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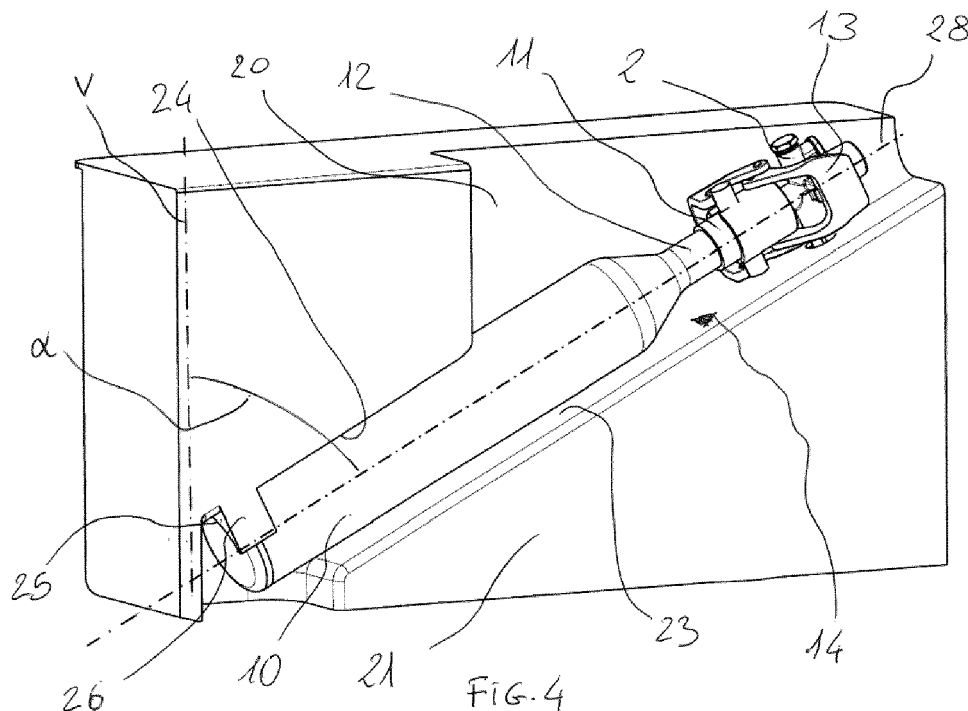
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(54) **Refrigerating appliance**

(57) A refrigerating appliance includes a body defining at least a refrigerated compartment and a carbonating gas cylinder seat (14) for receiving a replaceable gas cylinder (10) of a water carbonation system. The gas cylinder seat (14) has a longitudinal axis slanted with respect

to a vertical axis of an angle ( $\alpha$ ) lower than the maximum angle preventing liquid gas contained in a filled gas cylinder (10) from reaching a cylinder outlet (12) when said gas cylinder (10) is positioned into said gas cylinder seat (14).



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## Description

**[0001]** The invention relates to a refrigerating appliance comprising a beverage carbonator.

**[0002]** Sparkling water can be easily obtained by adding carbon dioxide (CO<sub>2</sub>) to plain water. This is normally done in domestic devices, known as water carbonators, including a gas cylinder containing liquefied CO<sub>2</sub> and a mixing vessel in which the gas delivered at a reduced pressure from the cylinder is mixed and dissolved into the water.

**[0003]** Carbonators can be used as stand-alone devices, such as the one describe in GB2190007, or they can be included in refrigerator appliances, in order to provide sparkling cold water.

**[0004]** For example, WO03098136 describes a refrigerator incorporating in its door a water dispenser within a compartment present on the outside of the door. The dispenser is connected to a water container of given capacity carried by the door and provided to enable the contained water to be carbonated via a connection to a cylinder which contains the carbonating gas and is also disposed in the door.

**[0005]** In the above disclosures, the CO<sub>2</sub> gas cylinder is mounted in the appliance in a vertical or quasi vertical orientation. This is required in order to prevent that liquid gas may flow through the distribution components such as pressure reducer devices, valves and connectors that are placed at the cylinder outlet. Only vaporized gas should flow at the cylinder outlet, otherwise liquid gas may enter the distribution components causing a drastic temperature drop while evaporating. This process, also known as lamination, may cause icing of the distribution components that are positioned at the cylinder outlet, during the gas passage.

**[0006]** Further to obstructing the gas passages, icing may cause malfunction of the pressure reducer and other distributing components.

**[0007]** Placing the gas cylinder in a vertical position resolves this issue but has other prejudicial implications, such that of imposing a strict limit to the minimum height of the appliance, which cannot be reduced below the height of the upstanding gas cylinder plus fittings.

**[0008]** Other carbonators are disclosed in US4251473, US4646797 and US4422371, relating to water carbonators including a gas cylinder which is mounted slightly slanted with respect to an upright position. This orientation is merely due to the general shape of the apparatus with no other purpose. The slant is minimal and does not provide any significant effect on the carbonator geometry.

**[0009]** As a further alternative, US331283 discloses a water carbonator including a gas cylinder which is mounted horizontal within the carbonator casing. It is unknown if and how this carbonator may resolve icing problems in the distribution circuit.

**[0010]** The technical problem faced by this invention is to provide a water carbonator and related appliances

allowing better placement in reduced height compartments.

**[0011]** In particular, in refrigerators provided with a carbonated water dispenser, the cabinet requires a special design to accommodate a CO<sub>2</sub> gas cylinder and the carbonation module is typically dimensioned with a height higher than the length of the gas cylinder, as this is accommodated in a vertical position. Clearly, this is an important constraint in the design of the appliance, and reduces the space available for the other functional parts of the appliance.

**[0012]** Another scope of the invention is to ease mounting of a water carbonator in a refrigerated cabinet such as a domestic refrigerator and the like.

**[0013]** The mentioned problems are resolved by providing a refrigerating appliance including a body in which a refrigerated compartment is defined, a carbonating gas cylinder seat, for receiving a replaceable gas cylinder having a cylinder outlet, being defined in the body, wherein the gas cylinder seat has a longitudinal axis slanted with respect to a vertical axis of an angle lower than the maximum angle preventing liquid gas contained in a filled gas cylinder from reaching the cylinder outlet when the gas cylinder is positioned into the gas cylinder seat. In other words the cylinder seat is willfully inclined to minimize its total height with a maximum slant limit with respect to the vertical axis of the appliance set by the possibility of liquid gas to reach the cylinder outlet when the gas cylinder is housed in the cylinder seat. This inclination limit must be respected with fully filled gas cylinders.

**[0014]** By providing a slanted gas cylinder seat, as taught by the present invention, integration of a water carbonator device in a refrigerator can be greatly eased and the loss of refrigerated space can be minimized.

**[0015]** According to a preferred embodiment, in order to avoid the liquid gas to reach the cylinder outlet and to have a significant reduction of space, the inclination angle is comprised between 10° and 80°.

**[0016]** In preferred embodiments of the invention a useful position of the gas cylinder seat is suggested at the corner of a rear wall and a bottom wall of the refrigerated compartment, or between two support members such as shelves or the like, or behind a drawer of the refrigerated compartment.

**[0017]** In all these mountings, the cylinder seat can be partially or totally encased in the rear wall of the cabinet, thereby minimizing its visual impact and optimizing access to the internal space of the refrigerated cabinet.

**[0018]** Furthermore this placement allows for easy insertion and easy removal of the gas cylinder for prompt replacement thereof.

**[0019]** In another preferred embodiment of the invention the gas cylinder seat may be in the form of a slot or recessed area in a rear wall of the cabinet with the proper slant to receive the cylinder in the right inclination with respect to the pressure reducer or the cylinder connection means. A stop member provided in the cylinder seat may prevent the possibility to pull out the cylinder from

a wrong side during replacement thereof. The slot shaped cylinder seat is also designed to support the cylinder and guide it into the connection system providing good accessibility during cylinder installation and replacement.

**[0020]** Preferably, the gas cylinder seat is formed as a slot in a thickened portion of a wall of the refrigerated compartment. In this manner, the cylinder seat can be easily manufactured and integrated with the structure of the refrigerated compartment.

**[0021]** Preferred non limitative embodiments of the invention will be better described below with reference to the appended drawings in which:

- Figures 1 to 3 are perspective views of a refrigerating appliance according to the invention in three different configurations;
- Figure 4 is a perspective partial view of a water carbonator of the refrigerating appliance according to the invention;
- Figure 5 is a front view of the water carbonator of figure 4 with a gas cylinder shown in cross section; and
- Figure 6 is a perspective view of the water carbonator showing all components thereof.

**[0022]** In the following description reference is made to carbon dioxide as a carbonating gas and to carbonated water as a final product. It is however intended that the invention also applies to any other liquid or whipped product dispenser as well as to any gas even different from carbon dioxide which is suitable to be dispersed in the form of gas bubbles in the product to be dispensed. Water carbonator will therefore include in general terms also these kind of devices.

**[0023]** With reference initially to Figure 1 to 3, a refrigerating appliance, such as a domestic refrigerator, comprising a water carbonator 1, is designated as a whole with the reference number 30. Typically a refrigerating appliance 30 includes a body 31 in which a refrigerated compartment 32 is defined. Further compartments such as a freezer compartment 32' may be included in the same body. According to a preferred embodiment, the water carbonator 1 is included in the refrigerated compartment 32.

**[0024]** The refrigerated compartment 32 has top and bottom walls 33, 34 as well as side walls 36, 37 and a rear wall 38. Support members 39, such as shelves, and/or drawers 40 may also be conventional parts of the refrigerating appliance 30.

**[0025]** With reference now to Figure 6, the water carbonator 1 will be described in detail.

**[0026]** According to the present embodiment, the carbonator 1 includes a pressure reducer device 2, connected via a gas line 3 to a carbonating vessel 4. A gas cylinder or bottle 10 is removably attached to the pressure reducer device 2 in order to feed carbon dioxide gas through the gas line 3, when carbonating water so re-

quires.

**[0027]** A main water line 5 feeds plain water, which can be preliminary chilled by the refrigerating appliance, to the carbonating vessel 4 by means of an inlet pump 6. Line 5 can be intercepted by means of an electro valve 7.

**[0028]** An outlet line 8 which can be intercepted by means of an electro valve 9 connects the outlet of the carbonating vessel 4 to a delivery spout (not shown) for dispensing carbonated sparkling water to users.

**[0029]** All these components are well known in the art and thus they will not be described in further details.

**[0030]** As better shown in Figure 4, the pressure reducer device 2 includes a collar 11 for receiving a gas cylinder outlet 12 and a blocking lever 13 for blocking the gas cylinder 10, together with the pressure reducer device 2, in a gas cylinder seat 14. The liquid carbon dioxide free-resting-surface level in the cylinder 10 is indicated by reference 15 in Figure 5. It is intended that above the level 15 of the liquid phase the gas cylinder 10 contains carbon dioxide only in vapor phase. Since the level 15 changes when CO<sub>2</sub> is gradually used to carbonate water, a reference level is set with reference to a fully filled cylinder, i.e. a cylinder unused and fully charged with carbon dioxide.

**[0031]** According to the present invention the gas cylinder seat 14 is slanted with respect to a vertical direction V (shown in dotted lines in Figs. 4 and 5) with an inclination angle  $\alpha$  chosen such that the reference level 10 mentioned above is always lower than the gas cylinder outlet 12, as can be seen in Figure 5. In other words the angle  $\alpha$  between a longitudinal axis 28 of the gas cylinder seat and the vertical axis V is close to but lesser than the maximum angle at which liquid gas contained in a filled cylinder placed into the seat 14 is prevented from reaching the cylinder outlet 12.

**[0032]** It should be also noticed that according to the present embodiment, the vertical axis V corresponds to a longitudinal axis of the refrigerating appliance 30.

**[0033]** With normal CO<sub>2</sub> gas cylinders the maximum inclination of the gas cylinder seat 14 ensuring this safety measure is comprised between 70° and 80°.

**[0034]** Therefore, in order to gain space vertically and at the same time satisfy the mentioned safety requirement, the angle  $\alpha$  is advantageously comprised between 10° and 80°, more preferably between 20° (to gain more space vertically) and 70° (to guarantee safety for all the most common models of gas cylinder).

**[0035]** In a preferred embodiment of the invention the gas cylinder seat 14 is defined as a slot in a parallelepiped-like housing body 21. In its lower longitudinal part, where the bottom of the gas cylinder 10 is hosted, the seat 14 is delimited by a back wall 20, a bottom wall 23 (which however does not extend to the lower end of the seat 14) and a top wall 24, while it is open on front. The bottom and the top walls 23, 24 are slanted as axis 28 and are spaced from each other substantially as (more precisely, slightly more than) the diameter of the gas cylinder 10. In this way, the gas cylinder 10 can be at least

partially nested within that space. In its upper longitudinal part, where the top of the gas cylinder 10 (provided with the collar 11 and the blocking lever 13) is hosted, the seat 14 is delimited by the back wall 20 and the bottom wall 23, while it is open on front and on top. The open front side facilitates accommodation of the gas cylinder 10.

**[0036]** A stop member 25 is formed at the bottom end of the cylinder seat 14 so that the gas cylinder 10 is abutted against it when properly positioned into seat 14. Thus, the bottom of gas cylinder 10 is held by stop member 25 and is prevented from sliding down in the seat 14 or pulled out without releasing the blocking lever 13.

**[0037]** The stop member 25 has a side wall 26 extending across the open front side of the slot defined by the gas cylinder seat 14 from top wall 24 toward bottom wall 23. The extension thereof is limited to a fraction of the width of the slot, just enough to prevent the gas cylinder 10 from falling out of the cylinder seat 14 as previously explained.

**[0038]** The pressure reducer device 2 is located in the seat 14 opposite the stop member 25 to receive the cylinder outlet 12 when a gas cylinder 10 is properly positioned into the gas cylinder seat 14.

**[0039]** With reference again to Figures 1 to 3, the housing body 21 of the water carbonator 1 is positioned adjacent to the bottom wall 34 and adjacent to the rear wall 38 of the refrigerating appliance. Preferably, the housing body 21 is formed as a single body with the rear wall 34, i.e. the rear wall 38 includes a portion which is shaped as the housing body 21 disclosed above. While this solution is preferred, other ways to form the gas cylinder seat 14 may be used, such as simply fixing the gas cylinder 10 to the rear wall 38 by means of a latch, shoulder, profiles or combinations thereof provided that the seat is slanted to accommodate the gas cylinder 10 as specified above.

**[0040]** The carbonating gas cylinder seat 14 can be located at the rear wall 38 between two spaced apart support members 39, one of which may be the bottom wall 34 or another support member 39, as shown in Figure 2, or behind a drawer 40 equipping the refrigerating compartment 32, as in Figure 3. In all cases the spacing between the support members 39 may be conveniently reduced compared to the height of an upstanding gas cylinder 10 plus fittings, being limited only by the vertical encumbrance of the cylinder plus fittings which are oriented in a slanted position.

**[0041]** The invention offers therefore many advantages compared to water carbonator with an upstanding vertical gas cylinder.

**[0042]** One first advantage is the possibility to fit the carbonator device in reduced spaces, thereby offering a large design freedom.

**[0043]** Another advantage is the possibility to integrate a water carbonator in a refrigerating compartment using only one single space of the compartment, such as the space between two juxtaposed support members.

**[0044]** Furthermore the visual impact of the water carbonator within a refrigerating appliance is minimized and the internal available space of the refrigerated compartment is maximized.

**[0045]** Another important advantage is that of facilitating appropriate replacement of the gas cylinder in the corresponding seat.

## 10 Claims

1. A refrigerating appliance including a body (31) that defines at least a refrigerated compartment (32) and a carbonating gas cylinder seat (14) for receiving a replaceable gas cylinder (10) of a water carbonation system, **characterized in that** the gas cylinder seat (14) has a longitudinal axis slanted with respect to a vertical axis of an angle ( $\alpha$ ) lower than the maximum angle preventing liquid gas contained in a filled gas cylinder (10) from reaching a cylinder outlet (12) when said gas cylinder (10) is positioned into said gas cylinder seat (14).
2. The refrigerating appliance according to claim 1 wherein said angle ( $\alpha$ ) is comprised between 10° and 80°.
3. The refrigerating appliance according to claim 1 or 2, wherein said gas cylinder seat (14) includes a cylinder stop member (25) to which said gas cylinder (10) is abutted when positioned into said gas cylinder seat (14).
4. The refrigerating appliance according to claim 3, wherein said cylinder stop member (25) is located at a bottom end of said cylinder seat (24).
5. The refrigerating appliance according to claim 3 or 4, wherein the stop member (25) has a side wall (26) extending across an open front side of the gas cylinder seat (14).
6. The refrigerating appliance according to any of claims 3 to 5, wherein the stop member (25) has a shoulder (27) which terminates the seat bottom.
7. The refrigerating appliance according to any of the preceding claims, wherein said cylinder seat (24) is made in the form of a slot at least partially open along one of its longitudinal sides.
8. The refrigerating appliance according to any of the preceding claims, further comprising a pressure reducer device (2) located in said cylinder seat (24) to receive the cylinder outlet (12) when a gas cylinder (10) is positioned into said gas cylinder seat (14).
9. The refrigerating appliance according to any of the

preceding claims, wherein said refrigerated compartment (32) comprises walls (20) and one of said walls (20) has a thickened portion (21), and wherein said gas cylinder seat (14) is formed in said thickened portion (21).

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10. The refrigerating appliance according to any of the preceding claims, wherein said refrigerated compartment (32) comprises bottom and rear walls (34, 38).

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11. The refrigerating appliance according to claim 10, wherein said gas cylinder seat (14) is located at the corner between said bottom and rear walls (34, 38).

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12. The refrigerating appliance according to claim 10 or 11, wherein said refrigerated compartment (32) comprises at least two juxtaposed support members (39), said carbonating gas cylinder seat (14) being located at said rear wall (38) between said two support members (39).

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13. The refrigerating appliance according to claim 12, wherein at least one of said two support members (39) is a first shelf positioned in said refrigerated compartment (32), the other support member of said two support members (39) being either another shelf positioned in said refrigerated compartment (32) in a spaced apart position from said first shelf or a bottom wall of said refrigerated compartment (32).

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14. The refrigerating appliance according to any of claims 10 to 14, said refrigerated compartment (32) comprising and at least one drawer (40) movable toward and away said rear wall (38), wherein said carbonating gas cylinder seat (14) is located at said rear wall (38) behind said drawer (40).

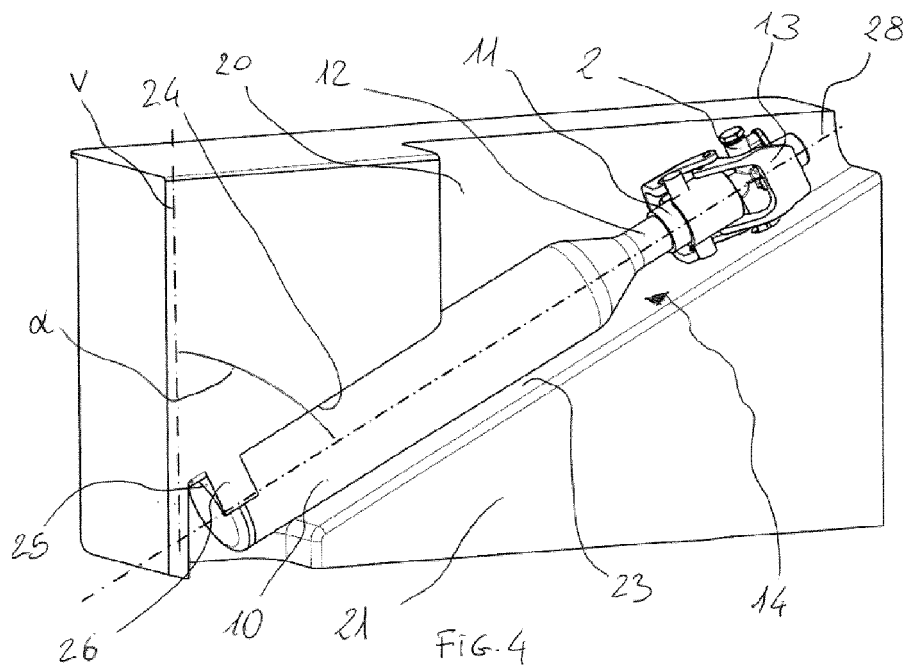
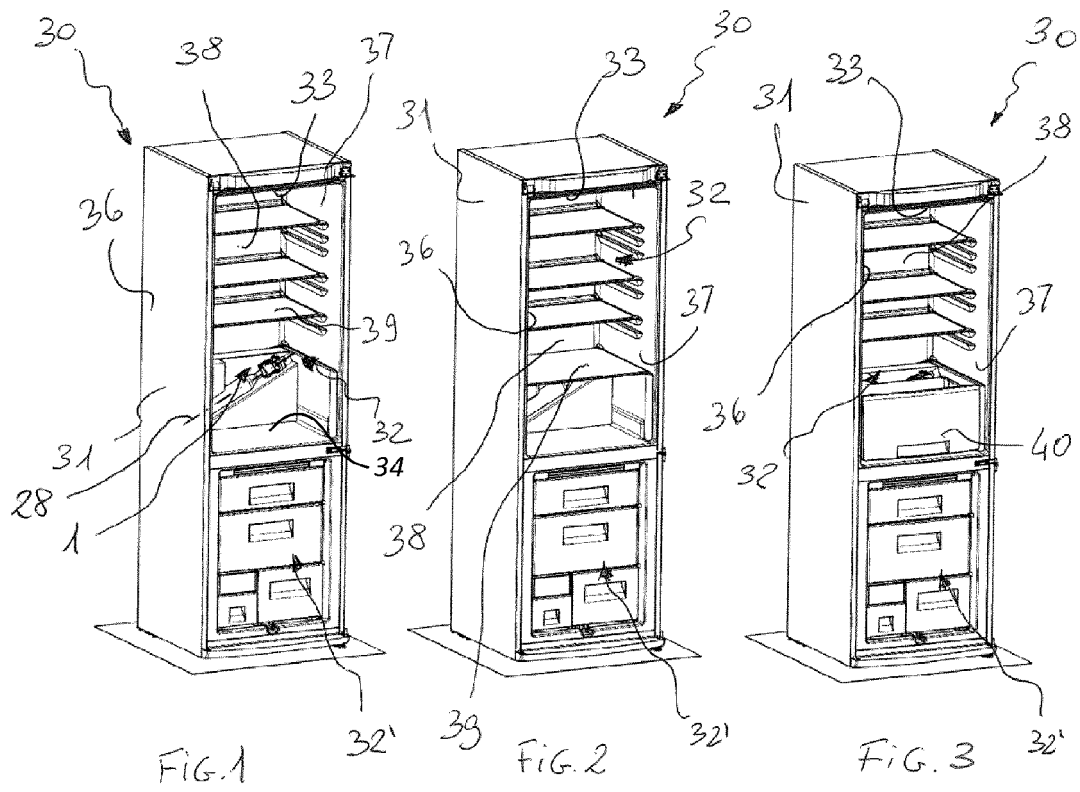
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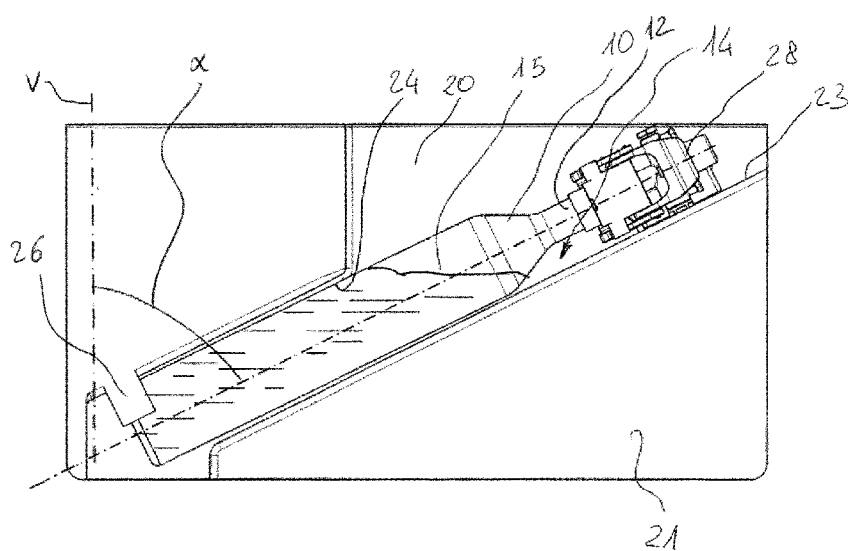


Fig. 5

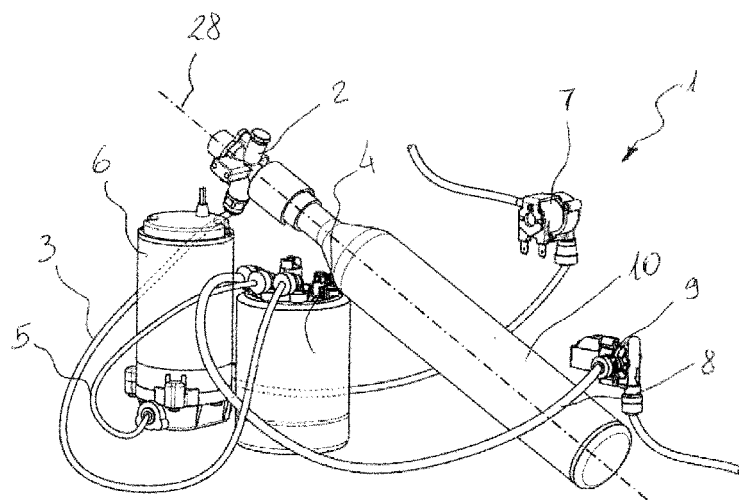


FIG. 6



## EUROPEAN SEARCH REPORT

Application Number  
EP 13 17 9678

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Place of search Munich		Date of completion of the search 8 November 2013	Examiner Jessen, Flemming
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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 &amp; : member of the same patent family, corresponding document</p>			



**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 13 17 9678

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**REFERENCES CITED IN THE DESCRIPTION**

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