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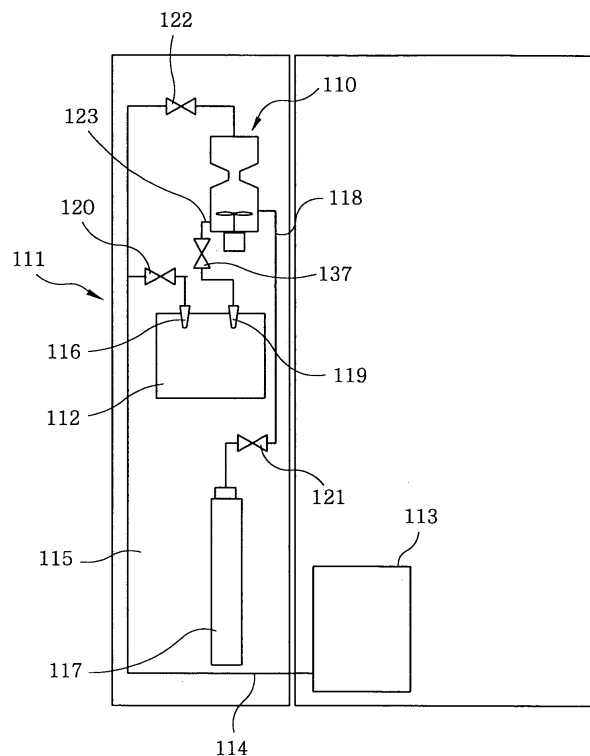
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(54) **Refrigerator including a carbonated liquid supplying unit**

(57) A refrigerator includes a carbonated liquid supplying unit. The carbonated liquid supplying unit has an agitating unit provided at a lower portion in a container for facilitating dissolution of carbon dioxide injected into

liquid supplied in the container. Alternatively, the carbonated liquid supplying unit includes a tubular main body having a configuration of a venturi tube for facilitating dissolution of carbon dioxide into water.

FIG.2



Description

[0001] The present invention relates to a refrigerator; and, more particularly, a refrigerator including a carbonated liquid supplying unit with a simpler structure capable of producing and dispensing carbonated liquid with ease.

[0002] Recently, some of home refrigerators have been designed to produce carbonated liquid by dissolving carbon dioxide into cooled water and supply it to a user through a dispenser installed to a door.

[0003] For example, U.S. Patent No. 4,866,949 discloses a conventional carbonated liquid supplying system for use in a refrigerator. Referring to Fig. 1, in the conventional carbonated liquid supplying system, a carbonator unit is located interiorally of and enveloped by an evaporator unit 50 of a closed cycle refrigerator system separate and apart from the main refrigeration system of a refrigerator 10 and which also includes a condenser 52 located in a freezer compartment 12. The reason why the carbonator unit is located in the evaporator unit 50 is that it is preferable to maintain the carbonator unit at a low temperature for keeping the carbon dioxide dissolved in water since solubility of the carbon dioxide becomes greater as temperature thereof decreases and pressure increases. Accordingly, in the conventional carbonated liquid supplying system, there is provided the separate refrigeration system including the condenser 52 and the evaporator 50 for dispensing a chilled carbonated liquid such as water or beverage from the front door of the refrigerator, so that the arrangements thereof are complicated. As a result, the manufacturing processes thereof are increased, thereby resulting in an increase in the production cost.

[0004] It is, therefore, an object of the present invention to provide a refrigerator including a carbonated liquid supplying unit with a simpler structure capable of producing and dispensing carbonated liquid with ease.

[0005] In accordance with an aspect of the present invention, there is provided a refrigerator comprising a carbonated liquid supplying unit, characterized in that: the carbonated liquid supplying unit includes: a container having a first inlet through which liquid is supplied from a liquid tank thereinto and a second inlet through which carbon dioxide fed from a carbon dioxide supply source is injected thereinto; and an agitating unit provided in the container for facilitating dissolution of carbon dioxide injected from the second inlet into liquid supplied in the container.

[0006] Preferably, the agitating unit is installed on a porous plate provided at a position spaced apart from a bottom wall of the container.

[0007] Preferably, the container has an upper portion with the first inlet and a lower portion with the second inlet, the upper and the lower portions communicating with each other through a narrow passageway; and the agitating unit is provided in the lower portion.

[0008] Preferably, the agitating unit is a rotatable

member, and the rotatable member is rotated by carbon dioxide injected thereonto through the second inlet.

[0009] Preferably, the rotatable member includes a plurality of rotatable blades.

[0010] In accordance with another aspect of the present invention, there is provided a refrigerator comprising a carbonated liquid supplying unit, characterized in that: the carbonated liquid supplying unit includes: a main body into which liquid is supplied from a liquid tank, the main body having a first section and a second section connected with each other, wherein the first section has a first inner space with a portion gradually narrowing to the second section and the second section has a second inner space communicating with the gradually narrowing portion of the first inner space of the first section; and a connection body having an inner space communicating with the second inner space of the second section of the main body, wherein carbon dioxide fed from a carbon dioxide supply source is injected through the connection body into the second inner space of the second section of the main body while liquid flows through the main body to produce carbonated liquid.

[0011] Preferably, the main body further has a third section with a third inner space communicating with the second inner space of the second section, the third inner space having a gradually enlarging portion in a liquid flowing direction.

[0012] Preferably, at least one partition wall is extended along the inner surface of the third section of the main body to resist the flow of carbonated liquid.

[0013] The above and other objects and features of the present invention will become apparent from the following description of preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 provides a schematic diagram of a conventional carbonated liquid supplying system for use in a refrigerator;

Fig. 2 shows a schematic diagram of a carbonated liquid supplying unit for use in a refrigerator in accordance with a first preferred embodiment of the present invention;

Fig. 3 describes an enlarged cross-sectional view schematically showing the carbonated liquid supplying unit in Fig. 2;

Fig. 4 sets forth a schematic diagram of a carbonated liquid supplying unit for use in a refrigerator in accordance with a second preferred embodiment of the present invention;

Fig. 5 depicts an enlarged cross-sectional view schematically showing the carbonated liquid supplying unit in Fig. 4; and

Fig. 6 illustrates a cross sectional view taken along the line VI-VI in Fig. 5.

[0014] Hereinafter, preferred embodiments of the present invention will be described with reference to the accompanying drawings.

(First embodiment)

[0015] Fig. 2 illustrates a schematic diagram of a carbonated liquid supplying unit 110 for use in a refrigerator in accordance with a first preferred embodiment of the present invention. In the carbonated liquid supplying unit 110, carbon dioxide is dissolved into chilled water to produce carbonated water which is supplied to a user through a dispenser 112 installed at a door 115 for a freezer compartment.

[0016] The chilled water is fed through a water feeding line 114 from a water tank provided in a refrigeration compartment to a nozzle 116 of the dispenser 112. The water feeding line 114 is also connected to the carbonated liquid supplying unit 110 provided in the door 115, so that water is also supplied to the carbonated liquid supplying unit 110 through a first inlet thereof. Since the carbonated liquid supplying unit 110 is provided in the freezer compartment door 115, the temperature thereof is decreased by the cooled air in the freezer compartment without using any separate refrigeration system and, therefore, solubility of the carbon dioxide is increased. Electrically controlled check valves 120 and 122 are provided on the line 114 to selectively feed water to the dispenser 112 or the carbonated liquid supplying unit 110.

[0017] A carbon dioxide supply source 117 for containing liquefied or compressed carbon dioxide is provided in the door 115, and the carbon dioxide is fed through a carbon dioxide feeding line 118 to the carbonated liquid supplying unit 110. Also, a controllable check valve 121 is provided on the line 118 in order to selectively supply carbon dioxide to the carbonated water supplying unit 110.

[0018] Referring now to Fig. 3, the carbonated liquid supplying unit 110 includes a sandglass-shaped container 130 having an upper and a lower portion 130A and 130B, a porous plate 134 provided in the lower portion 130B and an agitating unit 135 installed on the porous plate 134. The porous plate 134 is supported by an annular support member 133 protruding from the inner surface of the lower portion 130B of the container 130.

[0019] Although, in this embodiment, the upper and the lower portion 130A and 130B of the container 130 are integrally formed, they may be flange-coupled to each other by using bolts (not shown).

[0020] The agitating unit 135 serves to facilitate the dissolution of carbon dioxide into water in the lower portion 130B. In this embodiment, the agitating unit 135 is constituted by a rotatable member, e.g., rotatable blades. The rotatable blades 135 are rotatably installed on the porous plate 134 at an approximately same level as that of a second inlet of the lower portion 130B through which carbon dioxide under pressure (of, e.g., 1 to 10 atmospheres) fed via the line 118 is injected into the lower portion 130B of the container 130, so that the rotatable blades 134 are rotated by the carbon dioxide injected thereonto.

[0021] With such arrangements, by the agitating unit, i.e., by the rotation of the blades 135, the carbon dioxide injected thereonto spreads to be substantially uniformly distributed in the water remaining on the porous plate 134. Therefore, the contact of carbon dioxide with water is increased, so that the dissolution of the carbon dioxide into the water is facilitated. The carbonated water thus produced passes through pores of the porous plate 134 to be supplied to the user through, in turn, a carbonated liquid supplying line 123 and a carbonated liquid supplying nozzle 119 of the dispenser 112. A controllable check valve 137 is provided on the line 123 to selectively supply the carbonated water to the nozzle 119.

[0022] Further, in this embodiment, since the sandglass-shaped container 130 has the upper portion 130A and the lower portion 130B which communicate with each other through a narrow passageway 130C, the water in the lower portion 130B is suppressed from flowing back into the upper portion 130A by the pressure of carbon dioxide injected into the lower portion 130B. Further, as the pressure in the lower portion 130B increases, the dissolution of the carbon dioxide into the water becomes increased.

(Second embodiment)

[0023] Fig. 4 illustrates a schematic diagram of a carbonated liquid supplying unit 210 for use in a refrigerator in accordance with a second preferred embodiment of the present invention. In the second embodiment, the components identical to those in the first embodiment are presented by like reference numerals, and detailed descriptions thereon will be omitted.

[0024] Referring to Fig. 5, the carbonated liquid supplying unit 210 of the second embodiment includes a tubular main body 230 and a connection body 231. The tubular main body 230 includes an upper section 230A, a lower section 230C and an intermediate section 230B connecting them with each other. The upper section 230A has a first inner space with a portion that gradually narrows in a water flowing direction, e.g., from a certain position spaced apart from the top end of the upper section 230A to the intermediate section 230B. The intermediate section 230B has a second inner space with a diameter substantially same as that of the end of the gradually narrowing portion of the first inner space of the upper section 230A. The lower section 230C has a third inner space with a portion that is gradually enlarged in the water flowing direction, e.g., from an end thereof contacting with the intermediate section 230B to a certain position spaced apart from the other end thereof. The bottom end of the tubular main body 230 is connected through the line 123 to the nozzle 119 of the dispenser 112.

[0025] One end of the connection body 231 is connected to the intermediate section 230B of the tubular main body 230 such that the inner space thereof communicates with an inlet hole of the intermediate section

230B. The other end of the connection body 231 is connected to the carbon dioxide feeding line 118. Carbon dioxide fed via the line 118 is injected into the tubular main body 230 through the connection body 231 and the inlet hole of the intermediate section 230B to be dissolved into water flowing in the tubular main body 230. Preferably, the connection body 231 has an inner space with a portion that gradually narrows to the inlet hole of the intermediate section 230B.

[0026] With such configurations, since the tubular main body 230 has a configuration of a venturi tube, in terms of water flowing in the tubular main body 230, the pressure at the intermediate section 230B is lower than that at the upper section 230A while the velocity at the intermediate section 230B is greater than that at the upper section 230A. Accordingly, the water can be prevented from flowing back due to the carbon dioxide injected into the tubular main body 230 and the dissolution of the carbon dioxide into the water can be facilitated.

[0027] Further, referring to Figs. 5 and 6, the lower section 230C has at least one, e.g., four, partition walls 233 extended downwardly along the inner surface thereof, so that the flow of the carbonated water is subject to resistance of the partition walls 233, thereby facilitating the dissolution of the carbon dioxide into the water.

[0028] In accordance with the carbonated liquid supplying unit of the present invention, without using a separate refrigeration system for cooling the carbonated liquid supplying unit, carbonated liquid can be obtained with a simpler structure, thereby decreasing the production cost thereof.

[0029] While the invention has been shown and described with respect to the preferred embodiments, it will be understood by those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

Claims

1. A refrigerator comprising a carbonated liquid supplying unit, **characterized in that:**

the carbonated liquid supplying unit includes:

a container having a first inlet through which liquid is supplied from a liquid tank thereinto and a second inlet through which carbon dioxide fed from a carbon dioxide supply source is injected thereinto; and an agitating unit provided in the container for facilitating dissolution of carbon dioxide injected from the second inlet into liquid supplied in the container.

2. The refrigerator of claim 1, wherein the agitating unit

is installed on a porous plate provided at a position spaced apart from a bottom wall of the container.

3. The refrigerator of claim 1 or 2, wherein the container has an upper portion with the first inlet and a lower portion with the second inlet, the upper and the lower portions communicating with each other through a narrow passageway; and the agitating unit is provided in the lower portion.
4. The refrigerator of any one of claims 1 to 3, wherein the agitating unit is a rotatable member, and the rotatable member is rotated by carbon dioxide injected thereonto through the second inlet.
5. The refrigerator of claim 4, wherein the rotatable member includes a plurality of rotatable blades.
6. A refrigerator comprising a carbonated liquid supplying unit, **characterized in that:**

the carbonated liquid supplying unit includes:

a main body into which liquid is supplied from a liquid tank, the main body having a first section and a second section connected with each other, wherein the first section has a first inner space with a portion gradually narrowing to the second section and the second section has a second inner space communicating with the gradually narrowing portion of the first inner space of the first section; and

a connection body having an inner space communicating with the second inner space of the second section of the main body, wherein carbon dioxide fed from a carbon dioxide supply source is injected through the connection body into the second inner space of the second section of the main body while liquid flows through the main body to produce carbonated liquid.

7. The refrigerator of claim 6, wherein the main body further has a third section with a third inner space communicating with the second inner space of the second section, the third inner space having a gradually enlarging portion in a liquid flowing direction.
8. The refrigerator of claim 7, wherein at least one partition wall is extended along an inner surface of the third section of the main body to resist the flow of carbonated liquid.

FIG. 1
(PRIOR ART)

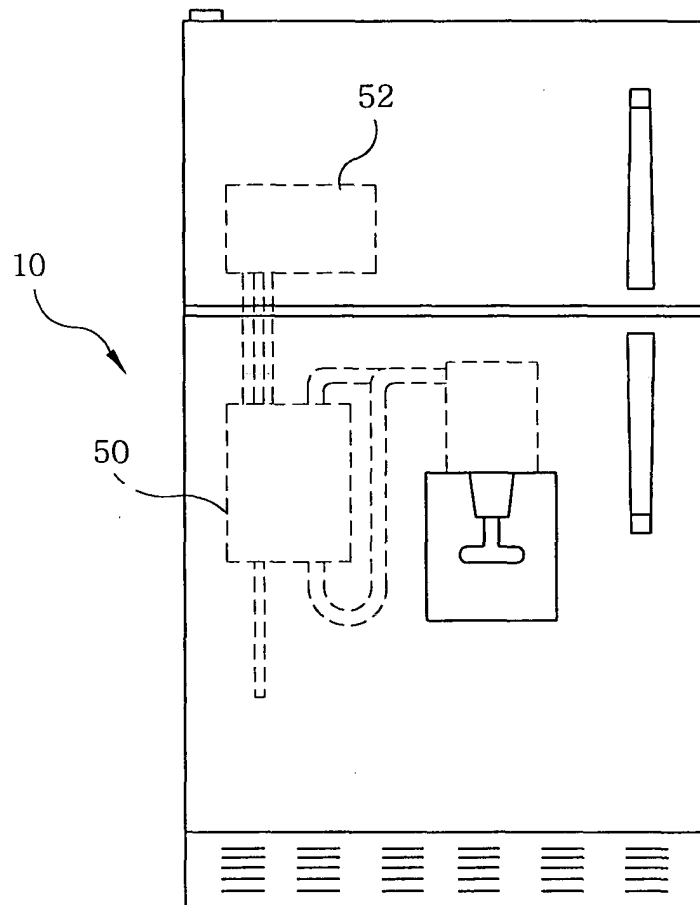


FIG. 2

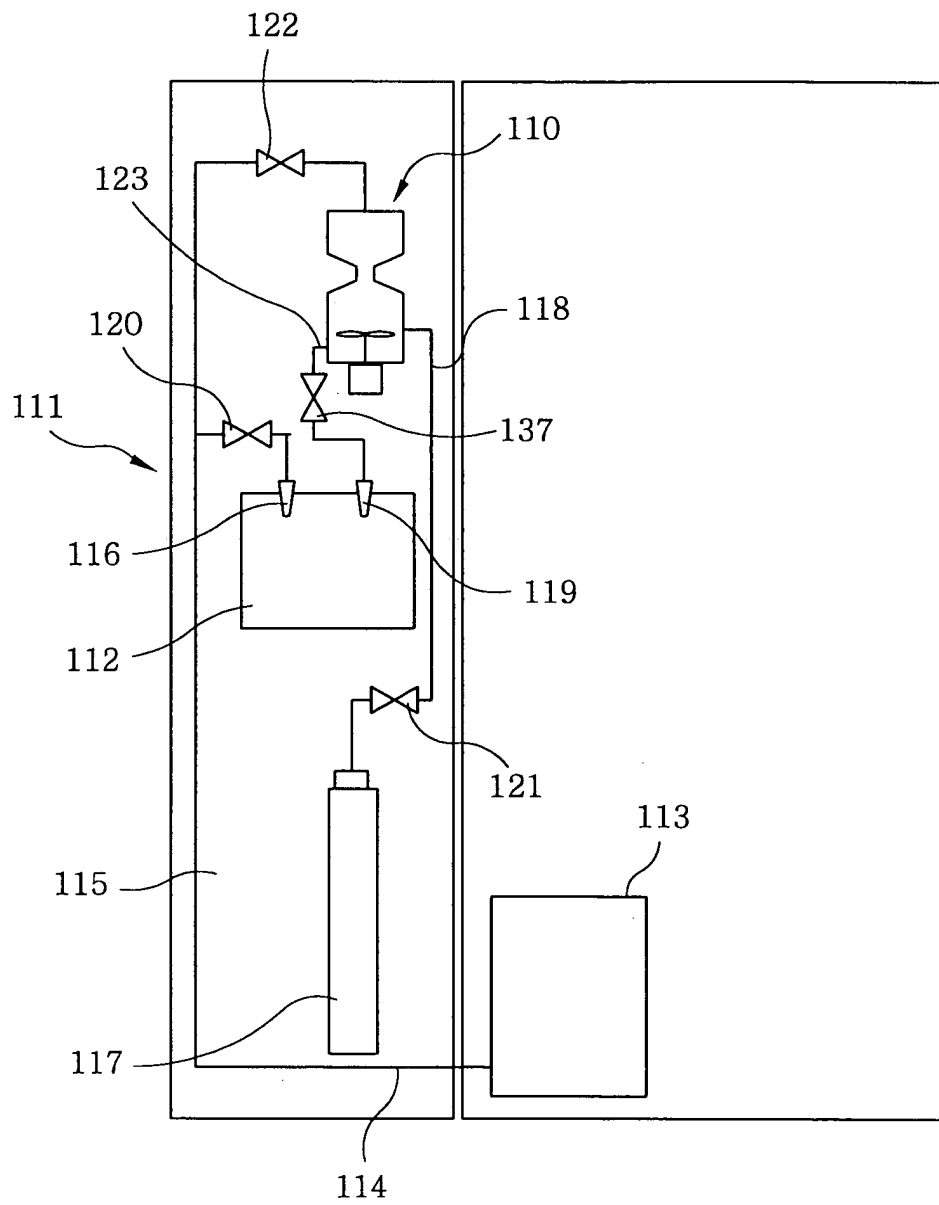


FIG. 3

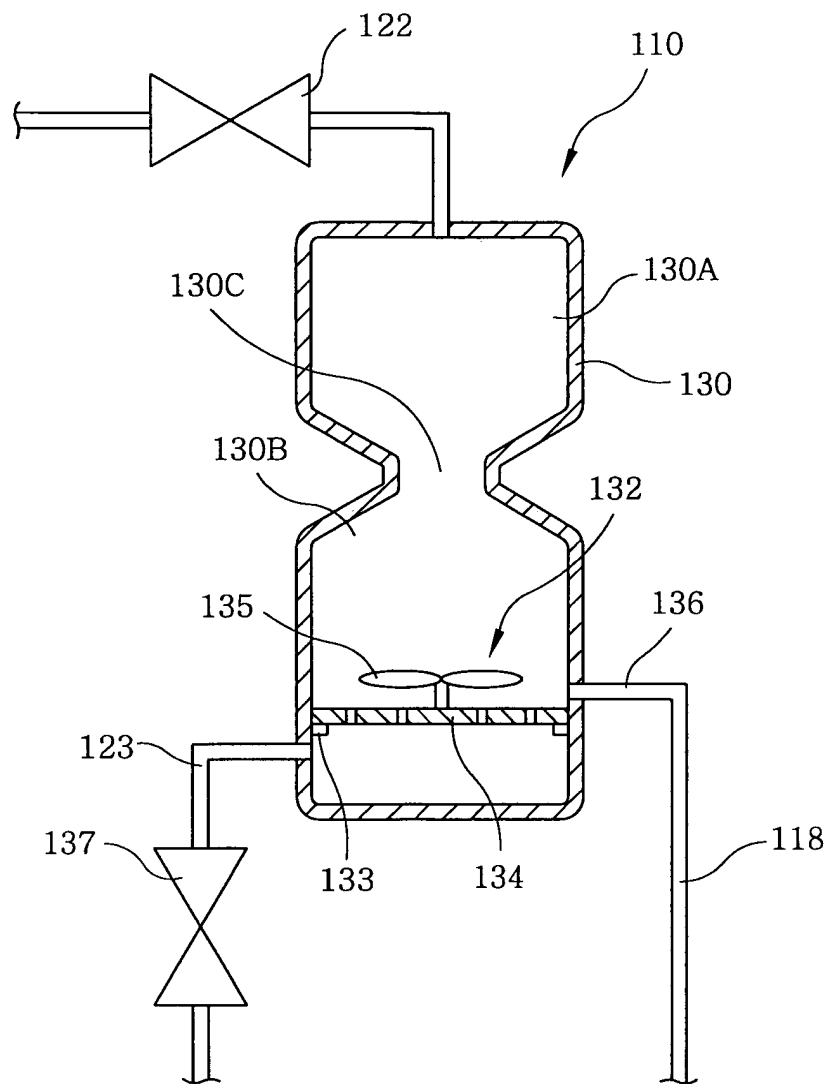


FIG. 4

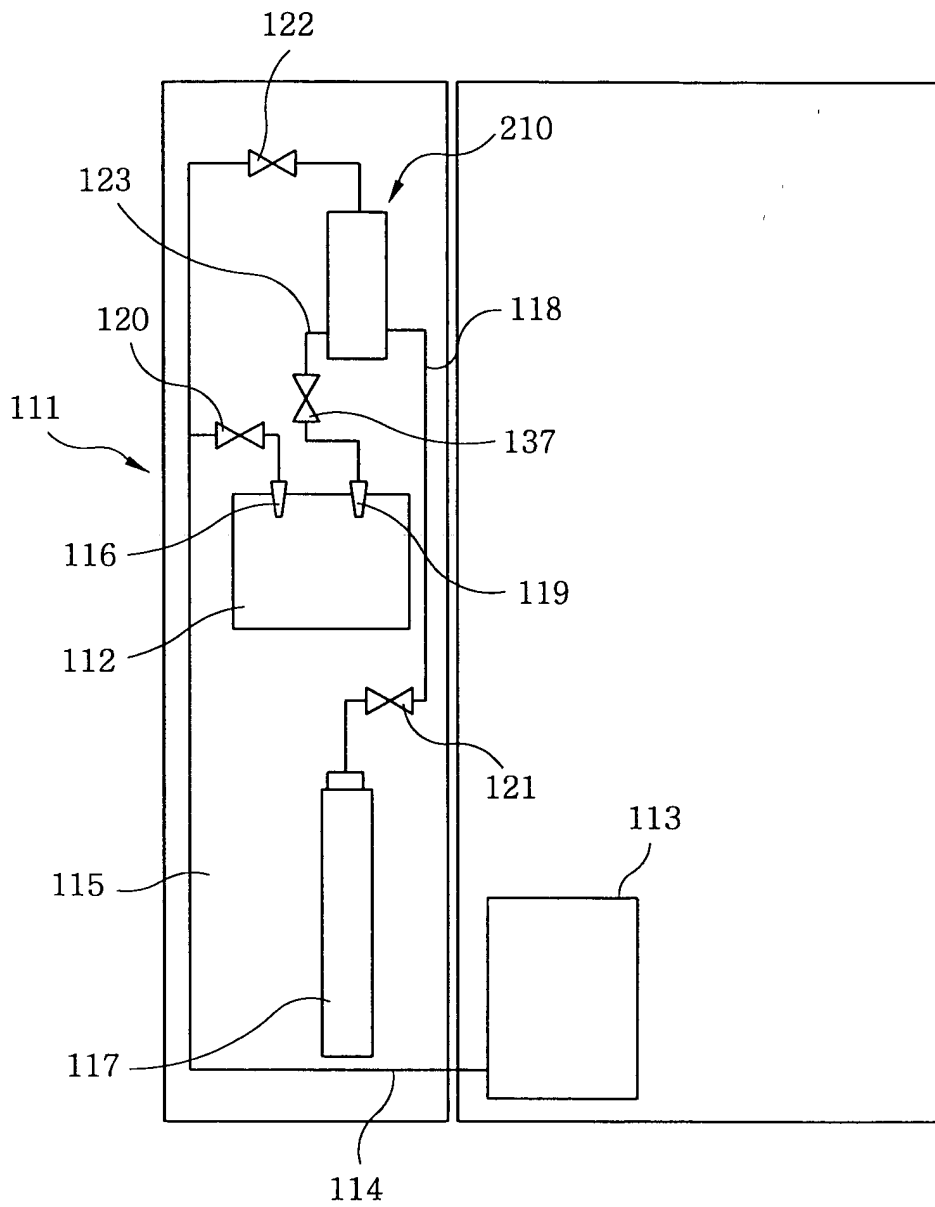


FIG. 5

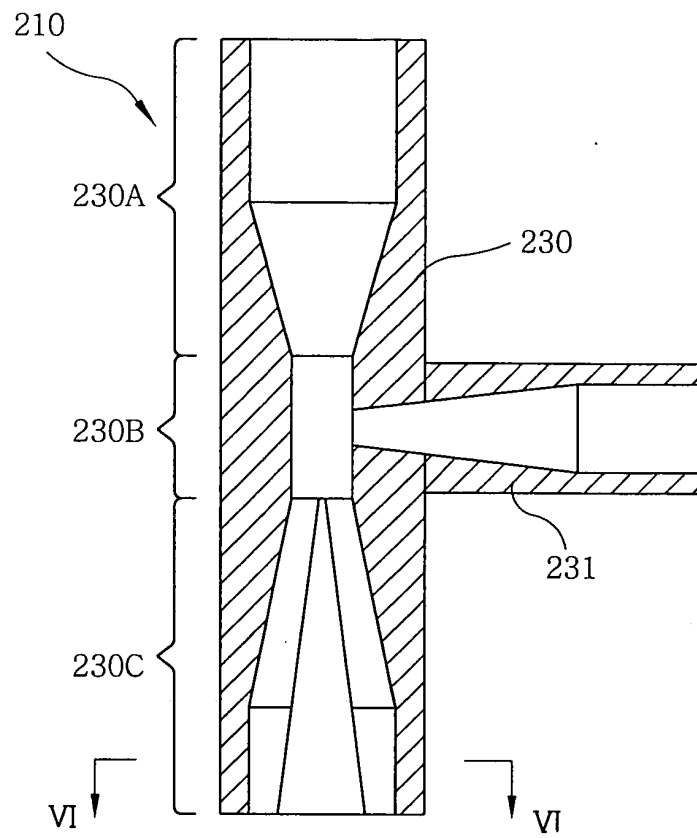
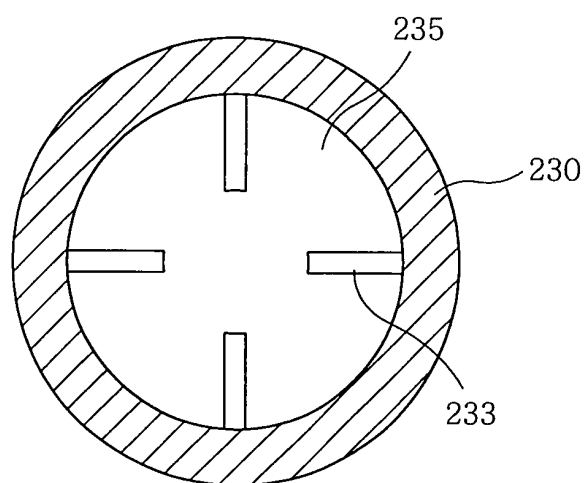


FIG. 6





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Application Number
EP 05 00 6581

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Place of search Munich		Date of completion of the search 30 June 2005	Examiner Muller, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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