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(54) **Title:** METHOD AND DEVICE FOR PRODUCING A CARBONATED BEVERAGE

(54) **Bezeichnung:** VERFAHREN UND VORRICHTUNG ZUR HERSTELLUNG EINES KARBONISIERTEN GETRÄNKS

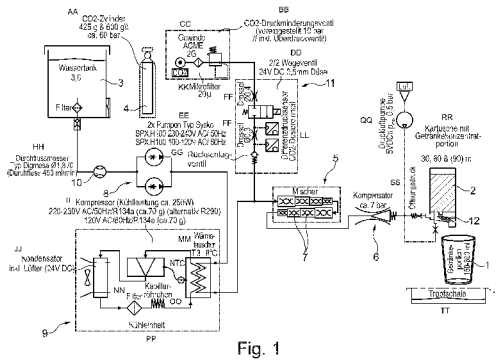

Fig. 1

AA CO2 cylinder 425 g & 600 g\\ approx. 60 bar
BB CO2 pressure reducing valve (preset to 10 bar // incl. pressure relief valve)
CC Thread ACME 2G
DD 2/2 way valve
24V DC 0,5mm orifice
EE 2X pumps type Sysko
FF Choke coil
GG Check valve
HH Flow meter type Digmesa O/ 1.8 / 0'
(flow 450 ml/min)
II Compressor (cooling capacity approx. 250W)
220-230V AC/50Hz/R134a (approx. 70 g) (alternatively R290)
120V AC/60Hz/R134a (approx. 70 g)
JJ Condenser incl. fan (24V DG)
KK Microfilter
LL Differential pressure sensor
CO2 dosing unit
MM Heat exchanger
NN Filter
OO Capillary tube
PP Cooling unit
QQ Pressurized pump
RR Cartridge with beverage concentrate dose
SS Opening pressure
TT Drip tray
1 Beverage dose
3 Water reservoir
Filter
5 Mixer
6 Compensator approx. 7 bar

(57) **Abstract:** The invention relates to a method for producing a beverage in portions, wherein a beverage concentrate portion is mixed with a water portion, said water portion being mixed with carbon dioxide prior to being mixed with the beverage concentrate. The invention additionally relates to a device for producing a beverage in portions, wherein a beverage concentrate portion is mixed with a water portion, said water portion being mixed with carbon dioxide in a static mixer prior to being mixed with the beverage concentrate.

(57) **Zusammenfassung:** Die Erfindung betrifft ein Verfahren zur portionsweisen Herstellung eines Getränks, bei dem eine Getränkekonzentratportion mit einer Wasserportion gemischt wird, wobei die Wasserportion vor der Vermischung mit dem Getränkekonzentrat mit Kohlenstoffdioxid versetzt wird. Des Weiteren betrifft die vorliegende Erfindung eine Vorrichtung zur portionsweisen Herstellung eines Getränks, bei dem eine Getränkekonzentratportion mit einer Wasserportion gemischt wird, wobei die Wasserportion vor der Vermischung mit dem Getränkekonzentrat mit Kohlenstoffdioxid in einem Statikmischer versetzt wird.

[Fortsetzung auf der nächsten Seite]

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Method and device for producing a carbonated beverage

The invention relates to a method for portionwise preparation of a beverage, in which a portion of beverage concentrate is mixed with a portion of water, wherein the portion of water is admixed with carbon dioxide prior to mixing with the beverage concentrate. The present invention further relates to a device for portionwise preparation of a beverage, in which a portion of beverage concentrate is mixed with a portion of water, wherein the portion of water is admixed with carbon dioxide in a static mixer prior to mixing with the beverage concentrate.

The need for portionwise preparation of carbonated beverages using a portion of beverage concentrate is constantly increasing. However, the often insufficient carbonation in the past meant that the beverage prepared portionwise using a portion of beverage concentrate did not taste like the bottled or kegged original.

An embodiment of the invention seeks to provide a method and a device for portionwise preparation of a beverage, in which a portion of beverage concentrate is mixed with a portion of water, which method/device does not have the disadvantages of the prior art.

Alternatively or additionally, an embodiment of the invention seeks to at least provide the public with a useful choice.

The present invention provides a method for portionwise preparation of a beverage, in which a portion of beverage concentrate is mixed with a portion of water, wherein the portion of water is admixed with carbon dioxide in a static mixer prior to mixing with the beverage concentrate, wherein the admixing with carbon dioxide is done at a positive pressure of at least 7 bar, and wherein a compensator is provided downstream of the static mixer

The disclosure made in relation to this subject of the present invention also applies to the other subjects of the present invention. Features disclosed in connection with this subject of the present invention can also be incorporated into other subjects.

The present invention relates to a method for portionwise preparation of a beverage. Provided for this purpose, especially in disposable or reusable packaging, is a portion of beverage concentrate, the liquid or powdered content of which is mixed with a portion of

water, especially a portion of tap water, which forms the completed beverage. Prior to mixing with the beverage concentrate, the water admixed with carbon dioxide admixed with carbon dioxide bubbles, and the carbon dioxide at least partially, preferably completely, dissolved in the water. The admixing of the water with the carbon dioxide is preferably likewise done portionwise and particularly preferably done immediately before the carbonated water is mixed with the beverage concentrate.

The admixing of the water with the carbon dioxide is preferably done in a continuous process in which water and carbon dioxide are admixed in a ratio attuned to one another.

According to the invention, a positive pressure of at least 7 bar, preferably > 8 bar, particularly preferably at 9–11 bar, prevails during the admixing of the water with carbon dioxide. As a result, the carbon dioxide at least substantially dissolves in the water, preferably completely.

The portion of water is preferably taken from a water tank and brought to the desired pressure using a pump. The carbon dioxide is preferably taken from a pressure cylinder.

The mixing of water and carbon dioxide is preferably done portionwise, but particularly preferably continuously while the water is flowing, is in particular being taken from a water tank for beverage preparation.

According to a preferred embodiment, the water is provided at a temperature of 0–4°C prior to mixing with carbon dioxide. According to a further preferred embodiment, the water is provided at a temperature of 4–10°C prior to mixing with carbon dioxide. For this purpose, the water is preferably cooled, especially in a heat exchanger, after removal from the water tank. The cooling of the water is preferably done portionwise.

The carbon dioxide is preferably added to the water at least substantially in the form of bubbles. Preferably, the carbon dioxide is dissolved in the water by mixing the carbon dioxide with the water in a static mixer, though, according to another preferred embodiment, a dynamic mixer, i.e., a mixer with a rotor, is alternatively or additionally used. Particularly preferably, the flow rate in the static mixer is 3–8 m/s.

A reduced pressure compared to the operating conditions, preferably ambient pressure, preferably prevails in the static mixer before and after the preparation of the portion of

carbonated water. As soon as the volume of water required for the preparation of a portion of beverage has been carbonated, the pump is switched off and the pressure in the static mixer is reduced, preferably to ambient pressure.

According to a preferred embodiment, the ratio of the amount of water to the amount of carbon dioxide is regulated. For this purpose, the volumetric flow rate and/or the flow rate of the water is particularly preferably measured and the volumetric flow rate of the carbon dioxide is metered in accordingly.

The present invention further provides a device for portionwise preparation of a beverage, in which a portion of beverage concentrate is mixed with a portion of water, wherein the portion of water is admixed with carbon dioxide in a static mixer prior to mixing with the beverage concentrate, wherein the static mixer is formed of multiple mixer stages, and wherein a compensator is provided downstream of the static mixer.

The disclosure made in relation to this subject of the present invention also applies to the other subjects of the present invention. Features disclosed in connection with this subject of the present invention can also be incorporated into other subjects.

This subject of the present invention relates to a device for portionwise preparation of a beverage. A portion of water is mixed with a portion of a beverage concentrate, resulting in the beverage to be prepared. The water is carbonated prior to mixing with the beverage concentrate. For this purpose, carbon dioxide is added to the water and they are mixed together in a static mixer in such a way that the carbon dioxide metered in at least substantially dissolves in the water.

According to the invention, the static mixer has multiple mixer stages which are, for example, separated from one another by a wall having a hole. The water and the carbon dioxide flow through the hole.

Preferably, the static mixer is manufactured as a single piece, preferably as a plastic injection-molded part.

Preferably, the exit of a downstream mixer stage forms a nozzle for the upstream mixer stage adjacent thereto.

Preferably, the flow cross section of the static mixer decreases in the direction of flow, preferably in steps.

Preferably, two to four, preferably four, static mixers, especially static mixers of identical construction, are connected in series.

The compensator is provided downstream of the static mixer. The carbonated water flows through the compensator before it is used to prepare a beverage. The compensator can be used for pressure reduction in which little gas outgasses from the liquid.

The compensator is preferably a substantially rotationally symmetrical component.

Preferably, the compensator has an inlet and an outlet, and the outlet is offset from the longitudinal central axis of the compensator. According to this preferred embodiment of the present invention, the outlet is offset from the longitudinal central axis of the compensator, preferably eccentric to the longitudinal central axis of the compensator. As a result, the center of the compensator is free and can be used for other purposes, for example for regulation of pressure loss.

Preferably, the compensator has a housing in which a fitted element is present, wherein a gap, the width of which is preferably adjustable, is present between the housing and the fitted element. The carbonated water flows through this gap from the inlet of the compensator to the outlet thereof. The gap width is preferably constant over its entire length.

Preferably, the fitted element has a conical and a cylindrical section, wherein the cylindrical section has provided thereon projections and/or indentations, the length of which in the longitudinal direction is at most 40% of the length of the cylindrical part.

According to a preferred embodiment, the conical part of the fitted element has provided thereon ribs, which are preferably elastic. The ribs can consist of the same material as or a different material than the fitted element and/or be a characteristic of the conical part of the fitted element. Preferably, the fitted element has provided therein indentations which receive the ribs interlockingly and/or frictionally.

In the description in this specification, reference may be made to subject matter which is not within the scope of the appended claims. That subject matter should be readily identifiable by a person skilled in the art and may assist in putting into practice the invention as defined in the presently appended claims.

The present invention will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Figure 1 shows schematically the method according to the invention.
Figures 2 – 4 each show a depiction of the compensator.

These explanations are merely by way of example and do not limit the general concepts of the invention. These explanations apply equally to all subjects of the present invention.

Figure 1 shows the device for preparation of a beverage 1. To prepare the beverage, a beverage concentrate, which is provided in the present case as portion 2 in disposable or reusable packaging, for example a plastic or metal cartridge, is mixed with a portion of water, for example 200 ml, and then collected in a container. The water is provided in the water tank 3 and brought to the desired pressure of at least 7 bar by means of the pump 8, in this case two parallelly connected or redundant pumps. The flow rate running from the tank 3 into the container 1 is preferably monitored by means of a flow meter 10, which preferably also controls the pumps such that the desired volume of water is conveyed. To prepare a beverage, the pump is preferably switched on and, after the desired amount of water has been obtained, switched off. Preferably, the water is cooled, especially before carbonation thereof. Provided for this purpose is a water cooling system comprising a heat exchanger with a cooling water circuit. The CO_2 is preferably metered into the water after cooling. The CO_2 is taken from a carbon dioxide supply 4, in this case a pressure cylinder, and metered, especially in the form of bubbles, into the water by means of a CO_2 metering system 11. Preferably, CO_2 metering is done depending on the water flow rate, which is ascertained by means of the flow meter 10. Provided downstream of the CO_2 metering system is a mixer, in this case a static mixer 5 having in this case two stages, it being possible for each stage to preferably comprise multiple mixer stages. The static mixer is preferably constructed in such a way that the flow cross section decreases after each mixer stage in the direction of flow. Preferably, the two stages of the static mixer are uniform. Preferably, the static mixer is a plastic part, especially a plastic injection-molded part. In the static mixer, the CO_2 metered in in the form of bubbles is dissolved in the

water, preferably completely in particular. Provided downstream of the static mixer is a compensator, by means of which the pressure in the static mixer can be adjusted. According to the invention, said pressure should be at least 7 bar.

Preferably, the residence time of the water between the static mixer and the chamber 12, in which the carbonated water is mixed with the portion of beverage concentrate, is as short as possible. The completed beverage runs out of the beverage concentrate portion capsule 2 and is collected in a container, in this case a glass. The beverage concentrate is preferably pushed out of the portion capsule 2 by means of air.

Figures 2 to 4 each show a depiction of the compensator 6. The compensator 6 is provided downstream of the mixer 5. The compensator 6 has a housing 13 in which a fitted element 14 is provided. In the present case, the fitted element 14 and the housing 13 are substantially rotationally symmetrical. The compensator 6 has a longitudinal central axis 26. Present in the housing 13 is an inlet 19 through which the carbonated water flows in and then flows in the direction of the outlet 20 within a gap 15 present between the housing 13 and the fitted element 14. In the present case, the outlet 20 is offset from the longitudinal central axis 26. Furthermore, the outlet in the present example is provided in an insert 18, which is inserted into the housing 13. Provided between the fitted element and the insert 18 is an adjustment means 17, which can be adjusted in the directions depicted by the double arrow by means of the screw 21, which in the present case with a thread present in the insert 18. As a result, the width of the gap 15 and thus the pressure loss that occurs in the compensator can be adjusted. In the present case, what is provided between the adjustment means 17 and the fitted element 14 is a spring element 16, which attempts to prestress the fitted element in the direction of the inlet and/or in the direction of a smallest possible gap. What can be provided both on the adjustment means 17 and on the insert 18 are sealing elements 25, which prevent the water flowing in the direction of the outlet from leaving the compensator at undesired points.

As can be seen in Fig. 4 in particular, the fitted element 14 has here a conical part 23 and a cylindrical part 24. As can likewise be seen in Figure 4 in particular, the conical part in particular preferably has provided thereon ribs 22, which space the fitted element from the housing and thereby provide channels 15 through which the liquid can flow from the inlet in the direction of the outlet, as depicted by the arrows.

Throughout this specification, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

List of reference signs:

1	Beverage
2	Portion of beverage concentrate, beverage concentrate portion capsule
3	Portion of water, water tank
4	Carbon dioxide, carbon dioxide supply
5	Mixer, static mixer
6	Compensator
7	Mixer stage
8	Pump
9	Water cooling system
10	Flow meter
11	CO_2 metering system
12	Mixing chamber
13	Housing
14	Fitted element
15	Flow channel between the housing and the fitted element
16	Spring means
17	Adjustment means to adjust the width of the flow channel
18	Insert
19	Inlet
20	Outlet
21	Screw, nut
22	Rib
23	Conical part of the fitted element 14
24	Cylindrical part of the fitted element 14
25	Seal
26	Longitudinal central axis

Claims:

1. A method for portionwise preparation of a beverage, in which a portion of beverage concentrate is mixed with a portion of water, wherein the portion of water is admixed with carbon dioxide in a static mixer prior to mixing with the beverage concentrate, wherein the admixing with carbon dioxide is done at a positive pressure of at least 7 bar, and wherein a compensator is provided downstream of the static mixer.

2. The method as claimed in claim 1, wherein the admixing with carbon dioxide is done at a positive pressure of > 8 bar.

3. The method as claimed in claim 2, wherein the admixing with carbon dioxide is done at a positive pressure at 9–11 bar.

4. The method as claimed in any one of the preceding claims, wherein the water is provided at a temperature of 0–10°C prior to mixing with carbon dioxide.

5. The method as claimed in claim 4, wherein the water is provided at a temperature of 0–4°C prior to mixing with carbon dioxide.

6. The method as claimed in any one of the preceding claims, wherein the flow rate in the static mixer is 3–8 m/s.

7. The method as claimed in any one of the preceding claims, wherein a reduced pressure compared to operating conditions is present in the static mixer before and after the preparation of the portion of water.

8. The method as claimed in claim 7, wherein the reduced pressure is ambient pressure.

9. The method as claimed in any one of the preceding claims, wherein the ratio of the amount of water to the amount of carbon dioxide is regulated.

10. A device for portionwise preparation of a beverage, in which a portion of beverage concentrate is mixed with a portion of water, wherein the portion of water is admixed with carbon dioxide in a static mixer prior to mixing with the beverage concentrate, wherein the static mixer is formed of multiple mixer stages, and wherein a compensator is provided downstream of the static mixer.

11. The device as claimed in claim 10, wherein the exit of a downstream mixer stage forms a nozzle for the upstream mixer stage adjacent thereto.

12. The device as claimed in claim 10 or claim 11, wherein the flow cross section of the static mixer decreases in the direction of flow.

13. The device as claimed in claim 12, wherein the flow cross section decreases in steps.

14. The device as claimed in claim 13, wherein the compensator has an inlet and an outlet, and the outlet is offset from the longitudinal central axis of the compensator.

15. The device as claimed in claim 14, wherein the outlet is eccentric to the longitudinal central axis of the compensator.

16. The device as claimed in any one of claims 13 to 15, wherein the compensator has a housing in which a fitted element having a conical and a cylindrical section is present, wherein the cylindrical section has provided thereon projections and/or indentations, the length of which in the longitudinal direction is at most 40% of the length of the cylindrical part.

17. The device as claimed in claim 16, wherein the conical part has provided thereon ribs.

18. The device as claimed in claim 17, wherein the ribs are elastic.

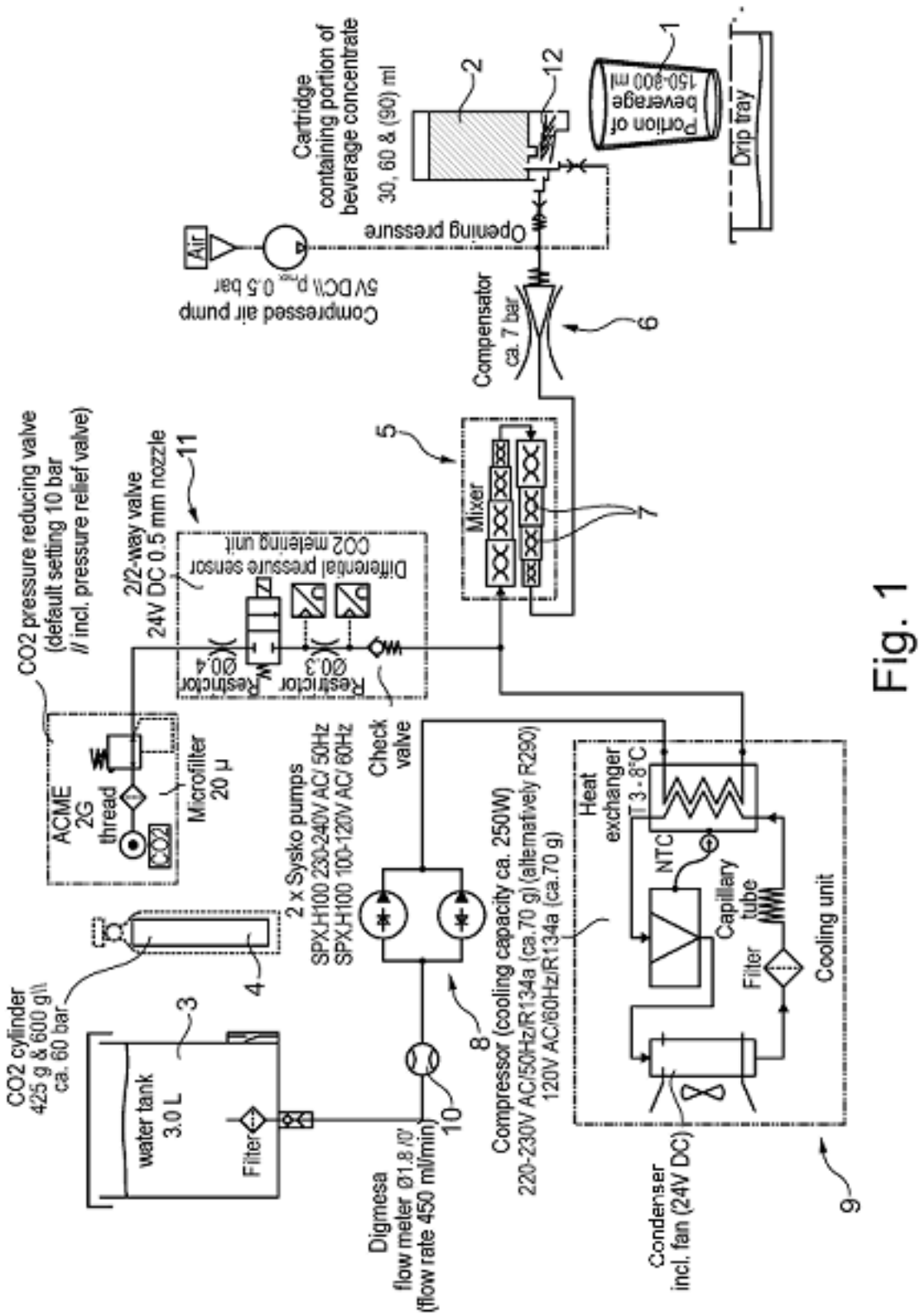
Cartridge containing portion of beverage concentrate
30, 60 & (90) ml
2
12
1
Portion of beverage 150-300 ml
Drip tray
Opening pressure
Air
Compressed air pump
5V DC\\ p_{max} 0.5 bar
Compensator ca. 7 bar
6
5
Mixer
7
CO2 pressure reducing valve (default setting 10 bar // incl. pressure relief valve)
2/2-way valve 24V DC 0.5 mm nozzle
11
Differential pressure sensor CO2 metering unit
Restrictor Ø0.3
Restrictor Ø0.4
ACME 2G thread
CO2
Microfilter 20 µ
Check valve
2 x Sysko pumps SPXJH100 230-240V AC/ 50Hz SPXJH100 100-120V AC/ 60Hz
Heat exchanger T 3 - 8°C
NTC
Capillary tube
Filter
Cooling unit
CO2 cylinder 425 g & 600 g\\ ca. 60 bar
4
3
water tank 3.0 L
Filter
Digmesa flow meter Ø1.8 /0' (flow rate 450 ml/min)
10
8
Compressor (cooling capacity ca. 250W) 220-230V AC/50Hz/R134a (ca.70 g) (alternatively R290) 120V AC/60Hz/R134a (ca.70 g)
Condenser incl. fan (24V DC)
9

Fig. 1

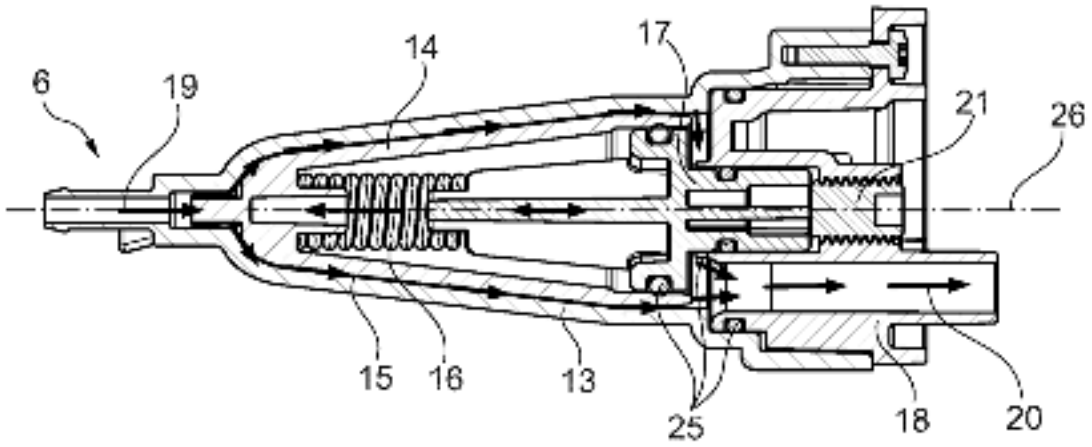

Fig. 2

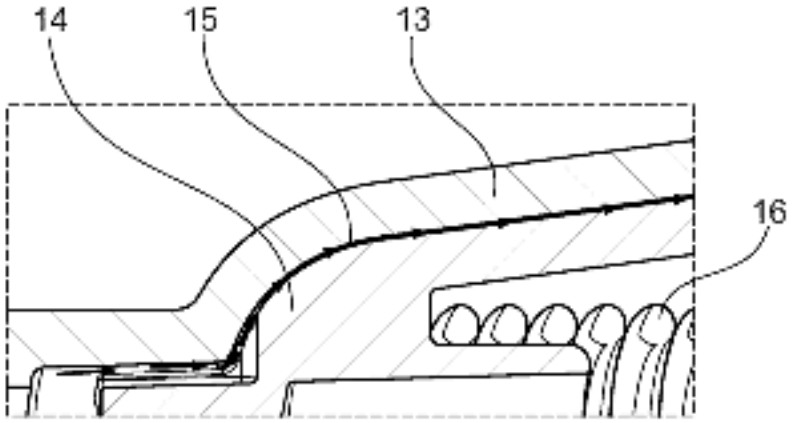

Fig. 3

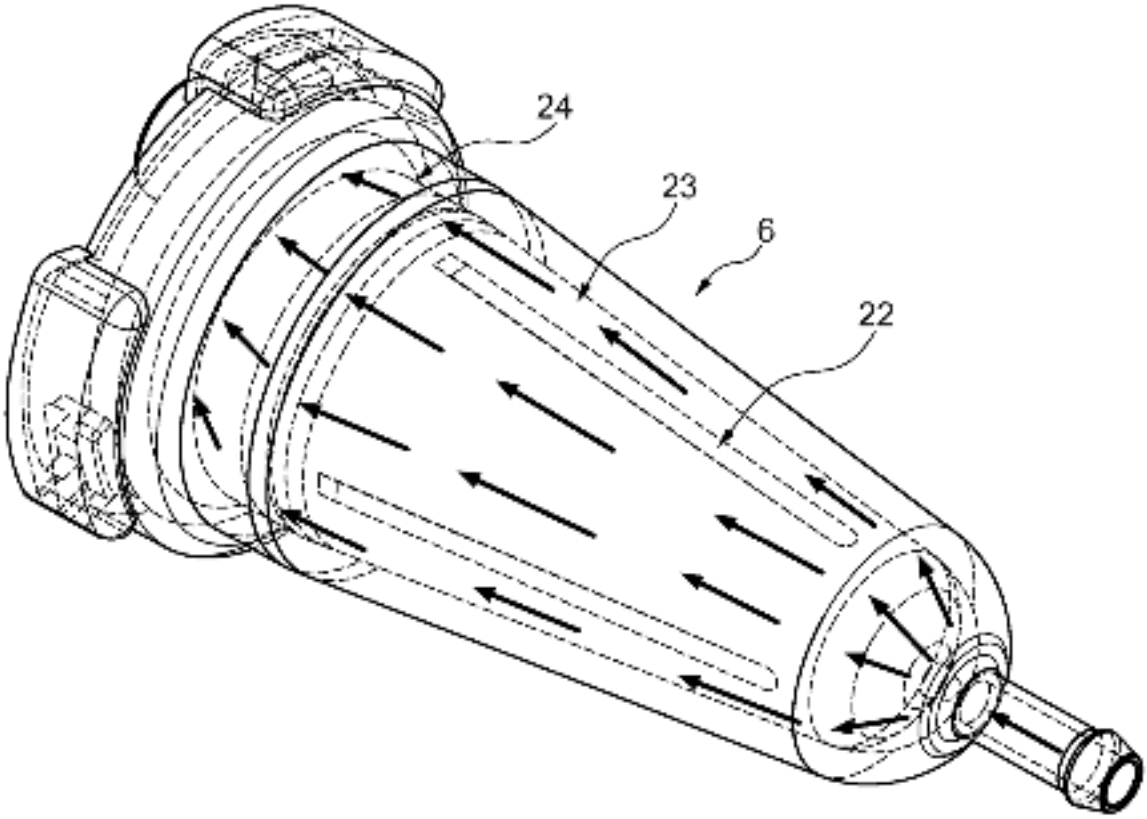

Fig. 4