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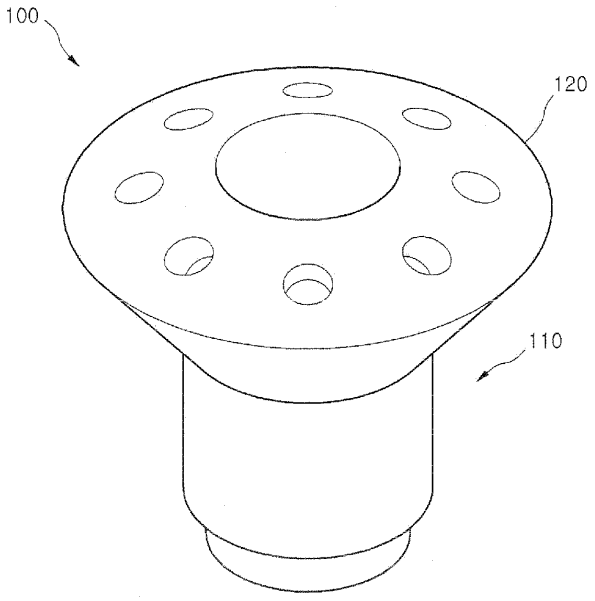
(54) Distributor and refrigerant circulation system comprising the same

(57) The embodiment provides a distributor (30) and refrigerant circulation system comprising the same. A distributor that distributes a refrigerant which flows in through an inlet pipe to a plurality of outlet pipes by the distributor includes: an inlet flow passage (111) on which liquid and gaseous refrigerants that flows in from the inlet pipe flows; a distribution flow passage (121) that receives the liquid and gaseous refrigerants which flow in to the inlet flow passage and distributes the received liquid and gaseous refrigerants to the plurality of outlet pipes; and a distribution projection (125) that evenly distributes the refrigerant to the outlet pipe through the distribution unit.

FIG.2



EP 2 184 564 A2

Description

[0001] The embodiment relates to a distributor, and more particularly, to a distributor which allows inputted liquid and gaseous refrigerants to evenly flow and be discharged and a refrigerant circulation system comprising the same.

[0002] In general, an air conditioner is a home appliance that cools or heats a predetermined space by using a refrigeration system using characteristics depending on changes in pressure and temperature of refrigerants.

[0003] FIG. 1 is a configuration diagram schematically showing a general refrigeration system.

[0004] Referring to FIG. 1, the refrigeration system includes a compressor 10 that compresses the refrigerant in a high-temperature and high-pressure gaseous state, a condenser 20 that condenses refrigerant compressed by the compressor 10 into a liquid state by heat radiation using air blowing of a cooling fan 22, a capillary tube 40 that expands the liquid refrigerant condensed by the condenser 20 into low-pressure liquid refrigerant by a throttle operation, a distributor 30 that evenly distributes the liquid refrigerant condensed by the condenser 20 to the capillary tube 40, and an evaporator 50 that evaporates the low-temperature and low-pressure refrigerant expanded by the capillary tube 40 into low-temperature and low-pressure gaseous refrigerant at the same time when providing cool air by using evaporation latent heat while evaporating the low-temperature and low-pressure refrigerant expanded by the capillary tube 40 by air blowing of the cooling fan 52. Accordingly, the refrigeration system of the air conditioner cools a room by a series of cooling cycles constituted by the pressure 10, the condenser 20, the distributor 30, the capillary tube 40, and the evaporator 50.

[0005] Meanwhile, the distributor 30 includes an inlet flow passage that is in communication with the capillary tube 40 and the evaporator 50, more specifically, a plurality of distribution flow passages that are in communication with a plurality of tubes constituting the evaporator 50. In addition, the inlet flow passage and the distribution flow passages are in communication with each other, such that the liquid refrigerant that flows in the inlet flow passage through the inlet flow passage is distributed into tubes of the evaporator 50 through the distribution flow passages.

[0006] However, by the distributor in the related art, the following problem occurs.

[0007] As described above, the refrigerant that flows in the inlet flow passage in part includes the liquid refrigerant and the gaseous refrigerant. However, since the liquid refrigerant and the gaseous refrigerant have specific gravities different from each other, the liquid refrigerant and the gaseous refrigerant that flow in the inlet flow passage through the capillary tube 40 are not evenly mixed with each other and the liquid refrigerant flows in some of the tubes of the evaporator 50 and the gaseous refrigerant flows in other tubes of the evaporator 50 through the distribution flow passage, such that the efficiency of a heat exchange cycle is deteriorated.

[0008] The embodiment relates to a distributor. In the present invention, refrigerant that flows in from an inlet pipe flows through an inlet flow passage of the distributor to be thus transferred to the distribution flow passage of the distributor, such that the refrigerant flows on the distribution flow passage to be evenly distributed and transferred to a plurality of outlet pipes. Accordingly, according to the present invention, the refrigerant that flows in through an inlet pipe by the distributor is evenly distributed to the plurality of outlet pipes.

FIG. 1 is a configuration diagram of a general cooling cycle;

FIG. 2 is a perspective view showing an embodiment of a distributor according to the present invention;

FIG. 3 is an exploded cross-sectional view of an embodiment of the present invention;

FIG. 4 is a cross-sectional view of an embodiment of the present invention; and

FIG. 5 is a cross-sectional view showing a process in which refrigerant is distributed by an embodiment of a distributor according to the present invention.

[0009] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings.

[0010] In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific preferred embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is understood that other embodiments may be utilized and that logical structural, mechanical, electrical, and chemical changes may be made without departing from the scope of the invention. To avoid detail not necessary to enable those skilled in the art to practice the invention, the description may omit certain information known to those skilled in the art. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims.

[0011] Hereinafter, a distributor and a refrigeration circulation system comprising the same according to an embodiment of the present invention will be described in detail with reference to the accompanying drawings.

[0012] FIG. 2 is a perspective of a distributor according to an embodiment of the present invention. FIG. 3 is an exploded cross-sectional view according to an embodiment of the present invention. FIG. 4 is a cross-sectional view according to an embodiment of the present invention.

[0013] Referring to FIG. 2, the distributor 100 according to the present invention includes a distributor body 110 and a distributor head 120. The distributor body 110

is inserted and fixed into the distributor head 120. For example, the distributor body 110 can be fixed with being inserted into the distributor head 120 by bonding or soldering.

[0014] More specifically, the distributor body 110 is formed in a hollow cylindrical shape having generally the same diameter. Accordingly, an inner diameter and an outer diameter of the distributor body 110 generally have the same value. In addition, an inlet flow passage 111 and a mixed flow passage 113 are provided in the distributor body 110.

[0015] The inlet flow passage 111 is provided at a central portion and a lower portion of the distributor body 110 in the figure. An inlet pipe 10 (see FIG. 4) for transferring refrigerant expanded at low pressure in a capillary tube (not shown) is connected to a lower end in the figure, that is, to a upstream portion of the inlet flow passage 111. Of course, the capillary tube may be directly connected. In addition, an upper end in the figure, that is, a downstream portion of the inlet flow passage 111 is in communication with a lower end in the figure of the mixed flow passage 113. Liquid refrigerant and some gaseous refrigerant expanded by the capillary tube flow in the inlet flow passage 111.

[0016] The mixed flow passage 113 is provided at a central portion and a lower portion of the distributor body 110 in the figure. The mixed flow passage 113 has a flow cross-sectional area comparatively smaller than the inlet flow passage 111. In addition, a downstream portion of the mixed flow passage 113 is in communication with an upstream portion of a distribution flow passage 121 to be described below. The liquid and gaseous refrigerants that flow on the inlet flow passage 111 flow in the mixed flow passage 113. However, the mixed flow passage 113 has a flow cross-sectional area smaller than the inlet flow passage 111. Accordingly, the liquid and gaseous refrigerants that flow on the inlet flow passage 111 are mixed with each other. More specifically, the liquid refrigerant has a specific gravity comparatively larger than the gaseous refrigerant. Therefore, for example, like a case in which the refrigerant is transferred to the inlet flow passage 111 through the inlet pipe 10 having a J or U shape, when the liquid and gaseous refrigerants that flow in the inlet flow passage 111 flow on not a linear trajectory but a curved trajectory, the liquid refrigerant flows in one portion of the inlet flow passage 111 adjacent to an inner peripheral surface of the distributor body 110 and the gaseous refrigerant flows at the rest portion of the inlet flow passage 111. In addition, the liquid and gaseous refrigerants that flow on the inlet flow passage 111, which are partitioned from each other, flow in different directions to be mixed with each other while flowing on the mixed flow passage 113 having a flow cross-sectional area comparatively smaller than the inlet flow passage 111.

[0017] Meanwhile, the flow cross-sectional area of the mixed flow passage 113 is substantially reduced by a flow interference unit 115 provided on the top of the inner peripheral surface of the distributor body 110. The flow interference unit 115 extends radially on the top of the inner peripheral surface of the distributor body 110. Therefore, a part of the downstream portion of the inlet flow passage 111 has a diameter comparatively smaller than the rest portions of the inlet flow passage 111 by the flow interference unit 115, such that the mixed flow passage 113 may be formed. In addition, one surface of the flow interference unit 115 facing the downstream portion of the inlet flow passage 111, that is, the bottom of the flow interference unit 115 in the figure is rounded. This purpose is to prevent a vortex phenomenon from being generated by an edge between the inner peripheral surface of the distributor body 110 corresponding to the downstream portion of the inlet flow passage 111 and one surface of the flow interference unit 115 while the liquid and gaseous refrigerants are transferred to the mixed flow passage 113.

[0018] Further, a projection portion 117 is provided in the distributor body 110. The projection portion 117 of the distributor body 110 is provided on the inlet flow passage 111. An end portion of the inlet pipe 10 connected to the inlet flow passage 111 is suspended on the projection portion 117 of the distributor body 110. The projection portion 117 of the distributor body 110 is substantially formed by stepping the upstream portion and the downstream portion of the inlet flow passage 111.

[0019] Meanwhile, a lower portion in the figure of the distributor head 120, that is, the upstream portion is formed in a hollow cylindrical shape having an inner diameter corresponding to an outer diameter of the distributor body 110. In addition, an upper portion in the figure of the distributor head 120, that is, the downstream portion has a cone shape of which a diameter gradually increases in comparison with the lower portion in the figure of the distributor head 120. Of course, the upstream portion and the downstream portion of the distributor head 120 are preferably formed integrally with each other.

[0020] In addition, the distribution flow passage 121 is provided in the distributor head 120. The distribution flow passage 121 is configured to distribute the liquid and gaseous refrigerants that are mixed with each other while flowing on the mixed flow passage 113 to a plurality of tubes (not shown) constituting an evaporator (not shown). For this purpose, the distribution flow passage 121 includes a mixing unit 122 and a plurality of distribution units 123.

[0021] A lower portion in the figure of the mixing unit 122, that is, the upstream portion is in communication with the mixed flow passage 113. In addition, an upper portion in the figure of the mixing unit 122, that is, the downstream portion is in communication with lower portions in the figure of the plurality of distribution units 123, that is, upstream end portions. The upstream portion of the mixing unit 122 has a flow cross-sectional area comparatively larger than the mixed flow passage 113. It can be expected a phenomenon that the liquid and gaseous refrigerants that are mixed in the mixed flow passage 113 and transferred to the mixing unit 122 are once again

mixed. In the embodiment, the upstream portion of the mixing unit 122 has the same flow cross-sectional area as the inlet flow passage 111, but is not necessarily limited thereto and may have a flow cross-sectional area comparatively larger than the mixed flow passage 113. Further, the downstream portion of the mixing unit 122 has a flow cross-sectional area that is reduced toward the distribution unit 123. This purpose is to evenly distribute and transfer the refrigerant that flows on the mixing unit 122 to the distribution unit 123. For this, the downstream portion of the mixing unit 122 has a cone shape using a virtual plane generally perpendicularly passing through a virtual straight line parallel to a flow direction of the refrigerant. More specifically, in the downstream portion of the mixing unit 122, the top of the cone projected on the downstream portion of the mixing unit 122 is cut, such that a cross section in a direction where the refrigerant flows has a trapezoidal shape.

[0022] As described above, in the distribution unit 123, each lower portion in the figure, that is, the upstream portion is in communication with the downstream portion of the mixing unit 122. More specifically, the upstream portions of the distribution unit 123 are positioned separated from each other by a predetermined central angle on a virtual circular shape having the same circular center at the downstream portion of the mixing unit 122 corresponding to a cone-shape outer peripheral surface. In addition, an upstream end portion to a downstream end portion of the distribution unit 123 extends to slope in the direction where the refrigerant flows at a predetermined angle. In addition, the outlet pipe 20 (see FIG. 4) for transferring the refrigerant to the tube is connected to the downstream portion of the distribution unit 123.

[0023] Meanwhile, a distribution projection 125 is provided in the distributor head 120 corresponding to an inner part of the distribution flow passage 121. A part of the downstream portion of the mixing unit 122 excluding a portion which is in communication with the upstream end portion of the distribution unit 123 is projected in a direction opposite to the flowing direction of the refrigerant to form the distribution projection 125. In the embodiment, the distribution projection 125 has the cone shape as a whole, but the shape of the distribution projection 125 is not limited thereto. The distribution projection 125 is configured to evenly distribute the refrigerant that flows on the mixing unit 122 to the distribution unit 123. That is, the refrigerant that flows on the distribution unit 123 flows substantially toward the distribution unit 123 by the distribution projection 125. Further, the distribution projection 125 serves to reduce the flow cross-sectional area of the downstream portion of the mixing unit 122 which is in communication with the distribution unit 123 toward the distribution unit 123.

[0024] Further, a projection portion 127 is provided in the distributor head 120. The projection portion 127 of the distributor head 120 is provided on the distribution unit 123 adjacent to the downstream end portion of the distribution unit 123. The projection portion 127 of the distributor head 120 is a location on which an end portion of the outlet pipe 20 connected to the downstream end portion of the distribution unit 123 is suspended. The projection portion 127 of the distributor head 120 is formed by stepping the distribution unit 123.

[0025] Next, an operation of an embodiment of a distributor and a refrigeration circulation system comprising the same according to the present invention will be described in more detail with reference to the accompanying drawings.

[0026] FIG. 5 is a cross-sectional view showing a process in which refrigerant is distributed by an embodiment of a distributor according to the present invention.

[0027] Referring to FIG. 5, refrigerant expanded in a capillary tube is first transferred to an inlet flow passage 111 through an inlet pipe 10. At this time, most of refrigerants transferred to the inlet flow passage 111 are a liquid refrigerant (indicated by solid lines in the figure), but some of refrigerants are transferred to the inlet flow passage 111 as a gaseous refrigerant (indicated by dot lines in the figure). Further, the liquid refrigerant will flow on a part of the inlet flow passage 111 mainly adjacent to an inner surface of the distributor body 110 and the gaseous refrigerant will flow on the rest part of the inlet flow passage 111 by a difference in centrifugal force depending on a difference in specific gravity between the liquid refrigerant and the gaseous refrigerant.

[0028] Meanwhile, the liquid and gaseous refrigerants that flow on the inlet flow passage 111 are transferred to the mixed flow passage 113. In addition, the liquid and gaseous refrigerants transferred to the mixed flow passage 113 are mixed with each other to be transferred to the distribution flow passage 121 while flowing on the mixed flow passage 113. However, the mixed flow passage 113 has a flow cross-sectional area comparatively smaller than the distribution flow passage 121 as described above. Accordingly, the liquid and gaseous refrigerants are mixed with each other to be transferred to the distribution flow passage 121 while flowing on the mixed flow passage 113.

[0029] In addition, the liquid and gaseous refrigerants transferred to the distribution flow passage 121 are remixed in the mixing unit 122 of the distribution flow passage 121 having the flow cross-sectional area comparatively larger than the mixed flow passage 113. As such, the liquid and gaseous refrigerants that are remixed in the mixing unit 122 are transferred to the outlet pipe 20 connected to the distribution unit 123 through the distribution unit 123 of the distribution flow passage 121.

[0030] At this time, the flow cross-sectional area of the downstream portion of the mixing unit 122 is reduced toward the distribution unit 123 by the distribution projection 125. Further, the refrigerant that flows on the mixing unit 122 is substantially guided to the distribution unit 123 by the distribution projection 125. Accordingly, the refrigerant that flows on the mixing unit 122 can be evenly distributed to the outlet pipe 20 through the distribution unit 123.

[0031] Next, the refrigerant that flows on the outlet pipe 20 is transferred to tubes of an evaporator (not shown) connected to the outlet pipe 20. In addition, the refrigerant transferred to the evaporator by circulating a compressor (not shown), a condenser (not shown), a capillary tube (not shown), a distributor (not shown), and an evaporator in sequence to drive a refrigeration cycle.

[0032] In the above-mentioned embodiment, a component forming the mixed flow passage is referred to as a flow interference unit, but its name is not limited to the flow interference unit. That is, when an inlet direction of the refrigerant that flows in the inlet flow passage can be substantially changed, although the component is referred to as another name, for example, a direction converting unit, the component will be substantially the same component.

[0033] Further, in the above-mentioned embodiment, one surface of the flow interference unit facing the inlet flow passage is rounded, but is not limited thereto. That is, one surface of the flow interference unit facing the inlet flow passage may be perpendicular to the flowing direction of the refrigerant that flows on the inlet flow passage.

[0034] In a distributor and a refrigeration circulation system comprising the same according to the present invention, which are configured as described above, a refrigerant that flows in through an inlet pipe is evenly distributed and discharged to a plurality of outlet pipes. Accordingly, according to the present invention, the refrigerant that is evenly distributed to the outlet pipe is transferred to a plurality of tubes constituting, for example, an evaporator, such that it can be expected an effect in which the efficiency of a refrigeration cycle is substantially increased.

Claims

1. A distributor that distributes a refrigerant which flows in through an inlet pipe to a plurality of outlet pipes by the distributor, comprising:

   an inlet flow passage on which liquid and gaseous refrigerants that flows in from the inlet pipe flows;
   a distribution flow passage that receives the liquid and gaseous refrigerants which flow in to the inlet flow passage and distributes the received liquid and gaseous refrigerants to the plurality of outlet pipes; and
   a distribution projection that evenly distributes the refrigerant to the outlet pipe through the distribution unit.

2. The distributor according to claim 1, wherein a downstream end portion of the distribution unit extends to slope to a direction in which the refrigerant flows at a predetermined angle in a state where upstream end portions are positioned separated from each other by a predetermined central angle on a virtual circular arc having the same center.

3. The distributor according to claim 2, wherein the distribution projection is provided at one side of the distribution flow passage corresponding to the center of the virtual circular arc where the distribution unit is positioned.

4. The distributor according to claim 1, wherein the distribution projection has a cone shape that projects to an upstream portion from a downstream portion of the distribution flow passage adjacent to the distribution unit.

5. The distributor according to claim 4, wherein an outer peripheral surface of the distribution projection is separated from an outer periphery of the distribution unit at the same interval.

6. The distributor according to claim 1, further comprising:

   a flow interference unit that has a flow cross-sectional area comparatively smaller than the inlet flow passage and the distribution flow passage and interferes the liquid and gaseous refrigerants that flow on the inlet flow passage from flowing in the same direction as an inlet direction from the inlet pipe.

7. The distributor according to claim 6, wherein in the flow interference unit, a flow cross-sectional area of a part of a downstream portion of the inlet flow passage adjacent to the distribution flow passage is comparatively smaller than the flow cross-sectional area of the rest portions of the inlet flow passage.

8. The distributor according to claim 6, wherein one surface of the flow interference unit facing the downstream portion of the inlet flow passage is rounded.

9. A distributor that distributes a refrigerant which flows in through an inlet pipe to a plurality of outlet pipes by the distributor, comprising:

   a distributor body that includes an inlet flow passage on which liquid and gaseous refrigerants that flow in from the inlet pipe; and
   a distributor head that includes a distribution flow passage including a mixing unit receiving the liquid and gaseous refrigerants that flows into the inlet flow passage and a plurality of distribution units distributing the refrigerants to the plurality of outlet pipes of which upstream end portions are in communication with downstream portions of the mixing unit,

wherein the distributor head has a flow cross-sectional area reduced toward the distribution unit from the downstream portion of the mixing unit.

10. The distributor according to claim 9, wherein a part of the distributor head corresponding to the downstream portion of the mixing unit that is in communication with the upstream end portion of the distribution unit has a cone shape using a virtual plane to which a virtual straight line parallel to a flowing direction of the refrigerant perpendicularly penetrates as a bottom surface.

11. The distributor according to claim 10, wherein the upstream end portion of the distributor is positioned separated from an outer surface of the mixing unit having the cone shape by a predetermined central angle.

12. The distributor according to claim 11, wherein the distribution unit radially extends to slope to the flowing direction of the refrigerant at a predetermined angle toward the downstream end portion of the distribution unit connected with the outlet pipe at the upstream end portion of the distribution unit.

13. The distributor according to claim 9, wherein a flow cross-sectional area of the downstream portion of the mixing unit is reduced toward the distribution unit by a distribution projection formed by projecting a part of the downstream portion of the mixing unit except for a portion which is in communication with the upstream end portion of the distribution unit toward the upstream portion of the mixing unit.

14. The distributor according to claim 9, wherein the distributor body and the distributor head are fixed by welding or an adhesive.

15. A refrigeration circulation system, comprising:

at least one inlet pipe on which a refrigerant flows;
a plurality of outlet pipes that receive the refrigerant which flows on the inlet pipe; and
a distributor according to any one of claims 1 to 14 that distributes the refrigerant received from the inlet pipe to the outlet pipe.

FIG.1

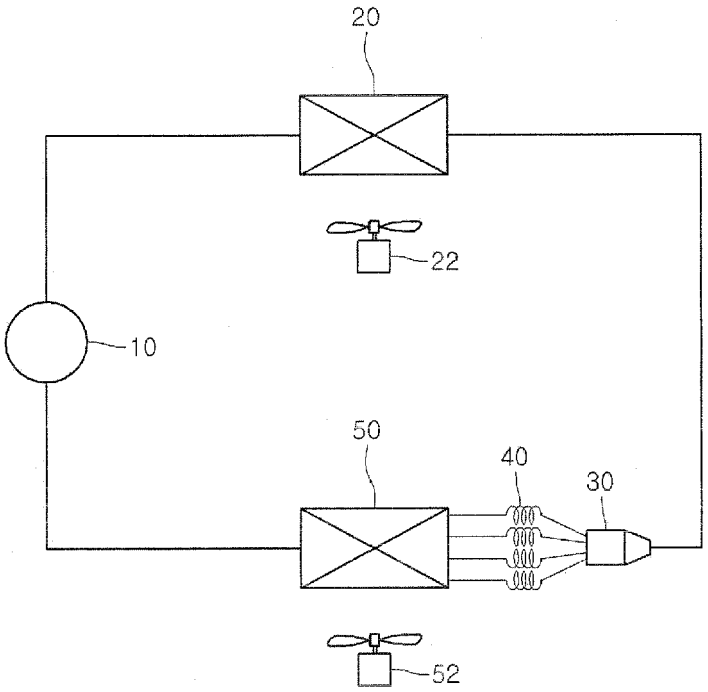


FIG.2

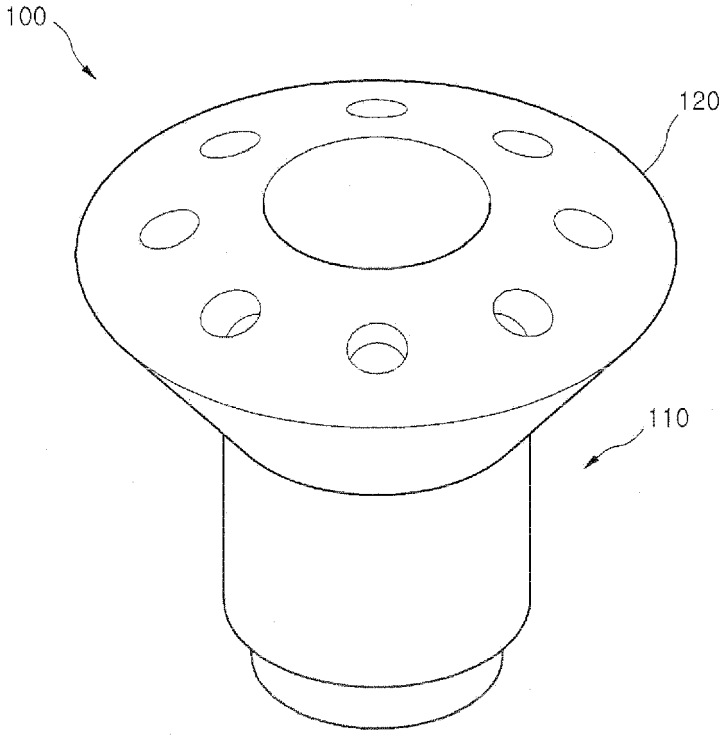


FIG.3

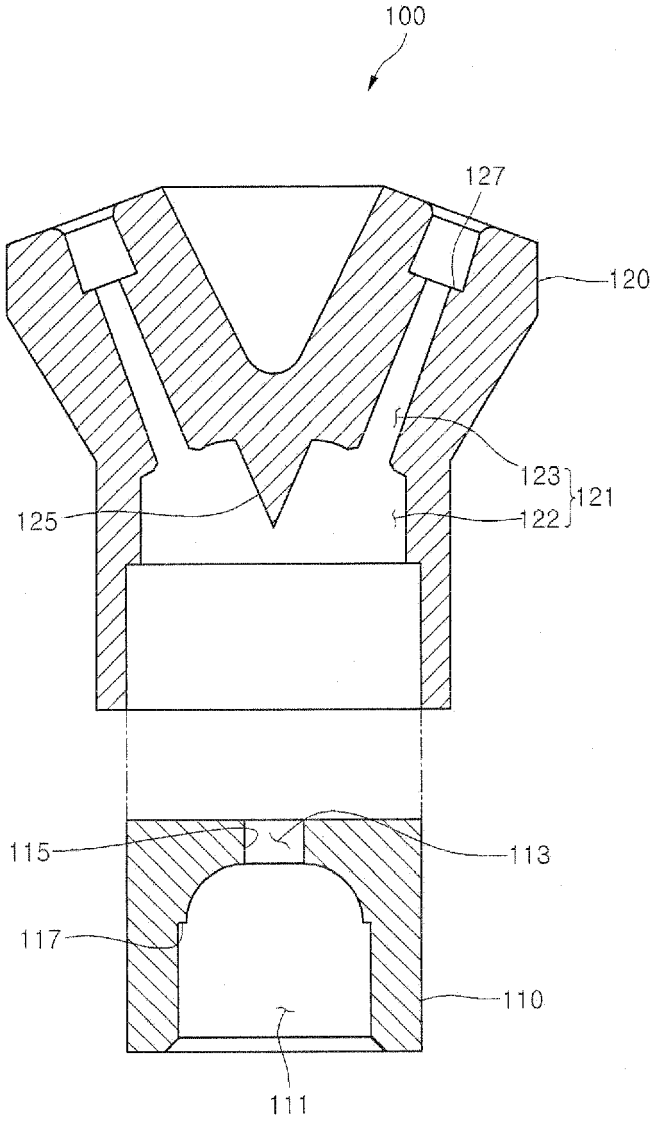


FIG.4

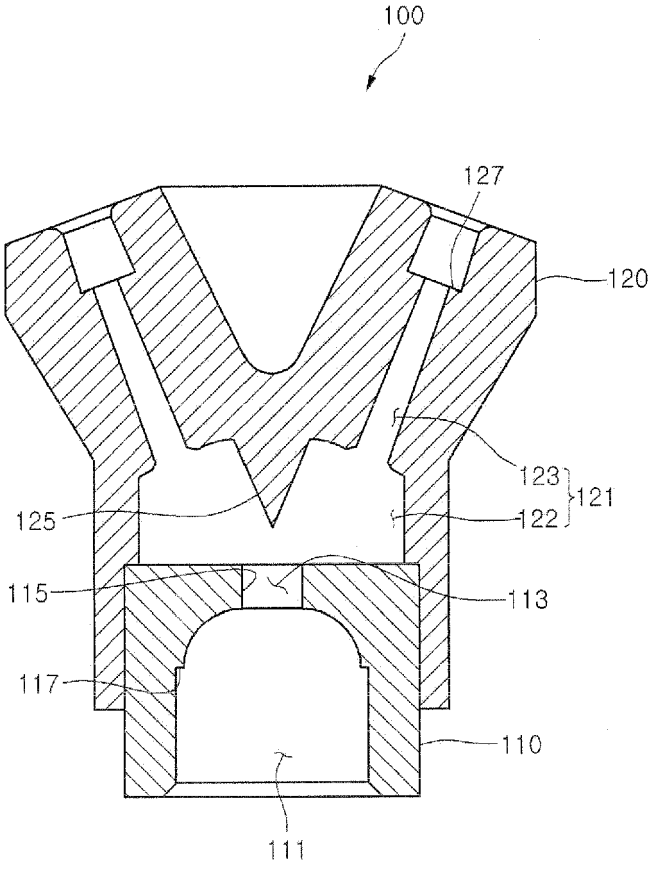


FIG.5