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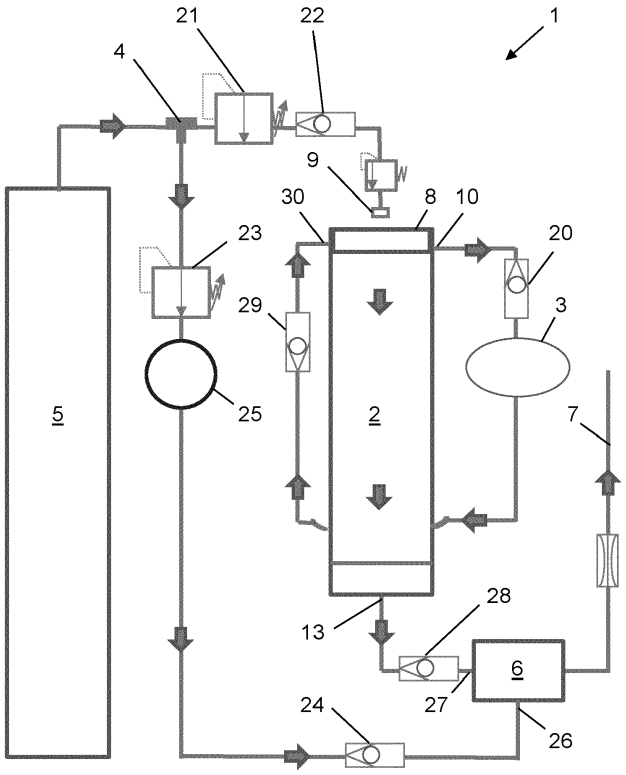
(54) **APPARATUS AND METHOD FOR ENRICHING A LIQUID WITH GAS**

(57) The present invention refers to an apparatus (1) for gas enrichment of a liquid as well to a method for gas enrichment. The apparatus (1) comprises a refillable liquid tank (2) having a tank liquid outlet (13), a gas supply port (4), and an inline mixer unit (6) having a liquid inlet (27) connectable with the tank liquid outlet (13), a mixer gas inlet (26) connectable with a gas supply port (4) and a gas enriched liquid outlet (7) for dispensing gas enriched liquid. The liquid tank (2) further comprises a tank gas inlet (9) connectable to the gas supply port (4). Optionally, the apparatus (1) further comprises a gas reservoir (3) connectable to a tank gas outlet (10) of the liquid tank (2).

Figure 4



EP 4 282 810 A1

Description

[0001] The present invention refers to an apparatus for enriching a liquid with gas, e.g. for carbonation of a liquid, for example an apparatus for in-line carbonation of water. Further, the present invention refers to a method for dispensing gas enriched liquid.

[0002] Many different systems and apparatuses for enriching gas in beverage liquids such as water are known on the market. The gas which is used to enrich the respective liquids is typically carbon dioxide (CO_2) which is introduced into a beverage container, usually a bottle, via a spout or opening of the container.

[0003] An example of such an apparatus is known from EP 0 000 813 B1 in which water may be carbonated in a water-filled pressure vessel into which pressurized CO_2 is introduced. Gas enriched water may be dispensed from the pressure vessel by introducing further (not gas enriched) water into the pressure vessel with a higher pressure than the gas enriched water in the pressure vessel, e.g. due to gravitational force. Further, DE 10 2015 213 843 A1 and US 5,124,088 A both disclose devices for carbonation of water in which pressurized CO_2 is introduced into a water-filled tank. Gas enriched water may be dispensed from this tank by means of the pressure applied by the CO_2 introduced into the tank. These known devices have in common that the amount of gas enriched water which may be dispensed is limited to the volume of the vessel or tank in which the water is carbonated by introducing pressurized CO_2.

[0004] In addition, EP 3 107 645 B1 discloses a system for in-line carbonation of water. In this system, water is fed into a main inlet of a mixing venturi nozzle by means of a pump, wherein pressurized CO_2 is fed to a side inlet of the venturi nozzle. This allows dispensing larger amounts of gas enriched water as the pump is operated and pressurized CO_2 is fed to the venturi nozzle. However, the operation of the pump requires an electrical power supply.

[0005] The need to provide a power supply or a piped water supply is perceived as disadvantageous for some applications.

[0006] Thus, it is an object of the present invention to provide a simple and reliable apparatus and method for carbonation of large quantities of liquid avoiding the drawbacks of known devices.

[0007] This object is solved by an apparatus according to claim 1 and by a method according to claim 14.

[0008] The present invention is based on the idea of using gas enriched liquid in an inline mixer to which gas and liquid are fed, while the pressure of the gas used for enriching (e.g. carbonation) is further used for feeding the liquid from a tank to the inline mixer unit. This allows operation of the apparatus without requiring electronic components and without an electronic power source. In addition, the apparatus has the benefit of being able to dispense a large amount of gas enriched liquid while being operable without connection to a water line. This makes it possible to provide the apparatus as a mobile or portable device. Still further, the relatively simple mechanical operation of the apparatus results in a high reliability.

[0009] For example, the apparatus for enriching a liquid with gas may substantially comprise a refillable liquid tank, a gas supply port and a mixer unit. The liquid tank may have a liquid outlet and may be releasably locked in the apparatus allowing replacement or refilling of the liquid tank. The mixer unit may have a liquid inlet connectable with the liquid outlet, a mixer gas inlet connectable with a gas supply port and an gas enriched liquid outlet, e.g. with a tap, for dispensing gas enriched liquid. In other words, the mixer unit may be an inline mixer for continuously mixing liquid and gas as they flow through the mixer unit. Further, the liquid tank may comprise a tank gas inlet connectable to the gas supply port. The gas supply port is connectable to a gas tank, e.g. a CO_2 bottle.

[0010] In an embodiment, the liquid inlet of the mixer unit is connected with the liquid outlet of the liquid tank via a line which may comprise a check valve and/or blocking means. Further, the mixer gas inlet may be connected with the gas supply port via a line which may comprise a pressure regulator, a control valve, a check valve and/or blocking means. Still further, the tank gas inlet may be connected with the gas supply port via a line which may comprise a pressure regulator, a control valve, a check valve and/or blocking means. The connections to the liquid tank may be made releasable permitting easy detachment of the liquid tank for refilling. In a similar manner, the gas supply port may permit easy attachment and detachment of a gas tank, like a gas bottle.

[0011] According to a further independent aspect of the present invention, the apparatus further comprises a gas reservoir connectable to a tank gas outlet of the liquid tank. The gas reservoir is a container suitable for temporarily storing pressurized gas. For example, the gas reservoir may comprise a reservoir gas inlet, a reservoir gas outlet and a reservoir space in communication with the reservoir gas inlet and the reservoir gas outlet. The reservoir space may serve to receive pressurized gas fed from the liquid tank to the gas reservoir in order to store the pressurized gas and to permit further use of the pressurized gas at a later point in time, e.g. during a subsequent operation. Optionally, the gas reservoir may further comprise an internal compartment sealed from the reservoir space by an elastically deformable membrane. This may contribute in storing more pressurized gas in the gas reservoir.

[0012] The provision of the gas reservoir is based on the idea that feeding liquid from the liquid tank to the mixer unit by means of pressurized gas, results in the liquid tank being substantially filled with the pressurized gas as the liquid tank gets empty. Generally, the pressurized gas may be simply dispensed into the ambient air when refilling the liquid tank. However, as replacement of an empty gas bottle costs time and money, it is preferred to save at least a portion of

the pressurized gas in the liquid tank by releasing it into the gas reservoir where it is stored and may be further used.

[0013] In more detail, the gas reservoir may be connected to the tank gas outlet via a valve and/or a blocking device to be selectively closed at least during dispensing gas enriched liquid and to be selectively opened at least at the beginning of a refilling step. Such a refilling step may initially comprise unlocking of the liquid tank form the apparatus or its housing, thereby blocking or disconnecting the gas supply port from the tank gas inlet and permitting a fluid communication between the liquid tank and the gas reservoir. In an embodiment, the liquid tank may comprise a lid detachable from the liquid tank for refilling, wherein a fluid connection between the liquid tank and the gas reservoir is blocked when the lid is air-tight sealed to the liquid tank and when the lid is fully removed from the liquid tank, and wherein the fluid connection between the liquid tank and the gas reservoir is established when the lid is partially lifted from the liquid tank.

[0014] Optionally, the liquid tank comprises an annular sealing surface for sealing abutment with an annular counter sealing surface of the lid wherein the tank gas outlet is arranged in the counter sealing surface. Thus, the tank gas outlet is closed by the sealing surface of the liquid tank if the sealing surface of the liquid tank abuts the counter sealing surface of the lid and automatically opens if the counter sealing surface of the lid is lifted from the sealing surface of the liquid tank. In an example, the lid may be attached to the liquid tank by means of a bayonet coupling permitting in one relative position of the lid relative to the liquid tank that the lid is slightly lifted from the liquid tank due to the internal pressure of the gas in the liquid tank, while still retaining the lid on the liquid tank. This may occur automatically when unlocking the liquid tank from the apparatus prior to exchanging or refilling the liquid tank.

[0015] A first option for using the pressurized gas retained in the gas reservoir, is to reintroduce the gas into the liquid tank after the liquid tank has been refilled. This avoids that excessive amounts of additional pressurized gas have to be used to build up feeding pressure in the liquid tank after refilling the liquid tank. Thus, the gas reservoir may comprise a reservoir gas outlet connectable to the tank gas inlet and/or to an optional further tank gas inlet. Preferably, the connection between the gas reservoir and the liquid tank is established automatically during or after locking the liquid tank in the apparatus. For example, the tank gas inlet and/or to an optional further tank gas inlet comprises a blocking valve which is opened if the sealing surface of the liquid tank abuts the counter sealing surface of the lid, thereby connecting the gas reservoir with the interior of the liquid tank.

[0016] A second additional or alternative option for using the pressurized gas retained in the gas reservoir, is to feed the gas into the inline mixer unit for enriching the liquid. This may include use of the pressurized gas for the inline gas enriching during dispensing gas enriched liquid and/or the use of the pressurized gas as a gas enriching booster in addition to the pressurized gas fed to the mixer unit from the gas supply port, i.e. for increasing the degree of gas enrichment. In this respect, the gas reservoir may comprises a reservoir gas outlet connectable to the mixer gas inlet and/or to a further mixer gas inlet. In more detail, the mixer gas inlet and/or the further mixer gas inlet may comprise a blocking valve operable by a user operated switch button.

[0017] Dispensing and at the same time gas enriching liquid may be facilitated if a first a pressure regulator is provided between the gas supply port and the tank gas inlet, wherein a second a pressure regulator is provided between the gas supply port and the mixer gas inlet wherein the first pressure regulator is set to a higher pressure than the pressure of the second pressure regulator. For example, the first pressure regulator may be set to about 4.5 bar while the second pressure regulator may be set to about 4.0 bar. The difference between the pressure to which the pressure regulators are set may be above 0.1 bar, e.g. at least 0.2 bar, preferably between 0.3 bar and 2.5 bar. The pressure to which the first pressure regulator is set may be above 1.5 bar, e.g. at least 2.0 bar, preferably between 3.0 bar and 7.0 bar.

[0018] The apparatus may further comprise a filter provided in the liquid outlet or interposed between the liquid outlet and the mixer liquid inlet. Preferably, the filter is a replaceable filter cartridge for cleaning the liquid fed from the liquid tank to the inline mixer unit.

[0019] Still further, the apparatus may comprise a housing encasing, at least partially, the refillable liquid tank, the gas supply port, the mixer unit and/or the gas reservoir. The housing may comprise latching means for releasably locking the liquid tank and/or a gas tank into the housing. A tap for dispensing gas enriched liquid from the gas enriched liquid outlet and, optionally, a user operable switch button may be accessible from outside the housing to allow operation of the apparatus. For example, a user may dispense gas enriched liquid from the apparatus simply by opening the tap such that gas enriched liquid is dispensed until either the liquid tank or the gas tank runs empty. As the apparatus is operable without external liquid supply or electricity, use of the apparatus is simple and reliable. An optional booster switch button may be used to increase the degree of gas enrichment by feeding additional pressurized gas and/or gas with higher pressure into the inline mixer unit.

[0020] According to a further aspect of the present invention, a method for producing and dispensing gas enriched liquid comprises the steps of: providing liquid in a refillable liquid tank, providing gas in a gas tank, introducing gas from the gas tank into the liquid tank, thereby dispensing liquid from the liquid tank to an inline mixer unit provided downstream of the liquid tank, introducing gas from the gas tank into the mixer unit, thereby enriching the liquid with gas, and dispensing gas enriched liquid, e.g. by operating a dispensing tap. Preferably, the method further comprises the steps of: releasing gas from the liquid tank into a gas reservoir prior to refilling the liquid tank, and furthermore at least one of the following

features i) and ii):

i) releasing gas from the gas reservoir into the liquid tank after refilling the liquid tank; and/or
ii) releasing gas from the gas reservoir into the mixer unit during gas enrichment of the liquid.

[0021] For example, the step i) of releasing gas from the liquid tank into a gas reservoir prior to refilling the liquid tank may take place as a lid of the liquid tank is lifted from the liquid tank, thereby establishing a fluid connection between the liquid tank and the gas reservoir.

[0022] While the present invention is generally described with respect to gas enrichment of a liquid, in a preferred embodiment the liquid is water and the gas is CO_2, i.e. the apparatus and method are suitable for dispensing and carbonation of water.

[0023] Non-limiting, exemplary embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 shows in a cross-sectional view a liquid tank of an apparatus according to the present invention;

Figure 2 shows in a side view the liquid tank of Figure 1;

Figure 3 shows in a cross-sectional view a gas reservoir of an apparatus according to the present invention;

Figure 4 shows a flowchart of a first embodiment of an apparatus according to the present invention; and

Figure 5 shows a flowchart of a second embodiment of an apparatus according to the present invention.

[0024] Figures 1 to 3 show components of an apparatus 1 for dispensing and enriching liquid, namely a liquid tank 2 (Figures 1 and 2) and a gas reservoir 3 (Figure 3). As shown in Figures 4 and 5, the apparatus 1 further comprises a gas supply port 4 which is releasably connectable with a gas tank 5, like a CO_2 bottle, and an inline mixer unit 6 located downstream of the liquid tank 2 and the gas supply port 4. Gas enriched liquid may be dispensed from a dispensing tap 7 located downstream of the inline mixer unit 6. The components of the apparatus 1 may be fully or partially received in a housing (not shown).

[0025] In the depicted embodiment, the liquid tank 2 is a substantially cylindrical container with a removable lid 8 attached to the liquid tank 2 e.g. by bayonet coupling means. An, e.g. centrally arranged, tank gas inlet 9 and an , e.g. laterally arranged, tank gas outlet 10 are provided in the lid 8. The cylindrical container of the liquid tank 2 has an annular sealing surface 11 facing upwards in Figure 1, whereas the lid 8 comprises an annular sealing counter-surface 12 arranged to abut the sealing surface 11 when the lid 8 is firmly attached to the cylindrical container of the liquid tank 2. The tank gas outlet 10 is arranged opening into the annular sealing counter-surface 12 facing towards the sealing surface 11. Thus, the tank gas outlet 10 is closed by abutment with the sealing surface 11 when the lid 8 is firmly attached to the cylindrical container of the liquid tank 2. On the other hand, the tank gas outlet 10 is opened when the lid 8 is slightly lifted from the sealing surface 11 of the cylindrical container of the liquid tank 2. Still further, the liquid tank 2 has at its lower end a tank liquid outlet 13. An optional filter 14, e.g. a disk-shaped replaceable filter cartridge, may be located in the tank liquid outlet 13.

[0026] The gas reservoir 3 may have a substantially spherical outer configuration with a reservoir gas inlet 15 and a reservoir gas outlet 16. In the gas reservoir 3, a reservoir space 17 is defined in communication with the reservoir gas inlet 15 and the reservoir gas outlet 16. The gas reservoir 3 further comprises an elastically deformable membrane 18 which is sealed to a shell 19 thereby defining an internal compartment within the reservoir 3. The internal compartment is sealed from the reservoir space 17 but may receive pressurized gas by deformation of the membrane 18. In the embodiment depicted in Figure 3, the membrane 18 and the shell 19 are held withing the gas reservoir 3 by a ring with support ribs such that gas may flow around the internal may be connected to the compartment between reservoir gas inlet 15 and reservoir gas outlet 16. The reservoir gas inlet 15 may be connected to the tank gas outlet 10 via a line comprising a check valve 20.

[0027] The gas supply port 4 is connected to the gas tank 5 as well as to the liquid tank 2 and to the inline mixer unit 6. At least one first pressure regulator 21 and a check valve 22 are arranged downstream of the gas supply port 4 in a gas line connectable with the tank gas inlet 9. Further, at least one second pressure regulator 23, a check valve 24 and a control valve 25 are arranged downstream of the gas supply port 4 in a gas line connectable with a mixer gas inlet 26 of the mixer unit 6. The first pressure regulator 21 is set to a higher pressure, e.g. above 4.5 bar, than the pressure of the second pressure regulator 23, e.g. 4.0 bar.

[0028] The mixer unit 6 further comprises a mixer liquid inlet 27 connectable with the tank liquid outlet 13 or the filter 14 via a liquid line which may comprise a further check valve 28.

[0029] During regular operation of the apparatus 1, the liquid tank 2 is held, e.g. locked, in the apparatus 1 and the lid 8 is firmly attached to the cylindrical container of the liquid tank 2 such that the tank gas outlet 10 is closed. With this configuration, the pressurized gas fed from the gas tank 5 via the gas supply port 4 to the liquid tank 2 feeds liquid from the liquid tank 2 to the mixer unit 6. Simultaneously, pressurized gas is fed from the gas tank 5 via the gas supply port 4 to the inline mixer unit 6 such that liquid from the liquid tank 2 and pressurized gas are mixed, i.e. the liquid is enriched with gas. The liquid enriched with gas may be continuously dispensed from the tap 7 until the liquid tank 2 and/or the gas tank 5 run empty.

[0030] For replacement or refilling of an empty liquid tank 2, the line connecting the gas supply port 4 with the tank gas inlet 9 is disconnected or blocked and the liquid tank 2 is unlocked from the apparatus 1 or its housing, thereby allowing lifting of lid 8. This opens the tank gas outlet 10 such that pressurized gas is released into the reservoir space 17 of the gas reservoir 3. The pressure of the gas may elastically deform the membrane 18 bulging into the internal compartment and the shell 19. Check valve 20 prevents that pressurized gas flows back towards the liquid tank 2 if the same is removed for refilling.

[0031] Figure 4 shows a configuration of the apparatus 1 according to a first embodiment of the invention. After re-introducing a fresh liquid filled liquid tank 2 into the apparatus, the pressurized gas stored in the gas reservoir 3 may be fed into the liquid tank 2 via a line optionally comprising a check valve 29. The gas may be introduced via the tank gas inlet 9 or via an additional gas inlet 30 which may open automatically by the pressure exerted when closing the lid 8 firmly onto the container of the liquid tank 2. Thus, pressurized gas contained in the liquid tank 2 may be re-used for feeding liquid from a refilled liquid tank 2.

[0032] Figure 5 shows a configuration of the apparatus 1 according to a second embodiment of the invention. This second embodiment has substantially the same configuration and operation as the above described first embodiment. However, the reservoir gas outlet 16 is not connected to the tank gas inlet 9 or to an additional tank gas inlet 30, but instead connected to the inline mixer unit 6 via the mixer gas inlet 26 or an additional mixer gas inlet 31. At least one further check valve 32 and/or a switch 33 may be provided in the line between the reservoir gas outlet 16 and the inline mixer unit 6. As the first pressure regulator 21 is set to a higher pressure than the pressure of the second pressure regulator 23, the gas fed from the gas reservoir 3 to the mixer unit 6 has a higher pressure than the gas directly fed from the gas supply port 4. This results in an increased gas enrichment of the liquid. Thus, pressurized gas contained in the liquid tank 2 may be re-used for enriching liquid with gas.

[0033] In a preferred embodiment, the liquid is water and the gas is CO_2.

[0034] An advantage common to both embodiments is that carbonated water may be continuously produced and dispensed from the apparatus 1 without using electrical energy or without having to connect the device to a water line. In addition, the comparatively expensive gas used for carbonation and for feeding the water is used very sparingly, as the gas available in an empty liquid tank 2 is reused.

Reference signs

1	apparatus	18	membrane
2	liquid tank	19	shell
3	gas reservoir	20	check valve
4	gas supply port	21	first pressure regulator
5	gas tank/gas bottle	22	check valve
6	inline mixer unit	23	second pressure regulator
7	tap/ gas enriched liquid outlet	24	check valve
8	lid	25	control valve
9	tank gas inlet	26	mixer gas inlet
10	tank gas outlet	27	mixer liquid inlet
11	sealing surface	28	check valve
12	sealing counter-surface	29	ckeck valve
13	tank liquid outlet	30	additional tank gas inlet
14	filter	31	additional mixer gas inlet
15	reservoir gas inlet	32	ckeck valve
16	reservoir gas outlet	33	switch
17	reservoir space		

Claims

1. Apparatus for gas enrichment of a liquid, the apparatus comprising:

    - a refillable liquid tank (2) having a tank liquid outlet (13),
    - a gas supply port (4), and
    - an inline mixer unit (6) having a liquid inlet (27) connectable with the tank liquid outlet (13), a mixer gas inlet (26) connectable with a gas supply port (4) and an gas enriched liquid outlet (7) for dispensing gas enriched liquid,

    characterized in that
    the liquid tank (2) further comprises a tank gas inlet (9) connectable to the gas supply port (4).

2. Apparatus according to claim 1, further comprising a gas reservoir (3) connectable to a tank gas outlet (10) of the liquid tank (2).

3. Apparatus according to claim 2, wherein the gas reservoir (3) is connected to the tank gas outlet (10) via a valve (20) and/or a blocking device (11) to be selectively closed at least during dispensing gas enriched liquid and to be selectively opened at least at the beginning of a liquid tank refilling step.

4. Apparatus according to claim 3, wherein the liquid tank (2) comprises a lid (8) detachable from the liquid tank (2) for refilling, wherein a fluid connection between the liquid tank (2) and the gas reservoir (3) is blocked when the lid (8) is air-tight sealed to the liquid tank (2), and wherein the fluid connection between the liquid tank (2) and the gas reservoir (3) is established when the lid (8) is partially lifted from the liquid tank (2).

5. Apparatus according to claim 4, wherein the liquid tank (2) comprises an annular sealing surface (11) for sealing abutment with an annular counter sealing surface (12) of the lid (8), and wherein the tank gas outlet (10) is arranged in the counter sealing surface (12) such that the tank gas outlet (10) is closed by the sealing surface (11) of the liquid tank (2) if the sealing surface (11) of the liquid tank (2) abuts the counter sealing surface (12) of the lid (8).

6. Apparatus according to any one of claims 2 to 5, wherein the gas reservoir (3) comprises a reservoir gas outlet (16) connectable to the tank gas inlet (9) and/or to an optional further tank gas inlet (30).

7. Apparatus according to claim 6, wherein the tank gas inlet (9) and/or to an optional further tank gas inlet (30) comprises a blocking valve which is opened if the sealing surface (11) of the liquid tank (2) abuts the counter sealing surface (12) of the lid (8).

8. Apparatus according to any one of claims 2 to 5, wherein the gas reservoir (3) comprises a reservoir gas outlet (16) connectable to the mixer gas inlet (26) and/or to a further mixer gas inlet (31).

9. Apparatus according to claim 8, wherein the mixer gas inlet (2) and/or the further mixer gas inlet (31) comprises a blocking valve operable by a user operated switch button (33).

10. Apparatus according to any one of claims 2 to 9, wherein the gas reservoir (3) comprises a reservoir gas inlet (15), the reservoir gas outlet (16) and a reservoir space (17) in communication with the reservoir gas inlet (15) and the reservoir gas outlet (16), and wherein the gas reservoir (3) further comprises an internal compartment sealed from the reservoir space (17) by an elastically deformable membrane (18).

11. Apparatus according to any one of the preceding claims, wherein a first a pressure regulator (21) is provided between the gas supply port (4) and the tank gas inlet (9), wherein a second a pressure regulator (23) is provided between the gas supply port (4) and the mixer gas inlet (26), and wherein the first pressure regulator (21) is set to a higher pressure, e.g. above 4.5 bar, than the pressure of the second pressure regulator (23), e.g. 4.0 bar.

12. Apparatus according to any one of the preceding claims, wherein a gas tank (5), e.g. a refillable CO_2 bottle, is connectable with the gas supply port (4).

13. Apparatus according to any one of the preceding claims, further comprising a filter (14) provided in the liquid outlet (13) or interposed between the liquid outlet (13) and the mixer liquid inlet (27).

14. Method for producing and dispensing gas enriched liquid, preferably by means of an apparatus according to any one of the preceding claims, the method comprising the steps of:

- providing liquid in a refillable liquid tank (2),
- providing gas in a gas tank (5),
- introducing gas from the gas tank (5) into the liquid tank (2), thereby dispensing liquid from the liquid tank (2) to a mixer unit (6) provided downstream of the liquid tank (2),
- introducing gas from the gas tank (5) into the mixer unit (6), thereby enriching the liquid with gas, and
- dispensing gas enriched liquid.

15. Method according to claim 14, further comprising the steps of:

- releasing gas from the liquid tank (2) into a gas reservoir (3) prior to refilling the liquid tank (2), and

at least one of the following features i) and ii):

i) releasing gas from the gas reservoir (3) into the liquid tank (2) after refilling the liquid tank; and/or
ii) releasing gas from the gas reservoir (3) into the mixer unit (6) during enriching the liquid with gas.

Figure 1

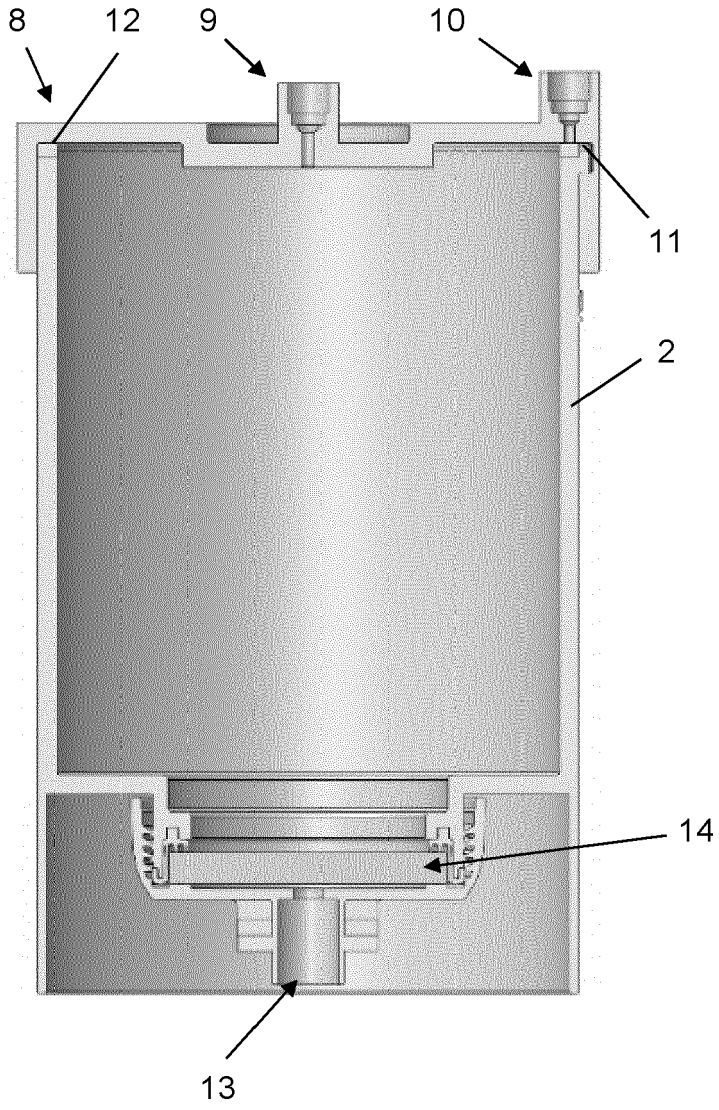


Figure 2

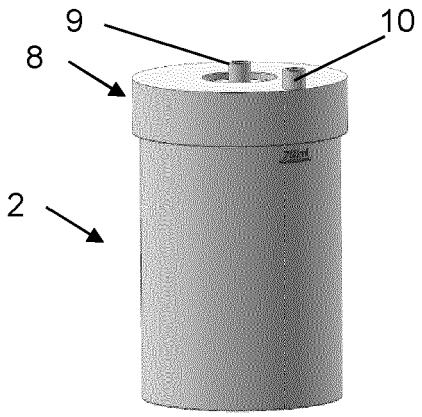


Figure 3

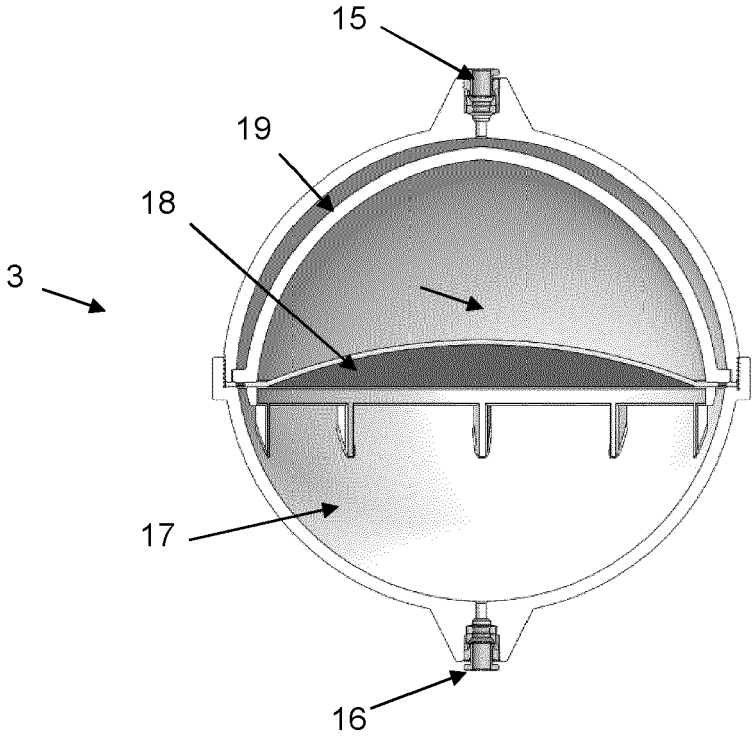


Figure 4

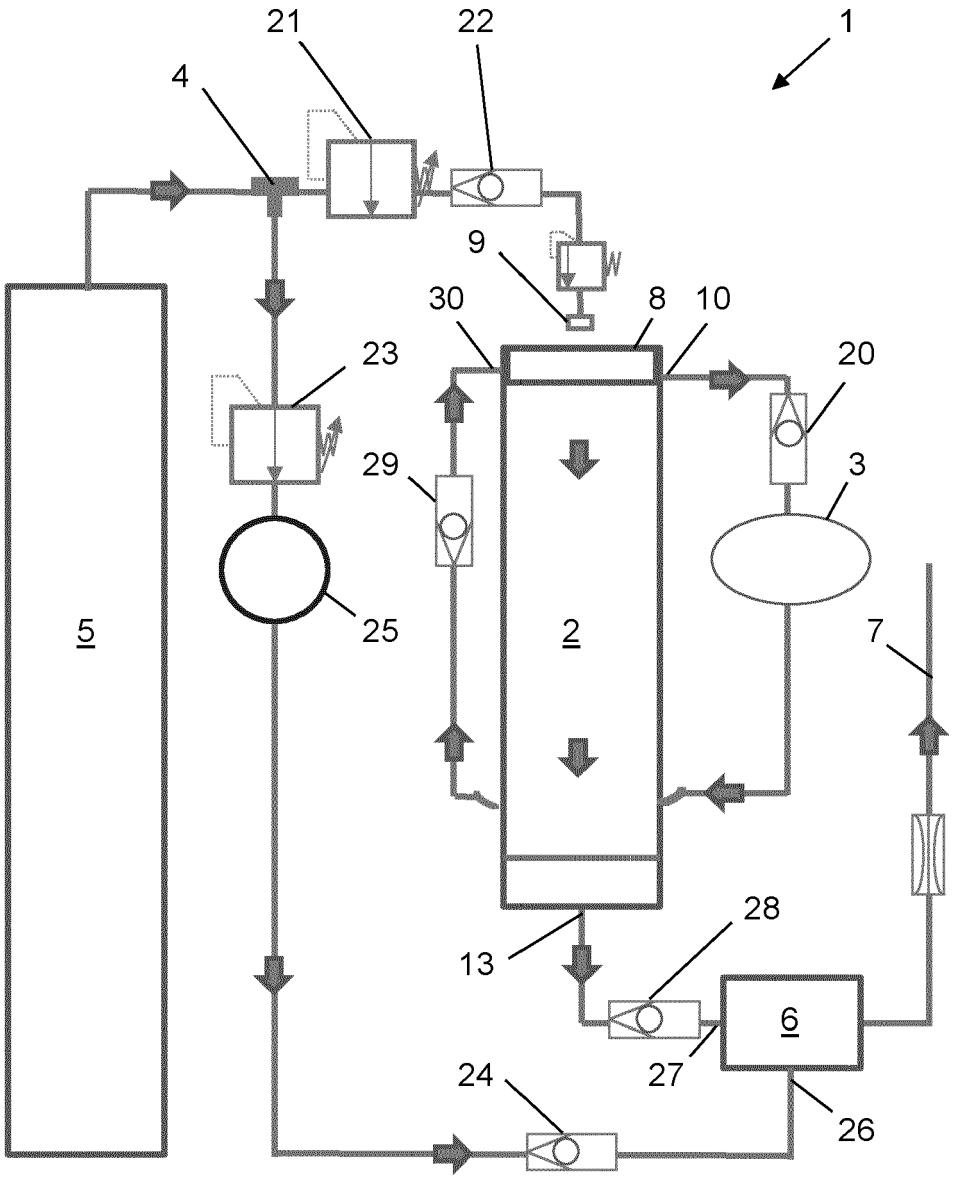
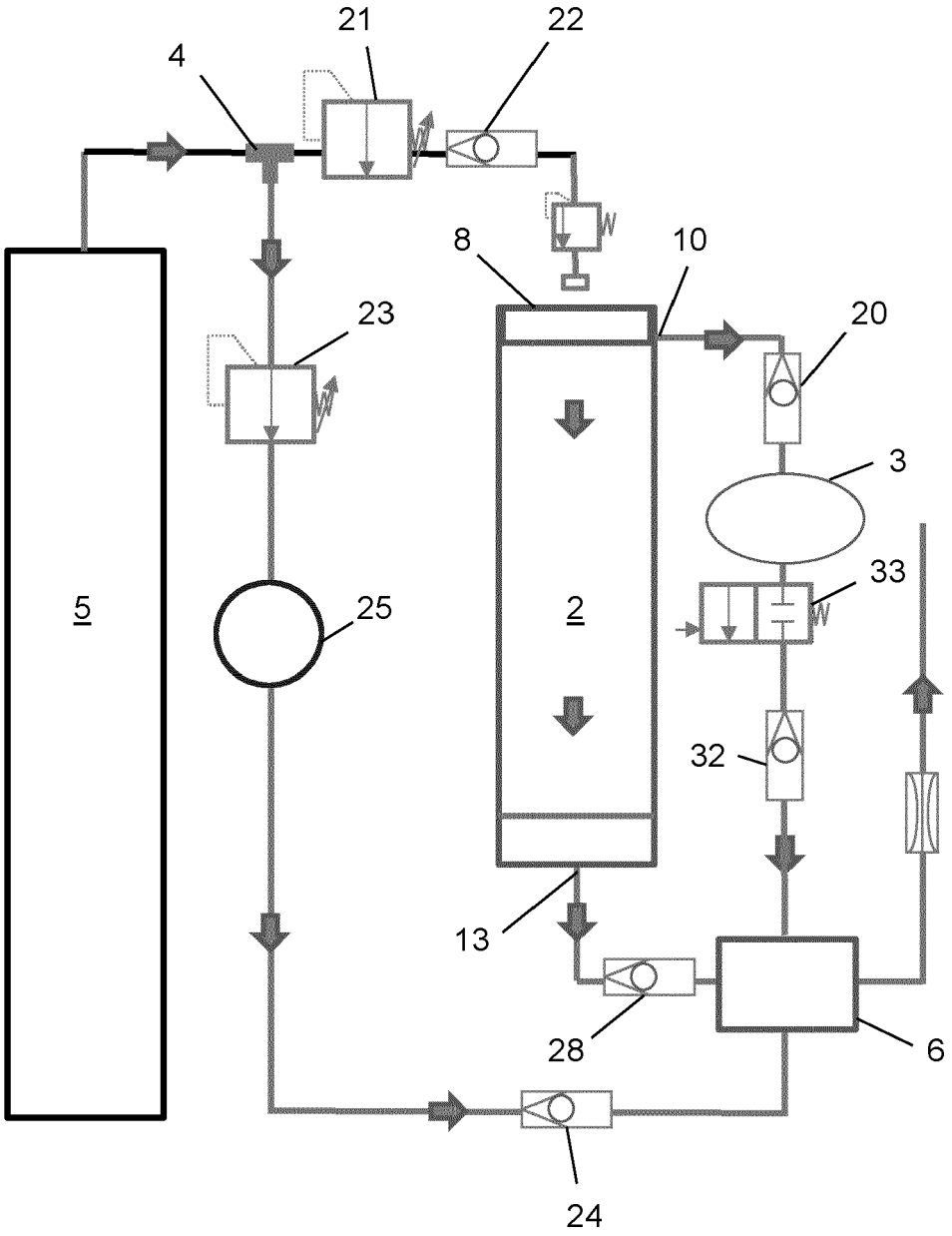


Figure 5



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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 5550

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2021/283558 A1 (YANG PEIYUAN [CN] ET AL) 16 September 2021 (2021-09-16) * paragraphs [0026], [0027]; figure 1 *	1,12,14 2,3,6,15	INV. B67D1/00 B01F23/236 B67D1/04
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A	US 6 059 270 A (KURZER FRITZ [DE] ET AL) 9 May 2000 (2000-05-09) * column 6, line 42 - column 8, line 12; figure 1 *	1	TECHNICAL FIELDS SEARCHED (IPC) B67D B01F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 October 2022	Schultz, Tom

CATEGORY OF CITED DOCUMENTS

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