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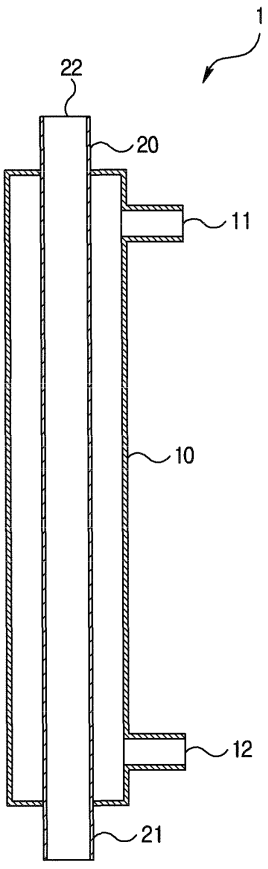
(54) Pipe in pipe heat exchanger with vibration reduction

(57) A heat exchanger is provided, including a first pipe, into which a first fluid may be introduced and flow, and a second pipe disposed in the first pipe, into which a second fluid may be introduced and flow. The first and second pipes may contact each other, to prevent the second pipe from vibrating.

Fig. 1



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Description

[0001] A heat exchanger is disclosed herein.

[0002] Heat exchangers are known. However, they suffer from various disadvantages.

[0003] It is the object of the present invention to provide a heat exchanger having improved characteristics. This object is solved with the features of the claims.

[0004] Embodiments will be described in detail with reference to the following drawings in which like reference numerals refer to like elements, wherein:

[0005] FIG. 1 is a front view of a heat exchanger;

[0006] FIG. 2 is a front view of a heat exchanger according to an embodiment;

[0007] FIG. 3 is a front view of a heat exchanger according to another embodiment;

[0008] FIG. 4 is a front view of the heat exchanger according to another embodiment;

[0009] FIG. 5 is a sectional side view taken along line V-V of FIG. 4;

[0010] FIG. 6 is a front view of a heat exchanger according to another embodiment; and

[0011] FIG.7 is a sectional view taken along line VII-VII of FIG. 6.

[0012] Hereinafter, embodiments will be described with reference to the accompanying drawings. In this disclosure, the size and shape of components shown in the drawings may be exaggerated for the sake of clarity and convenience. Further, terms that are specifically defined in consideration of the construction and operation of embodiments may be changed according to operator's intention or custom. Definition of such items should be made on the basis of the entire contents of the disclosure.

[0013] Generally, a heat exchanger is an apparatus that reduces a temperature of a high temperature fluid and increases a temperature of a low temperature fluid by transferring thermal energy from the high temperature fluid to the low temperature fluid. Such a heat exchanger may be used in a heater, a cooler, an evaporator, or a condenser, for example.

[0014] For example, in such a heater, a heat transfer medium used to transfer heat to a target fluid is referred to as a heat medium, and a heat transfer medium used to take heat from a target fluid is referred to as a refrigerant. The fluid used as the heat medium or refrigerant may be, for example, air or a liquid.

[0015] A double-pipe heat exchanger is one example of a heat exchanger and includes an internal pipe through which a first fluid passes, and an external pipe that encloses the internal pipe and through which a second fluid passes. Heat exchange is performed between first and second fluids using a side wall of the internal pipe acting as a heat transfer wall. A typical double-pipe heat exchanger may be a straight-type double-pipe heat exchanger or a helical-type double-pipe heat exchanger.

[0016] The straight-type double-pipe heat exchanger has a problem in that there is a vibration phenomenon in which the internal pipe vibrates and may contact the external pipe when fluid is circulated through the pipe in a case where the heat exchanger is long in a longitudinal direction. Further, because of the vibration phenomenon described above, there are problems in that the pipe is continuously worn out, noise occurs, and welding portions may experience metal fatigue failure. Furthermore, because of this vibration phenomenon, there occurs a limitation on length when designing the heat exchanger.

[0017] FIG. 1 is a front view of a heat exchanger. Referring to FIG. 1, the heat exchanger 1 is a double-pipe heat exchanger, in which a first pipe 10 and a second pipe 20, whose diameters are different each other, may be arranged with a concentric axis. A second fluid path formed by the second pipe 20 and a first fluid path formed by an external wall of the second pipe 20 and an internal wall of the first pipe 10 may be independent with each other. The heat exchanger may receive different temperature fluids introduced into a first fluid inlet 11 formed in the first pipe 10 and a second fluid inlet 21 formed in the second pipe 20, respectively, to perform a heat exchange due to the temperature difference between the two fluids.

[0018] In a case that such a heat exchanger is sufficiently long in a longitudinal direction, when the fluid is circulated through the pipes, the second pipe 20 may vibrate and contact the first pipe 10, so that there occurs continuous wear, noise, and metal fatigue failure at a welding portion(s). Accordingly, in order to prevent such problems from occurring, a heat exchanger having a vibration preventing structure is provided.

[0019] FIG. 2 is a front view of a heat exchanger according to an embodiment.

FIG. 3 is a front view of a heat exchanger according to another embodiment.

[0020] Referring to FIGS. 2 and 3, the heat exchanger 2A, 2B according to embodiments may include a first pipe 100A, 100B and a second pipe 200A, 200B. A first fluid may be introduced into and circulated in the first pipe 100A, 100B, while a second fluid may be introduced into and circulated in the second pipe 200A, 200B, which may be arranged in the first pipe 200A, 200B in the form of a double-pipe type heat exchanger.

[0021] The first fluid may be introduced into the first pipe 100A, 100B through a first fluid inlet 110 formed in one end of the first pipe 100A, 100B, and may be discharged through a first fluid outlet 120 formed in the other end of the first pipe 100. The second fluid may be introduced into the second pipe 200A, 200B through a second fluid inlet 210 formed in one end of the second pipe 200A, 200B, and may be discharged through a second fluid outlet 220 formed in the other end of the second pipe 200A, 2008.

[0022] The first and second fluids circulating in the first and second pipes 100A, 100B and 200A, 200B may have different temperatures from each other and a heat exchange may be made utilizing the temperature difference between two fluids. That is, a higher temperature one of the two fluids may be cooled and a lower temperature one of the two fluids heated.

[0023] Meanwhile, as shown in FIG. 2, the first pipe 100A of the heat exchanger 2A may be as a straight pipe of a cylindrical shape, and the second pipe 200A may be formed in a wave shape in which a convex portion 230 and a concave portion 240 may be repeatedly formed. The convex portion 230 of the second pipe 200A may contact an internal surface of the first pipe 100A and may be fixed thereto. That is, vibration occurring when the fluid is circulated may be prevented by making the second pipe 200 not a straight type pipe but a wave type pipe, and an external surface of the second pipe 200A may contact the internal surface of the first pipe 100A.

[0024] As such, in the heat exchanger according to this embodiment, vibration occurring when the fluid is circulated may be prevented by forming the second pipe 200A in a structure in which the convex portion 230 and concave portion 240 are repeatedly formed, and then making the convex portion 230 contact the internal surface of the first pipe 100A.

[0025] Alternatively, as shown in FIG. 3, the first pipe 100B may be formed in a wave shape, in which a convex portion 130 and a concave portion 140 may be repeatedly formed and the second pipe 200B formed in a straight shape. That is, the concave portion 140 of the first pipe 100B may contact an external surface of the second pipe 200B, so that vibration occurring when the fluid is circulated may be prevented. The first pipe 100B may be formed in a wave shape, and the second pipe 200B formed in a straight line shape so as to contact an internal surface of the first pipe 100B and may be fixed thereto.

[0026] FIG. 4 is a front view of a heat exchanger in accordance with another embodiment, and FIG. 5 is a sectional side view of the heat exchanger of FIG. 4, taken along line V-V of FIG. 4.

[0027] Referring to FIGS. 4 and 5, a heat exchanger 2C in accordance with this embodiment may include a first pipe 100C, into which a first fluid may be introduced and flow, a second pipe 200C inserted into the first pipe 100C so as to form concentric circles therewith and into which a second fluid may be introduced and flow, and one or more vibration preventing member(s) 300 installed between the first and second pipes 100C and 200C, so as to prevent vibration occurring when the fluid is circulated. In this embodiment, the first and second pipes 100C and 200C are each formed as a straight pipe having a cylindrical shape.

[0028] The vibration preventing member(s) 300 may be formed in a hemisphere shape and may be fixed to an internal surface of the first pipe 100C, such that a convex surface thereof may contact an external surface of the second pipe 200C. A plurality of vibration preventing members 300 may be provided on the internal surface of the first pipe 100C in a circumferential direction with a predetermined space therebetween along a longitudinal direction of the first pipe 100C.

[0029] For example, three vibration preventing members 300 may be arranged with a space therebetween in the circumferential direction of the first pipe 100 so that three convex projections 310 may contact the external surface of the second pipe 200C. For example, a central angle θ formed by two projections 310 of the three projections 300 may range from approximately 100° to approximately 140°.

[0030] Further, a distance L between the vibration preventing members 300 disposed with the space therebetween in the longitudinal direction of the first pipe 100C may be approximately 20 to approximately 40 times an external diameter of the second pipe 200C.

[0031] FIG.6 is a front view of a heat exchanger in accordance with another embodiment, and FIG. 7 is a sectional side view of the heat exchanger of FIG. 6 taken along line VII-VII.

[0032] Referring to FIGS. 6 and 7, the heat exchanger 2D in accordance with this embodiment may be similar in construction to the heat exchanger 2C of the previous embodiment, except that the vibration preventing member(s) 400 may be formed in a pin shape.

[0033] The vibration preventing member(s) 400 of the heat exchanger 2D in accordance with this embodiment may be fixed to and through the first pipe 100D with a predetermined space therebetween, and ends of the vibration preventing member(s) 400 may contact an external surface of the second pipe 200D so as to support the second pipe 200D.

[0034] The vibration preventing member(s) 400 may pass through the first pipe 100D and may be fixed to the first pipe 100D using a method, such as, for example, welding, and ends thereof may contact the external surface of the second pipe 200D.

[0035] A plurality of vibration preventing members 400 may be provided with a predetermined space therebetween in a longitudinal direction of the first pipe 100D, and may be disposed on an internal surface of the first pipe 100D in a circumferential direction of the first pipe 100D.

[0036] Moreover, the vibration preventing members 400 may be pins arranged with a space therebetween in the circumferential direction of the first pipe 100D, so that ends of the pins, which may be formed in a tapered shape, may contact the external surface of the second pipe 200D.

[0037] A central angle $\theta 1$ formed between two pins of the three pins of the vibration preventing members 400 may range from approximately 100° to approximately 140°. Further, a distance M between the vibration preventing members 400 disposed with the space along the longitudinal direction of the first pipe 100D may be approximately 20 to approximately 40 times an external diameter of the second pipe 200D.

[0038] Embodiments disclosed herein provide a heat exchanger capable of preventing a vibration phenomenon of an internal pipe when fluid is circulated therein, by including a vibration preventing structure in a straight-type double pipe heat exchanger.

[0039] Embodiments disclosed herein provide a heat exchanger which may include a first pipe, through which

a first fluid may pass, and a second pipe disposed in the first pipe, through which a second fluid may pass, wherein the first and second pipes may touch each other so that the second pipe may be prevented from vibrating.

[0040] Further, the first pipe may be formed in a cylindrical shape, and the second pipe may be formed in a wave shape, so that a convex portion of the second pipe contacts an internal surface of the first pipe. Alternatively, the first pipe may be formed in a wave shape, and the second pipe may be formed in a cylindrical shape, so that a concave portion of the first pipe contacts an external surface of the second pipe.

[0041] Also, the first and second pipes may be formed in a cylindrical shape, and a vibration preventing member may be included between the first and second pipes in order to prevent the second pipe from vibrating. The vibration preventing member may be formed in a hemisphere shape and fixed to the internal surface of the first pipe. A convex portion of the vibration preventing member may contact the external surface of the second pipe.

[0042] A plurality of the vibration preventing members may be arranged across a space along a longitudinal direction of the first pipe, and may be radially and circumferentially disposed on the internal surface of the first pipe. For example, three vibration preventing members may be circumferentially arranged across a space, and a central angle formed by two of the three vibration preventing members may range from approximately 100° to 140°.

[0043] Further, a distance between the vibration preventing members arranged in the longitudinal direction of the first pipe may be approximately 20 to 40 times an external diameter of the second pipe.

[0044] The vibration preventing member may be formed in a pin shape, so that the member may be fixed through the first pipe and an end of the member may be brought into contact with the external surface of the second pipe.

[0045] Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

[0046] 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 spirit and 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. A heat exchanger **characterized by**:

   a first pipe into which a first fluid is introduced and flows; and
   a second pipe disposed in the first pipe, into which a second fluid is introduced and flows, wherein the first and second pipes contact each other so that the second pipe is prevented from vibrating.

2. The heat exchanger according to claim 1, **characterized in that** the first pipe is formed in a cylindrical shape, and the second pipe is formed in a wave shape so that a convex portion of the second pipe contacts an internal surface of the first pipe.

3. The heat exchanger according to claim 1, **characterized in that** the first pipe is formed in a wave shape, and the second pipe is formed in a cylindrical shape so that a concave portion of the first pipe contacts an external surface of the second pipe.

4. The heat exchanger according to claim 1, **characterized in that** the first and second pipes are formed in a cylindrical shape, and a vibration preventing member is provided between the first and second pipes to prevent the second pipe from vibrating.

5. The heat exchanger according to claim 4, **characterized in that** the vibration preventing member is formed in a hemisphere shape and fixed to an internal surface of the first pipe, a convex portion of the vibration preventing member contacting an external surface of the second pipe.

6. The heat exchanger according to claim 5, **characterized in that** a plurality of vibration preventing members is arranged along a longitudinal direction of the first pipe, and radially and circumferentially disposed on the internal surface of the first pipe.

7. The heat exchanger according to claim 5, **characterized in that** three vibration preventing members are circumferentially arranged on the first pipe, and a central angle formed between any two of the three vibration preventing members ranges from approximately 100° to approximately 140°.

8. The heat exchanger according to claim 5, **characterized in that** a distance between the vibration preventing members arranged in the longitudinal direction of the first pipe is approximately 20 to approximately 40 times an external diameter of the second pipe.

9. The heat exchanger according to claim 4, **characterized in that** the vibration preventing member is formed in a pin shape so that the vibration preventing member is fixed through the first pipe and an end of the member contacts an external surface of the second pipe.

10. The heat exchanger according to claim 9, **characterized in that** a plurality of vibration preventing members are arranged along a longitudinal direction of the first pipe, and are circumferentially arranged on the internal surface of the first pipe with a predetermined space therebetween.

11. The heat exchanger according to claim 10, **characterized in that** three vibration preventing members are circumferentially fixed to the internal surface of the first pipe, and an angle formed between two of the three vibration preventing members ranges from approximately 100° to approximately 140°.

12. The heat exchanger according to claim 10, **characterized in that** a distance between the plurality of vibration preventing members arranged in the longitudinal direction of the first pipe is approximately 20 to approximately 40 times an external diameter of the second pipe.

13. The heat exchanger according to claim 1, **characterized in that** at least one of the first pipe or second pipe is shaped different from the other of the first pipe or second pipe, so as to prevent the respective pipe from vibrating.

14. A heat exchanger **characterized by**:

a first pipe into which a first fluid is introduced and flows; and

a second pipe disposed in the first pipe, into which a second fluid is introduced and flows, wherein at least one of the first pipe or second pipe is shaped different from the other of the first or second pipe, so as to prevent the respective pipe from vibrating.

15. The heat exchanger according to claim 14, **characterized in that** the first pipe is formed in a cylindrical shape, and the second pipe is formed in a wave shape so that a convex portion of the second pipe contacts an internal surface of the first pipe.

Fig. 1

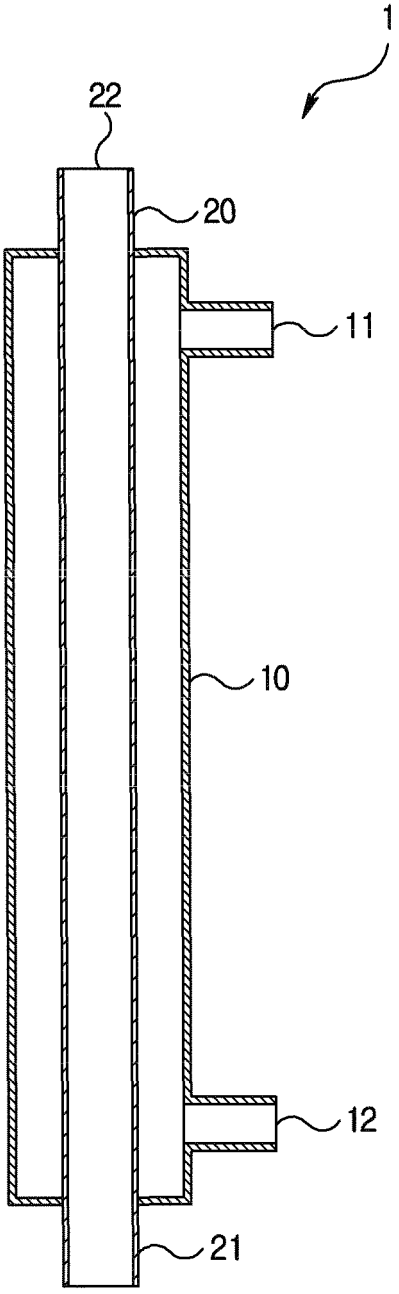

Fig. 2

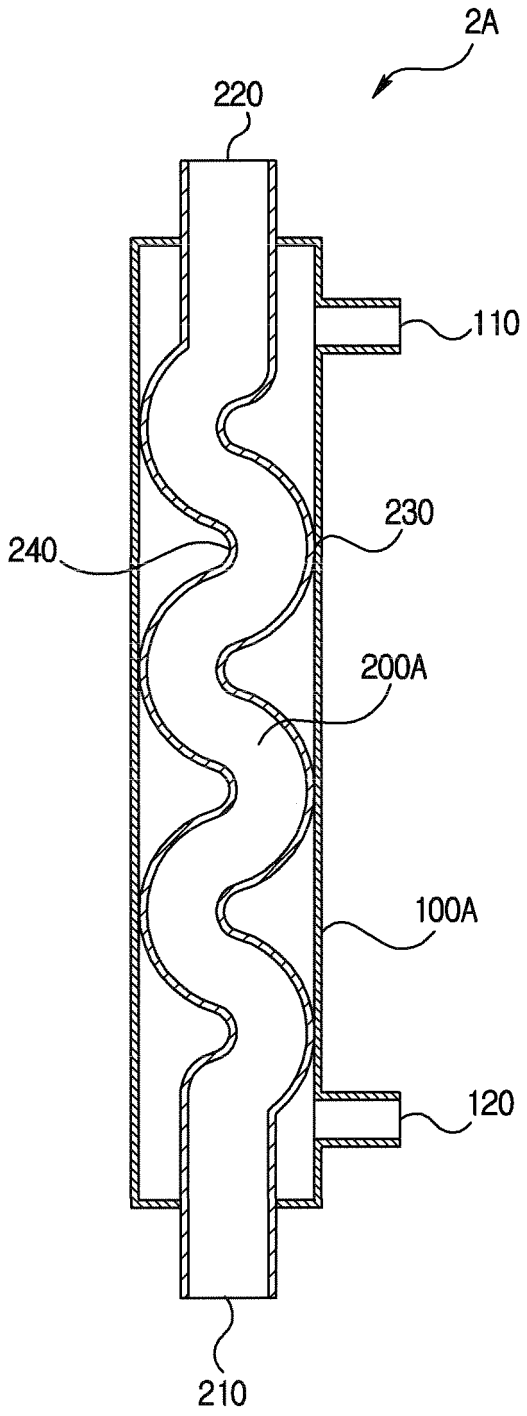

Fig. 3

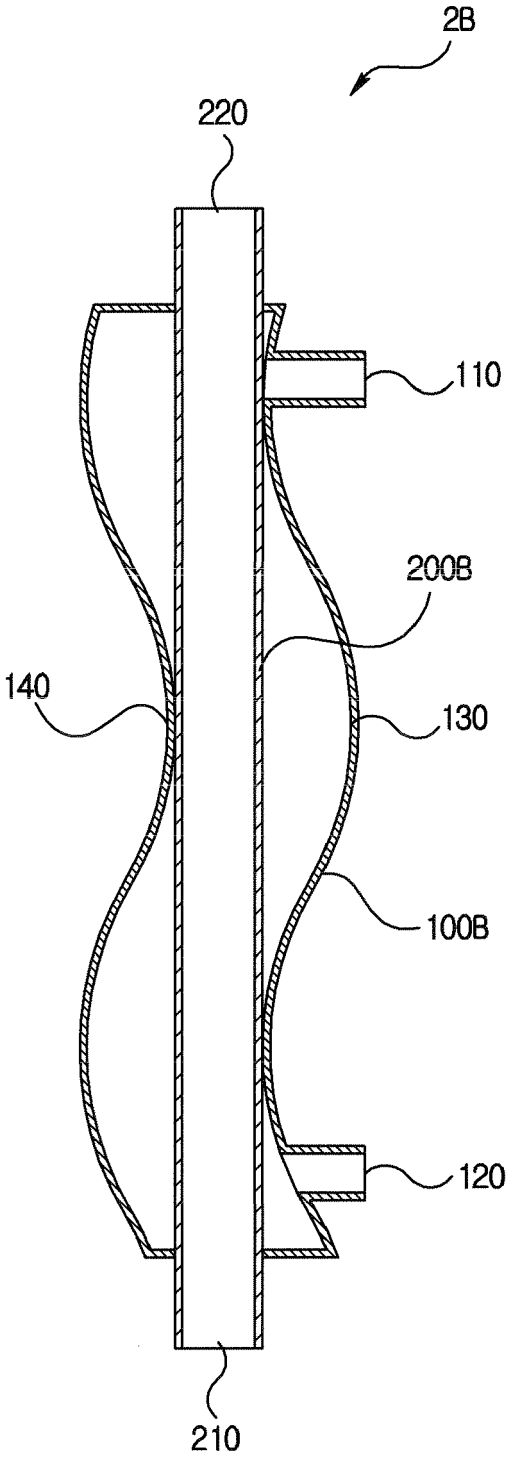

Fig. 4

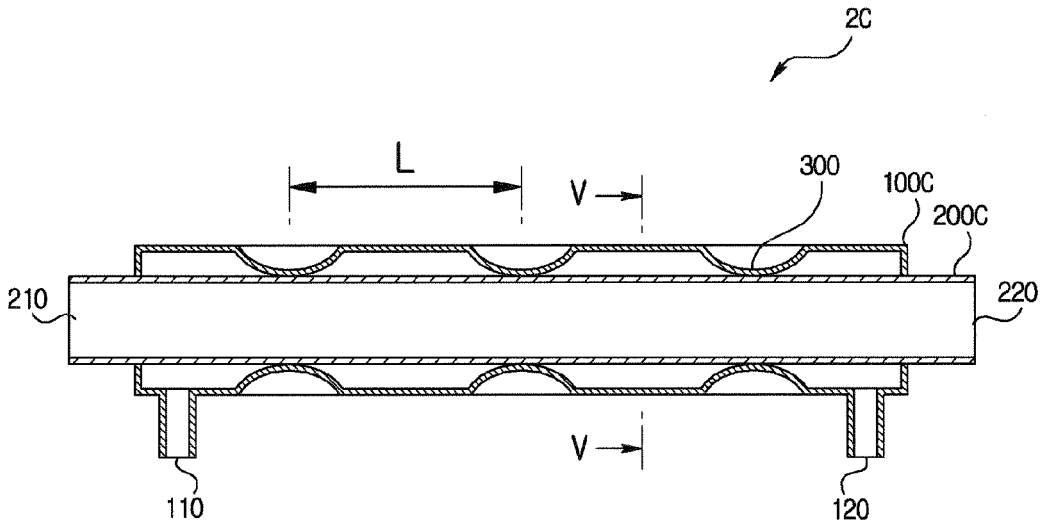

Fig. 5

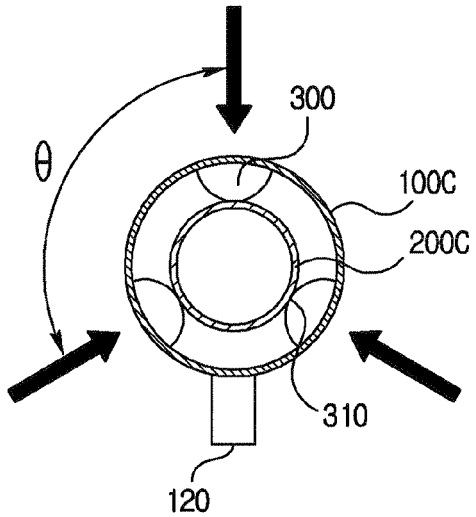

Fig. 6

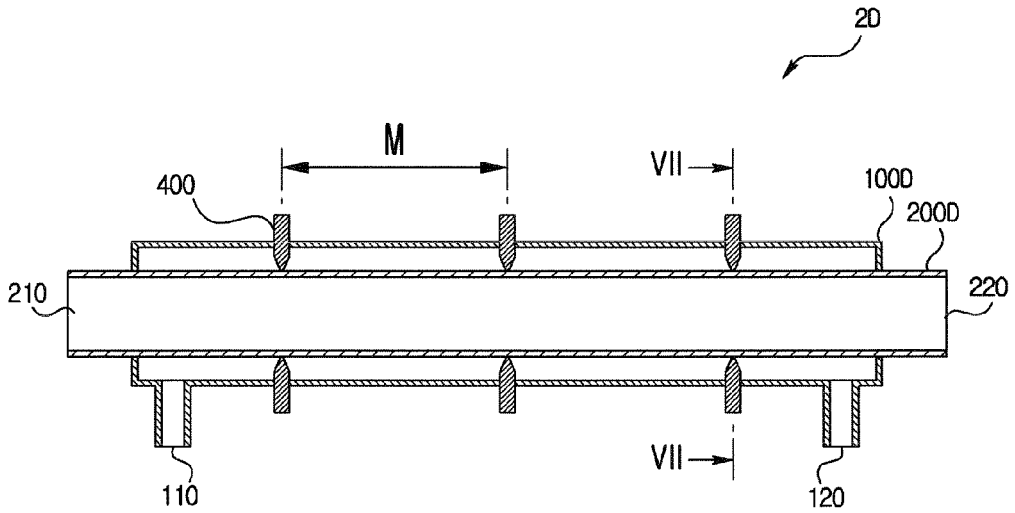

Fig. 7