tube 100, and has the through-holes 201 formed at both ends of an outer circumferential surface thereof to be in communication with the first and second collecting grooves 104a and 104b of the inner tube 100.

[0035] The outer tube 200 is adhered to the outer surface of the inner tube 100 to guide the gas or liquid coolant to the spiral groove 102.

[0036] The outer tube 200 receives the gas or liquid coolant supplied through either one of the through-holes 201, and discharges the gas or liquid coolant through the other one of the through-holes 201.

[0037] The outer tube 200 includes an inlet pipe 301 and an outlet pipe 302 respectively installed in the through-holes 201.

[0038] The outer tube 200 may have a cylindrical shape with a flat outer surface.

[0039] The through-holes 201 of the outer tube 200 have diameters smaller than widths of the first and second collecting grooves 104a and 104b of the inner tube 100.

[0040] The double tube type heat exchange pipe in accordance with the present invention configured as described above is used as follows, and an example in which the double tube type heat exchange pipe is installed in a cooling apparatus for a vehicle will be described.

[0041] First, a compressor 400 configured to compress a gas is provided, and a condenser 500 connected to the compressor 400 and configured to condense the gas ejected from the compressor 400 is installed. The outer tube 200 is connected to the condenser 500 to receive a liquid coolant having a high temperature and pressure ejected from the condenser 500, and the inner tube 100 is disposed in the outer tube 200 to guide the liquid coolant supplied to the outer tube 200 to the spiral groove 102 formed at the outer surface. An expansion valve 600 is connected to the outer tube 200 to depressurize and expand liquid coolant discharged through the spiral groove 102 of the inner tube 100, converting the liquid coolant into a gas coolant having a low temperature and pressure. An evaporator 700 is connected to the expansion valve 600 to convert the gas coolant having a low temperature and pressure into liquid coolant having a low temperature and pressure. The evaporator 700 is connected to one end of the inner tube 100 to communicate with the flow path hole 101, and the other end is connected to the compressor 400. Here, when the cooling apparatus is operated, the gas having a high temperature and pressure ejected from the compressor 400 is supplied to the condenser 500, and the liquid coolant having a high temperature and pressure condensed through the condenser 500 is supplied to the outer tube 200. The liquid coolant having a high temperature and pressure supplied to the outer tube 200 is guided to the spiral groove 102 of the inner tube 100 and continuously collides with the plurality of protrusions 103 to be rapidly cooled, and the cooled liquid coolant is converted into the gas coolant having a low temperature and pressure through the expansion valve 600 to be supplied into the evaporator 700. The liquid coolant having a low temperature and pressure ejected from the evaporator 700 passes through the flow path hole 101 of the inner tube 100 and is re-conveyed to the compressor 400 to cool the inner tube 100, and the liquid coolant passing through the spiral groove 102 of the cooled inner tube 100 is cooled through heat exchange.

[0042] Here, the above-mentioned process is repeated to cool the air blowing into the vehicle.

[0043] In addition, the gas coolant having a low temperature and pressure introduced into the evaporator 700 undergoes heat exchange with the air blowing into the vehicle to evaporate and simultaneously cool the air blowing into the vehicle by the coolant absorbing latent heat of evaporation and being converted into the coolant having a low temperature and pressure.

[0044] Further, the liquid coolant supplied through the outer tube 200 is collected in the first collecting groove 104a of the inner tube 100, the liquid coolant collected in the first collecting groove 104a is supplied into the spiral groove 102 to be cooled through heat exchange, the liquid coolant cooled via the spiral groove 102 is collected in the second collecting groove 104b, and the liquid coolant collected in the second collecting groove 104b is supplied into the expansion valve 600 through the through-holes 201 of the outer tube 200.

[0045] Here, a flow of the liquid coolant supplied into the spiral groove 102 and the expansion valve 600 is continued by the liquid coolant collected in the first and second collecting grooves 104a and 104b.

[0046] In addition, the first and second collecting grooves 104a and 104b may have any one of a hemispherical shape, an oval shape, and a polygonal shape.

[0047] Meanwhile, as the first and second collecting grooves 104a and 104b of the inner tube 100 have widths larger than diameters of the through-holes 201 of the outer tube 200, an amount of collected liquid coolant is increased to prevent a decrease in supply amount of the liquid coolant supplied into the spiral groove 102 and the expansion valve 600.

[0048] Here, the plurality of protrusions 103' protrude from outer surfaces of the first and second collecting grooves 104a and 104b so that the gas or liquid coolant collected in the first collecting groove 104a continuously collides with the protrusions 103' to be supplied into the spiral groove 102 after heat exchange to increase cooling efficiency, and the cooled gas or liquid coolant collected in the second collecting groove 104b collides with the protrusions 103' in the second collecting groove 104b to be continuously cooled and discharged to the outside.

[0049] In addition, as the interval within the spiral groove 102 of the inner tube 100 is reduced, a rate of a temperature change of the gas or liquid coolant cooled via the spiral groove 102 increases, and as the interval within the spiral groove 102 is increased, the rate of a temperature change of the cooled gas or liquid coolant

decreases.

[0050] Here, the interval and angle of the spiral groove 102 may be adjusted and manufactured according to selection of a user.

[0051] In addition, in the inner tube 100, the cooling rate of the gas or liquid coolant varies according to the number of protrusions 103 and 103' undergoing heat exchange with the gas, the number of protrusions 103 and 103' can be adjusted and manufactured according to selection of a user, and the protrusions 103 and 103' may have any one of a circular shape, a hemispherical shape, an oval shape, and a polygonal shape.

[0052] Here, the cooling rate of the gas or liquid coolant can vary according to the shape of the protrusions 103 and 103'.

[0053] In addition, the inner tube 100 may be formed of any one of aluminum, copper and a copper alloy, preferably, a copper material having good thermal conductivity, or may be manufactured of a non-metallic material according to selection of user.

[0054] Next, the outer tube 200 is adhered to the outer surface of the inner tube 100 to guide the gas or liquid coolant to the spiral groove 102, so that the gas or liquid coolant is supplied through either one of the through-holes 201 and the gas or liquid coolant is discharged through the other one of the through-holes 201.

[0055] Here, the inlet pipe 301 and the outlet pipe 302 may be respectively installed in the through-holes 201 to guide supply and discharge of the liquid coolant.

[0056] In addition, the outer tube 200 may have a cylindrical shape with a flat outer surface.

[0057] Further, the through-holes 201 of the outer tube 200 have diameters smaller than widths of the first and second collecting grooves 104a and 104b of the inner tube 100.

[0058] While the double tube type heat exchange pipe of the present invention is described herein as being installed in a cooling apparatus for a vehicle and used so that the liquid coolant having a low temperature and pressure passes through the flow path hole 101 of the inner tube 100 and the liquid coolant having a high temperature and pressure passes through the spiral groove 102 of the inner tube 100 to be cooled, a gas coolant may be supplied and used instead of the liquid coolant, depending on the cooling apparatus,.

[0059] As described above, the gas or liquid coolant supplied through the through-holes 201 of the outer tube 200 is collected in the first collecting groove 104a of the inner tube 100 to be supplied into the spiral groove 102, and the gas or liquid coolant cooled via the spiral groove 102 is collected in the second collecting groove 104b to be discharged through the through-holes 201 of the outer tube 200. Accordingly, the gas or liquid coolant is collected in the first and second collecting grooves 104a and 104b of the inner tube 100 to enable easy continuous supply and discharge, and the through-holes 201 through which the gas or liquid coolant passes can be easily manufactured in the outer surface of the outer tube 200 through punching, and a volume of the outer tube 200 is minimized because there is no need of separate machining.

[0060] As can be seen from the foregoing, the double tube type heat exchange pipe in accordance with the present invention has advantages as follows: the gas or liquid coolant is collected in the first and second collecting grooves of the inner tube to enable easy continuous supply and discharge, the through-holes through which the gas or liquid coolant passes can be easily manufactured in the outer surface of the outer tube through punching, a volume of the outer tube is minimized because there is no need of separate machining, manufacturing cost is reduced, and rapid manufacturing is possible.

[0061] While the invention has been shown and described with reference to certain example embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

Claims

1. A double tube type heat exchange pipe comprising:

   a hollow inner tube (100) having a flow path hole (101) through which a gas or liquid coolant passes, an annular spiral groove (102) formed at an outer surface thereof in a longitudinal direction at predetermined intervals, a plurality of protrusions (103) protruding along the spiral groove (102), and first and second collecting grooves (104a, 104b) formed at both ends of the spiral groove (102) and in which the gas or liquid coolant is collected; and

   a hollow outer tube (200) adhered to an outer surface of the inner tube (100) and having through-holes (201) formed at both ends of an outer circumferential surface thereof and in communication with the first and second collecting grooves (104a, 104b) of the inner tube (100).

2. The double tube type heat exchange pipe according to claim 1, wherein the through-holes (201) of the outer tube (200) have diameters smaller than widths of the first and second collecting grooves (104a, 104b) of the inner tube (100).

3. The double tube type heat exchange pipe according to claim 1, wherein a plurality of protrusions (103') protrude from outer surfaces of the first and second collecting grooves (104a, 104b).

4. The double tube type heat exchange pipe according to claim 1, wherein the inner tube (100) is formed of any one of aluminum, copper and a copper alloy.

5. The double tube type heat exchange pipe according to claim 1, wherein the first and second collecting grooves (104a, 104b) have any one of a hemispherical shape, an oval shape, and a polygonal shape.

6. The double tube type heat exchange pipe according to claim 1 or 3, wherein the protrusions (103, 103') have any one of a circular shape, a hemispherical shape, an oval shape, and a polygonal shape.

FIG. 1

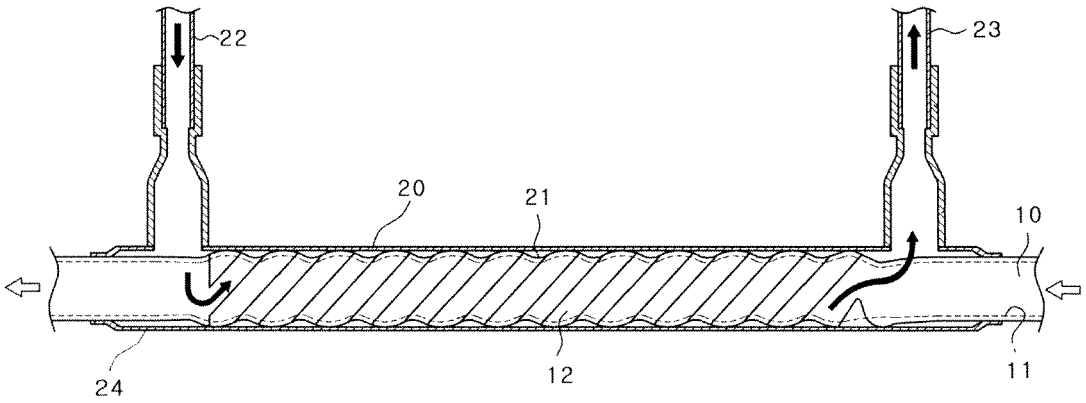

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FIG. 2

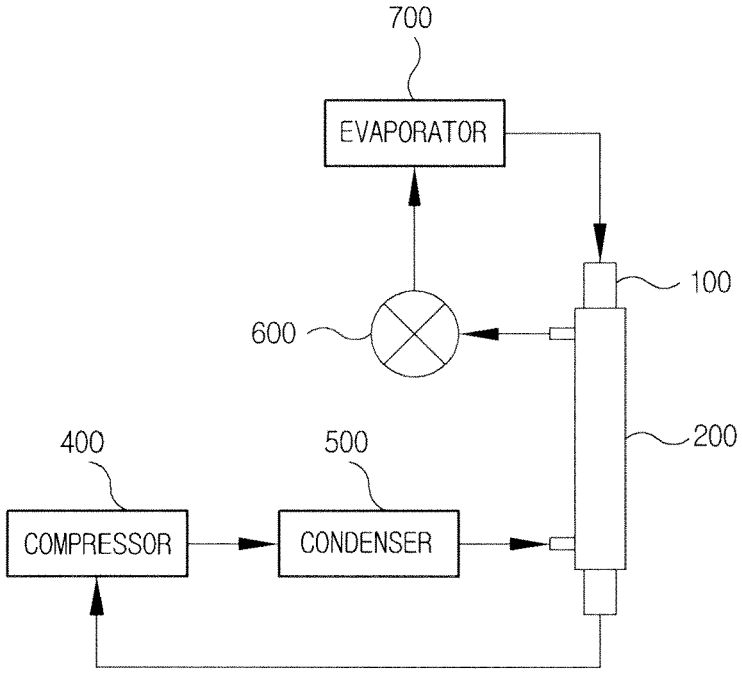

700
EVAPORATOR
100
600
200
400
500
COMPRESSOR
CONDENSER

FIG. 3

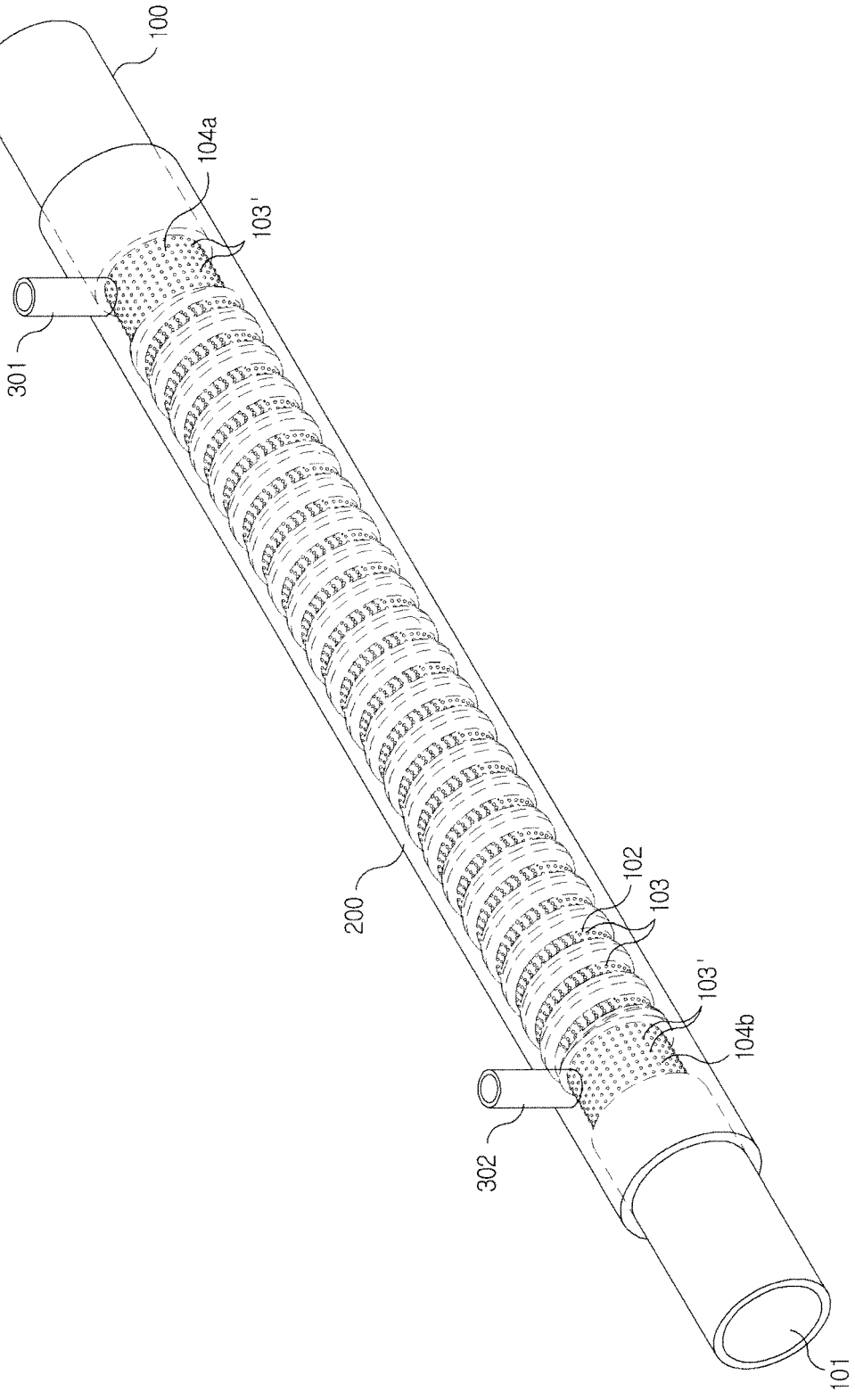


FIG. 4

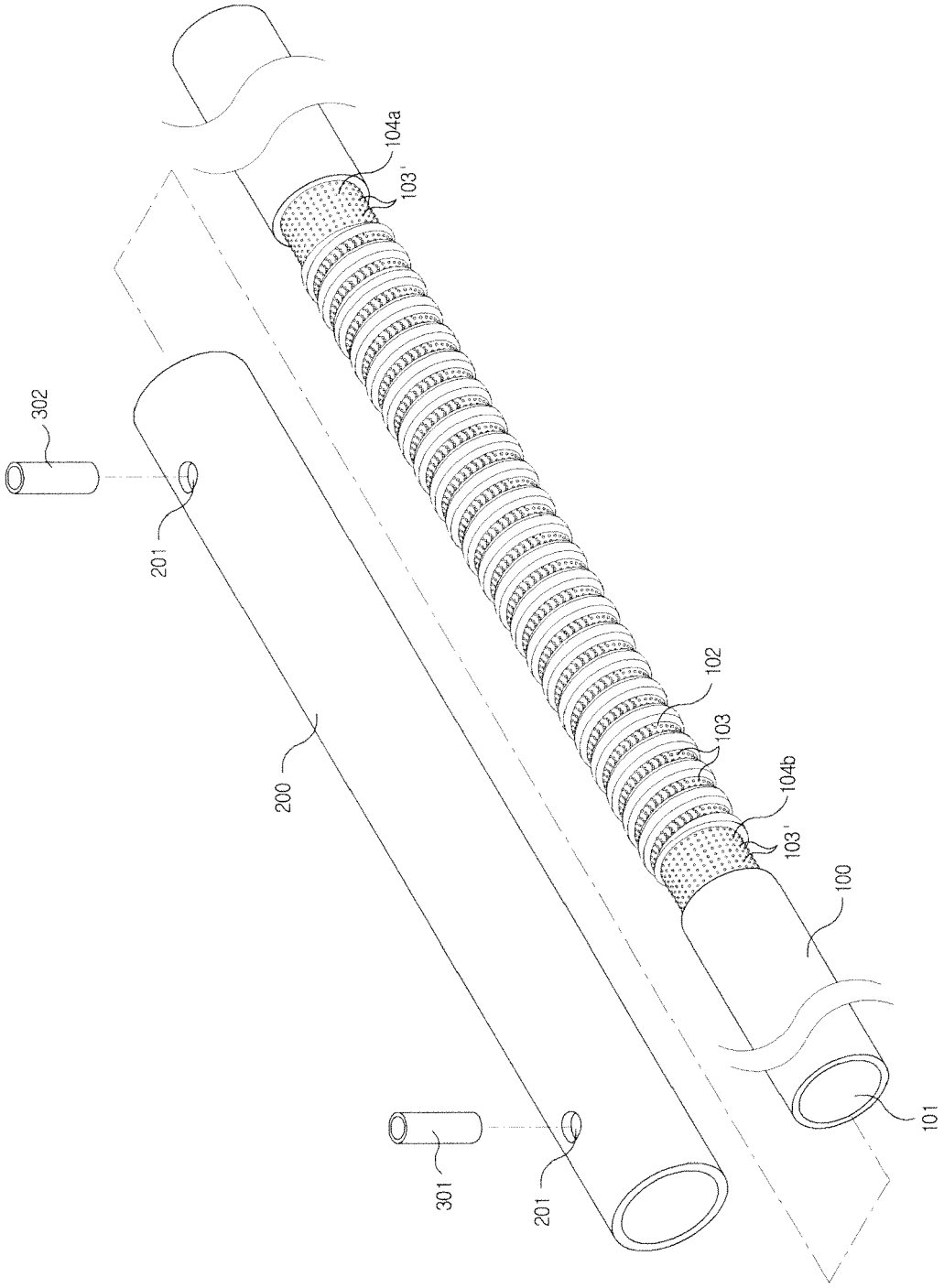
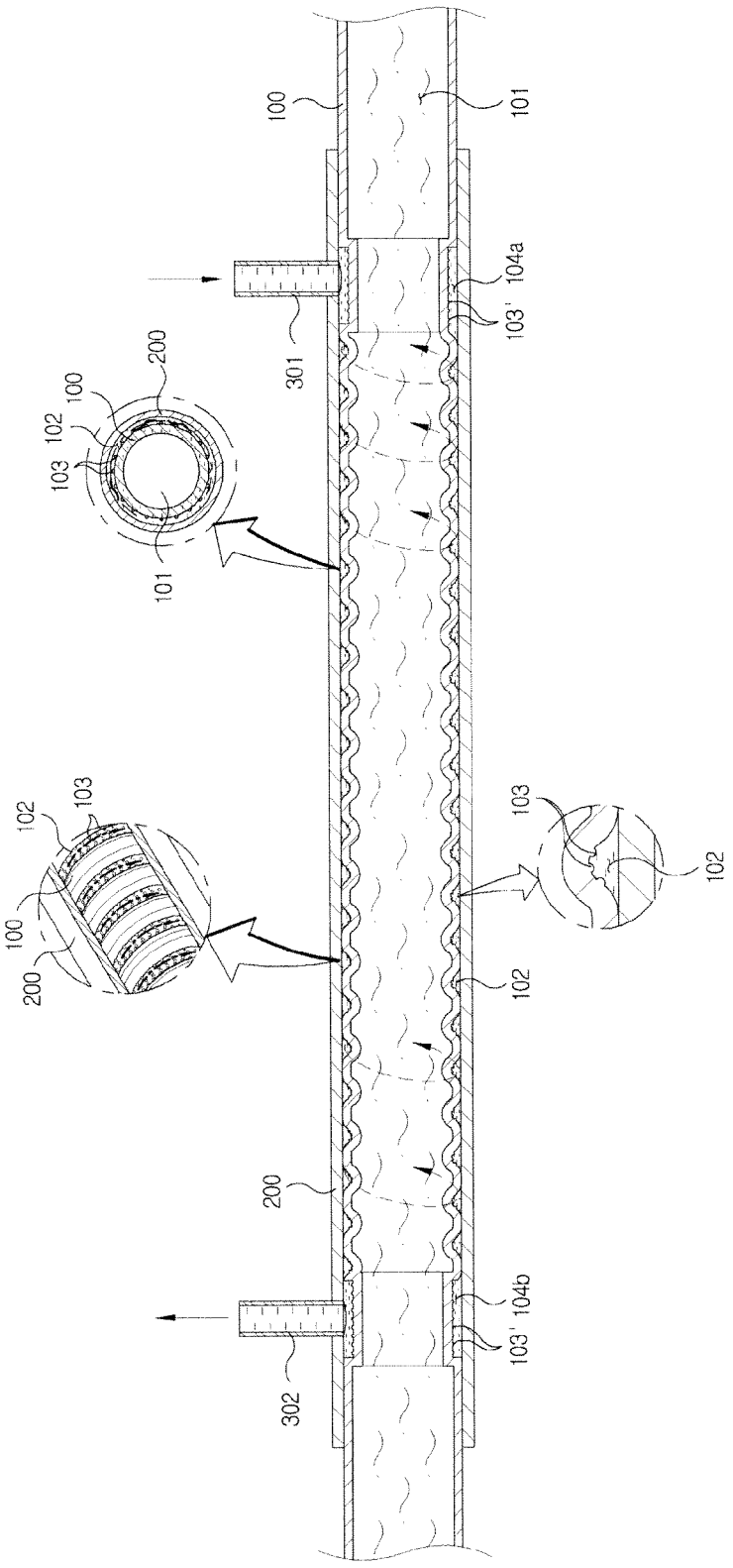


FIG. 5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