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(72) Inventors:
• **KOBAYASHI, Takahiro**
Tokyo 108-8215 (JP)
• **KASAI, Toshiaki**
Nagoya-shi
Aichi 453-0862 (JP)

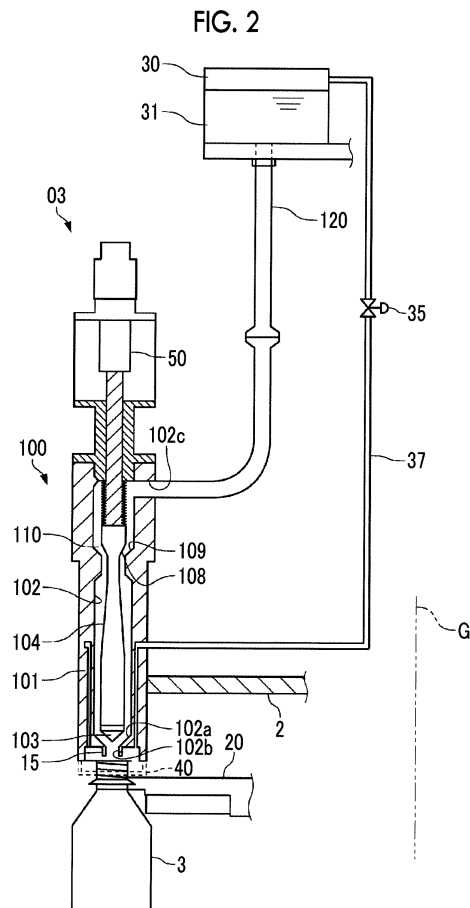
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(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(71) Applicant: **Mitsubishi Heavy Industries Food & Packaging Machinery Co., Ltd.**
Nagoya-shi, Aichi 453-0862 (JP)

(54) **BEVERAGE FILLING METHOD**

(57) Provided is a beverage filling method whereby a container can be filled with a normal filling amount of beverage even when bubbles are formed during a pressurization-draining process. A beverage (31) filling method is a method for filling a container (3) with a carbonated beverage (31) by means of a filling valve (100), which is equipped with a discharge port (102b) through which the beverage is discharged and a throttle (110) that is formed upstream of the discharge port (102b), and is characterized by involving: a cleaning process whereby the inside of the filling valve (100) is cleaned; a pressurization-draining process whereby air inside the filling valve (100) is discharged to the outside by means of pressurization, the inside of the filling valve (100) is completely filled with the beverage (31), and the discharge port (102b) and the throttle (110) are brought to a closed state; a bubble removing process whereby bubbles formed inside the filling valve (100) during the pressurization-draining process are removed after the pressurization-draining process; and a beverage filling process whereby the container (3) is filled with the beverage (31) after the bubble removing process.



Description

Technical Field

[0001] The present invention relates to a beverage filling method of filling a container with a beverage, and particularly, a carbonated beverage.

Background Art

[0002] As an apparatus for filling a container such as a PET bottle, a glass bottle, or a bottle can with a beverage, a rotary liquid filling apparatus has been used. In the rotary liquid filling apparatus, a plurality of filling valves are provided in the outer peripheral portion of a circular rotating wheel, and while the wheel makes substantially one revolution and the container is transported in the peripheral direction, filling the inside of the container with a liquid from a filling valve is performed. In addition, after the filling of the container is completed, mounting a cap on the container is performed by a capper (bottle capper) (for example, PTL 1).

[0003] A liquid filling apparatus of PTL 1 is provided with a filling valve which fills the inside of a container with a liquid. The filling valve is continuous in upward and downward directions, and the upper portion thereof is provided with a supply port through which the liquid is supplied, while the lower portion thereof is provided with a flow passage having a discharge port formed to discharge the liquid, and a rod which is provided to be movable in the flow passage in the upward and downward directions and has a valve portion formed at the lower end portion thereof to open and close the discharge port. In the rod, a tapered portion of which the outer diameter is gradually decreased toward the lower side from the upper side is formed. In addition, in the inner peripheral portion of the flow passage at a position that faces the tapered portion, a throttle portion of which the inner diameter is smaller on the lower side than on the upper side is formed.

[0004] In this configuration, the flow of the liquid supplied into the flow passage from the supply port is converted into a swirling flow around the rod, and thus the entire region of the inside of the flow passage can be reliably cleaned in a case where a cleaning liquid is allowed to flow as the liquid during cleaning of the filling valve.

[0005] In a case of filling of a beverage containing carbonic acid using the liquid filling apparatus, as main processes, a cleaning process, a pressure drain process, and a beverage filling process are employed and performed in this order. First, in the cleaning process, the inside of the filling valve is cleaned. In the pressure drain process, the pressure of the inside of the filling valve is increased, and the inside of the filling valve is filled with the beverage.

Citation List

Patent Literature

5 **[0006]** [PTL 1] Japanese Unexamined Patent Application Publication No. 2010-189035

Summary of Invention

10 Technical Problem

[0007] Here, when the filling of the carbonated beverage is performed by a beverage filling apparatus of PTL 1, bubbles are generated at the throttle portion during the pressure drain process. When the bubbles are generated, during subsequent filling of the beverage, the amount of the beverage filling the container is insufficient by the volume of the bubbles, and there is a problem in that a regular filling amount cannot be satisfied. The beverage which does not satisfy the regular filling amount cannot be distributed in the market and is thus discarded.

15 **[0008]** The present invention has been made on the basis of such problems, and an object thereof is to provide a filling method capable of filling a container with a regular filling amount of beverage even when bubbles are generated during a pressure drain process.

Solution to Problem

20 **[0009]** Based on the object, according to the present invention, there is provided a beverage filling method of filling a container with a beverage containing carbonic acid using a filling valve that includes a discharge port through which the beverage is discharged and a throttle which is formed upstream of the discharge port. The beverage filling method includes: a cleaning process of cleaning an inside of the filling valve; a pressure drain process of pressurizing and discharging air on the inside of the filling valve to the outside, filling the inside of the filling valve with the beverage, and allowing the discharge port and the throttle to be in a closed state; a bubble removing process of, after the pressure drain process, removing bubbles generated on the inside of the filling valve during the pressure drain process; and a beverage filling process of filling the container with the beverage after the bubble removing process.

25 **[0010]** By performing the bubble removing process, the bubbles generated during the pressure drain process can be removed. Therefore, the container can be filled with the beverage without including the generated bubbles, and thus the container can be filled with a set regular filling amount of the beverage.

30 **[0011]** In the beverage filling method of the present invention, it is preferable that in the bubble removing process, a tip end of the filling valve is obstructed, the inside of the filling valve is pressurized, and after the discharge port and the throttle are allowed to be in an opened state, the tip end of the filling valve is opened.

[0012] By performing the bubble removing process, the bubbles can be removed from the throttle. Therefore, the container can be filled with a set regular filling amount of the beverage.

[0013] In the beverage filling method of the present invention, it is preferable that in the bubble removing process, the throttle is allowed to be in a state of being opened by a predetermined distance.

[0014] When the throttle is allowed to be in an opened state, a passage through which the bubbles pass is formed, and thus the bubbles can be removed.

[0015] Furthermore, the present invention provides a beverage filling method of filling a container with a beverage containing carbonic acid using a filling valve, which includes a cylindrical body and a valve rod which opens and closes a discharge port of the body to form a flow passage inside the body, and has a throttle formed upstream of the discharge port. The beverage filling method includes: a cleaning process of cleaning an inside of the filling valve; a pressure drain process of pressurizing and discharging air on the inside of the filling valve to the outside, thereafter filling the inside of the filling valve with the beverage, and allowing the discharge port to be in a closed state; and a beverage supply process of, after the pressure drain process, filling the container with the beverage by postulating a volume of bubbles generated during the pressure drain process and compensating for an insufficient filling amount.

[0016] In this filling method, a filling amount which is insufficient due to the incorporation of the bubbles can be compensated for, and thus the container can be filled with a regular filling amount of the beverage.

Advantageous Effects of Invention

[0017] According to the present invention, after removing the bubbles generated during the pressure drain process, the container can be filled with the beverage. Therefore, the container can be filled with the regular amount of the beverage.

Brief Description of Drawings

[0018]

Fig. 1 is a view illustrating the schematic configuration of a beverage filling facility in an embodiment.

Fig. 2 is a view schematically illustrating a beverage filling apparatus.

Fig. 3 is a partial enlarged view illustrating the vicinity of the tip end of a filling valve.

Fig. 4 illustrates an upper portion of the filling valve, and is a sectional view illustrating an operation of a valve rod in a second embodiment.

Fig. 5 is a view illustrating a database for compensating for an insufficient filling amount. Description of Embodiments

[First Embodiment]

[0019] Hereinafter, the invention will be described in detail on the basis of embodiments illustrated in the accompanying drawings.

[0020] As illustrated in Fig. 1, a beverage filling facility according to an embodiment includes a supply conveyor 01, a transfer wheel 02, a liquid filling apparatus 03, a transfer wheel 04, a capper 05, a discharge wheel 06, and a discharge conveyor 07.

[0021] In the beverage filling facility, each of the transfer wheel 02, the liquid filling apparatus 03, the transfer wheel 04, the capper 05, and the discharge wheel 06 is provided with holders at equal intervals in the outer peripheral portion along the circumferential direction thereof so as to allow the container 3 (for example, PET bottle) to be transported while being gripped. Accordingly, each of the transfer wheel 02, the liquid filling apparatus 03, the transfer wheel 04, the capper 05, and the discharge wheel 06 grips, transports, and delivers the container 3 while rotating.

[0022] Therefore, the container 3 transported by the supply conveyor 01 is gripped by the holder of the transfer wheel 02 at a position A and is transported from the position A to a position B. At the position B, the container 3 is delivered from the transfer wheel 02 to the liquid filling apparatus 03, is gripped by the holder of the liquid filling apparatus 03, and is transported from the position B to a position C. When the container 3 is transported from the position B to the position C, the container 3 is filled with a liquid via a filling nozzle provided in the liquid filling apparatus 03.

[0023] Furthermore, the container 3 is delivered and transported from the liquid filling apparatus 03 to the transfer wheel 04 at the position C, from the transfer wheel 04 to the capper 05 at a position D, from the capper 05 to the discharge wheel 06 at a position E, and from the discharge wheel 06 to the discharge conveyor 07 at a position F. The capper 05 performs capping to put a cap on the container 3.

[0024] As illustrated in Fig. 2, in the liquid filling apparatus 03, a turning table 2 rotates on a horizontal plane about a turning axis G. At the outer peripheral edge of the turning table 2, a plurality of filling valves 100 and a plurality of holders 20 are disposed while forming pairs at equal intervals along the peripheral direction.

[0025] A liquid storage tank 30 is disposed at a position above the turning table 2. The liquid storage tank 30 rotates integrally and in synchronization with the turning table 2. The liquid storage tank 30 and each of the filling valves 100 are connected to each other by a liquid supply pipe 120.

[0026] In the center portion of a body block 101 of the filling valve 100, a flow passage 102 that extends in upward and downward directions is formed, and a liquid valve (valve portion) 103 is disposed inside the flow passage 102. A valve seat 102a is formed at a discharge port 102b in the lower portion of the flow passage 102,

and when the liquid valve 103 moves downward and abuts the valve seat 102a, the discharge port 102b is closed and the flow of a beverage 31 is blocked. When the liquid valve 103 is moved upward and becomes separated from the valve seat 102a, the beverage 31 is discharged from the discharge port 102b.

[0027] The liquid valve 103 is connected to an air cylinder (drive cylinder) 50 via a valve rod (rod) 104. In addition, by the drive of the air cylinder 50 in the upward and downward directions, the liquid valve 103 is moved in the upward and downward directions (vertical direction) and is allowed to be in an opened state or a closed state.

[0028] A filling nozzle 15 is disposed at the lower end of the body block 101, and allows the beverage 31, which flows downward from the flow passage 102 through the discharge port 102b, to be poured into the container 3.

[0029] The holder 20 is fixed to the turning table 2 and holds the container 3, and holds the held container 3 at a position below of the filling nozzle 15 of the filling valve 100.

[0030] The beverage 31 such as a beverage to fill the container 3 is stored on the inside of the liquid storage tank 30. In addition, on the inside of the liquid storage tank 30, a gas corresponding to the type of the filling beverage 31 is stored in a space on the upper side of the stored beverage 31 (hereinafter, referred to as a gas phase).

[0031] The upper end of the liquid supply pipe 120 communicates with the liquid storage tank 30, and the lower end thereof communicates with a supply port 102c formed at the upper portion of the flow passage 102 of the filling valve 100 such that the liquid storage tank 30 and the filling valve 100 are connected to each other.

[0032] In addition, a counter pipe 37 is provided between the filling valve 100 and the liquid storage tank 30, and a counter valve 35 is provided in the counter pipe 37. The counter pipe 37 connects the gas phase of the liquid storage tank 30 to the inside of the filling valve 100, and allows the pressure of the inside of the filling valve 100 and the pressure of the liquid storage tank 30 to be the same by opening the counter valve 35.

[0033] In the liquid filling apparatus 03 described above, when the liquid valve 103 is moved upward by the air cylinder 50, the beverage 31 in the liquid storage tank 30 fills the inside of the container 3 held by the holder 20 via the filling nozzle 15 through the liquid supply pipe 120 and the flow passage 102 of the filling valve 100. At this time, the amount of the filling beverage is measured by an electromagnetic flow meter (not illustrated). When the measured amount of the filling beverage becomes a prescribed amount determined in advance, the liquid valve 103 is moved downward to abut the valve seat 102a by the air cylinder 50.

[0034] In addition, as illustrated in Fig. 4, a seal member 105 which is formed of a corrugated pipe and contracts and stretches in an axial direction thereof is provided in the upper portion of the rod 104 so as to insulate

an operating space of the air cylinder 50 from the inside of the flow passage 102 of the filling valve 100. An upper flange 105a which extends toward the outer peripheral side is formed at the upper end portion of the seal member 105. The upper flange 105a is held by being interposed between a plurality of members 101A and 101B constituting the body block 101.

[0035] In addition, a lower flange 105b which extends toward the inner peripheral side is formed at the lower end portion of the seal member 105. The lower flange 105b is held by being interposed between a plurality of members 104A and 104B constituting the rod 104.

[0036] The seal member 105 contracts and stretches as the rod 104 is elevated by the drive of the air cylinder 50.

[0037] In addition, in the filling valve 100 of this embodiment, a rectifying portion 106, which converts a spiral flow of the beverage 31 flowing into the flow passage 102 from the liquid supply pipe 120 into a vertically downward flow, is formed in the upper portion of the rod 104.

[0038] The rectifying portion 106 is constituted by a plurality of concave portions 107 which are formed on the outer peripheral surface of the rod 104 along the peripheral direction with intervals therebetween.

[0039] Below the seal member 105 in the rod 104, a tapered portion 108 of which the outer diameter is gradually decreased toward the lower side from the upper side is formed. Each of the concave portions 107 has a vertically long shape in the upward and downward directions, and is formed to be continuous across the tapered portion 108 from a portion higher than the tapered portion 108 in the upward and downward directions.

[0040] In the inner peripheral surface of the flow passage 102 at a position that faces the tapered portion 108 of the rod 104, a flow rate adjusting portion 109 of which the inner diameter is gradually decreased toward the lower side from the upper side is formed.

[0041] The width dimension of the rod 104 in the peripheral direction thereof and the depth of the rod 104 in the radial direction thereof in the concave portion 107 vary with the position of the rod 104 in the upward and downward directions so that the area of a throttle 110 formed between the concave portion 107 and the flow rate adjusting portion 109 is changed when the rod 104 is elevated by the drive of the air cylinder 50.

[0042] The liquid filling apparatus 03 described above fills the first container 3 with a carbonated beverage by sequentially performing the following processes.

[Cleaning Process]

[0043] First, a clean-in-place (CIP) cap 40 (hereinafter, referred to as a CIP cap 40) is attached to the tip end of the filling valve 100 so as to allow a cleaning liquid to be circulated in the flow passage 102. The CIP cap 40 seals the opening of the tip end of the filling valve 100, and thus the cleaning liquid is not discharged to the outside from the filling valve 100.

[0044] By allowing the cleaning liquid to flow into the flow passage 102 and circulating the flow passage through the flow passage 102, the inside of the filling valve 100 is cleaned. When the circulation of the cleaning liquid which is set is ended, the CIP cap 40 is detached and the cleaning liquid is discharged to the outside. Thereafter, the cleaning liquid is washed away and air is blown thereinto, such that the remaining liquid in the flow passage 102 is discharged to the outside.

[Pressure Drain Process]

[0045] Subsequently, a pressure drain process for filling the inside of the filling valve 100 with the beverage 31 is performed.

[0046] In the pressure drain process, first, air that remains in the cleaning process is discharged to the outside of the filling valve 100 by pressurizing the inside of the filling valve 100. In addition, the liquid valve 103 is closed and the inside of the filling valve 100 is then filled with the beverage 31. The amount of the beverage 31 flowing into the filling valve 100 is adjusted by the opening of the throttle 110.

[0047] When the inside of the filling valve 100 is filled with the beverage 31, since the flow passage through which the beverage 31 passes is narrowed once at the throttle 110, a large number of bubbles are generated. The generated bubbles stay in the vicinity of the throttle 110.

[0048] In addition, the pressure drain process is performed at a saturated vapor pressure according to the amount of carbon dioxide contained in the beverage 31.

[Bubble Removing Process]

[0049] After the pressure drain process, a bubble removing process is performed to remove the bubbles generated at the throttle 110. The bubble removing process is a feature of this embodiment.

[0050] In the bubble removing process, first, the pressure of the inside of the filling valve 100 is increased to a pressure at which the beverage is filled (hereinafter, filling pressure). Next, as illustrated in Fig. 3, the CIP cap 40 (obstruction body) used in the cleaning process is attached to the tip end of the filling valve 100. The opening of the tip end of the filling valve 100 is then obstructed by the CIP cap 40 such that the inside of the filling valve 100 (the flow passage 102) is sealed.

[0051] In addition, the counter valve 35 is opened. Therefore, the pressure of the gas phase of the liquid storage tank 30 becomes equal to the pressure of the inside of the filling valve 100, and thus the filling pressure is also applied to the liquid valve 103 from the CIP cap 40.

[0052] Subsequently, the liquid valve 103 is opened and is maintained in this state for a predetermined time. When the liquid valve 103 is opened, the pressure on the beverage 31 from the gas phase of the liquid storage tank 30 and the pressure thereon from the CIP cap 40

side become equal to each other. That is, the pressure on the beverage 31 from the upper side and the pressure thereon from the lower side become equal to each other, and thus bubbles in the flow passage 102 rise due to their buoyancy and move to the gas phase of the liquid storage tank 30. A time during which the liquid valve 103 is opened, that is, a time for removing the bubbles, varies depending on the type of the beverage. Therefore, data in which the time for removing bubbles is associated with the types of beverages may be stored in advance to set the predetermined time.

[0053] After the predetermined time has elapsed, while closing the liquid valve 103 and the counter valve 35, the CIP cap 40 is detached. In addition, filling of the beverage 31 is started.

[Beverage Filling Process]

[0054] Prior to the filling of the beverage, the container 3 is attached to the tip end of the filling valve 100. The counter valve 35 is opened to allow the inside of the container 3 to have the same pressure as that of the gas phase of the liquid storage tank 30. Since the same pressure is achieved, the formation of bubbles during the filling of the beverage 31 can be prevented.

[0055] In addition, when the liquid valve 103 is further opened, the container 3 is filled with the beverage 31 via the filling nozzle 15.

[0056] The filling amount may be set in advance by a flow rate controller (not illustrated) of the filling valve.

[0057] In the bubble removing process of this embodiment, bubbles generated at the throttle 110 during the pressure drain process can be removed. Therefore, the container 3 can be filled with the beverage 31 without including the generated bubbles. Accordingly, the container 3 can be filled with a set regular filling amount of the beverage 31.

[0058] In addition, the bubble removing process according to this embodiment is particularly effective in filling of a carbonated beverage having a low sugar content. The size of the generated bubbles is influenced by the sugar content, and the bubbles are increased in size as the sugar content is decreased. However, large bubbles are less likely to be dissolved in the beverage 31, and remain as they are.

[0059] Furthermore, in the bubble removing process of this embodiment, since the CIP cap 40 included in the liquid filling apparatus 03 is used, there is no need to add a new member. Therefore, the bubble removing process can be performed by the existing liquid filling apparatus 03.

[Second Embodiment]

[0060] In the first embodiment, the method of removing bubbles after the pressure drain process by using the CIP cap 40 is described.

[0061] In this embodiment, bubbles generated at the

throttle 110 are removed by adjusting the opening of the throttle 110 (the opening of the liquid valve 103).

[0062] Hereinafter, a beverage filling method in this embodiment will be described. The same processes as those of the first embodiment are concisely described, and differences therefrom are mainly described.

[Cleaning Process]

[0063] The CIP cap 40 is attached to the tip end of the filling valve 100 so as to clean the flow passage 102 using the cleaning liquid. In addition, the CIP cap 40 is detached, the cleaning liquid is washed away, and air is blown thereinto, such that the remaining liquid in the flow passage 102 is discharged to the outside.

[Pressure Drain Process]

[0064] During pressure drain, as in the first embodiment, air that remains in the cleaning process is discharged to the outside of the filling valve 100 by pressurizing the inside of the filling valve 100. The inside of the filling valve 100 (the flow passage 102) is then filled with the beverage through the flow passage 102. At this time, the liquid valve 103 is closed.

[Bubble Removing Process]

[0065] Next, the bubble removing process, which is a feature of this embodiment, will be described with reference to Fig. 4.

[0066] After the pressure drain process, the liquid valve 103 is closed, and thus a region R1 is substantially sealed. Therefore, bubbles stay between the tapered portion 108 and the flow passage 102.

[0067] Here, by pulling the rod 104 in an upward direction X by a predetermined distance, the liquid valve 103 is opened. Therefore, a region R2 is formed between the flow rate adjusting portion 109 and the tapered portion 108. The bubbles move upward in the arrow H direction through a gap P due to the buoyancy and move to the gas phase of the liquid storage tank 30. Therefore, the generated bubbles are removed from the throttle 110.

[0068] That is, by pulling upward the rod 104 by the predetermined distance, the passage of the bubbles is formed, and thus the bubbles are removed.

[0069] The state of the rod 104 being pulled upward is maintained for a predetermined time, and the process is transitioned to the beverage filling process.

[0070] The predetermined distance is the minimum distance for passing the bubbles.

[Beverage Filling Process]

[0071] The container 3 is attached to the tip end of the filling valve 100. The counter valve 35 is opened to allow the inside of the container 3 to have the same pressure as that of the gas phase of the liquid storage tank 30. In

addition, by further increasing the opening of the liquid valve 103, the container 3 is filled with the beverage 31 via the filling nozzle 15.

[0072] In the filling method of this embodiment, the bubbles generated at the throttle 110 are removed in the bubble removing process, and thus the container 3 can be filled with a set regular filling amount of the beverage 31.

[0073] In this embodiment, bubbles can be removed only by adjusting the opening of the liquid valve 103 without the use of another member (for example, the CIP cap 40 in the first embodiment). Therefore, there is no need to clean the member after the end of the beverage filling. Accordingly, time and effort for the operation can be saved.

[Third Embodiment]

[0074] In the above-described embodiments, the method of filling a regular filling amount of the beverage 31 by performing the bubble removing process has been described. In this embodiment, a method of filling a regular filling amount of the beverage 31 without performing the bubble removing process will be described.

[0075] In this embodiment, the beverage is filled by the following processes. The same processes as those of the above-described embodiments are concisely described, and differences therefrom are mainly described.

[Cleaning Process]

[0076] The CIP cap 40 is attached to the tip end of the filling nozzle 15 so as to clean the flow passage 102 using the cleaning liquid. In addition, the CIP cap 40 is detached, the cleaning liquid is washed away, and air is blown thereinto, such that the remaining liquid in the flow passage 102 is discharged to the outside.

[Pressure Drain Process]

[0077] During pressure drain, as in the first embodiment, air that remains in the cleaning process is discharged to the outside of the filling valve 100 by pressurizing the inside of the filling valve 100. The inside of the flow passage 102 is then filled with the beverage 31. At this time, the liquid valve 103 is closed.

[Beverage Filling Process]

[0078] After the pressure drain, the container 3 is attached to the tip end of the filling valve 100, and filling of the beverage through the filling nozzle 15 is performed. In this embodiment, the filling amount of the beverage is set on the basis of a database.

[0079] For example, as illustrated in Fig. 5, a database regarding an insufficient filling amount is generated for the types (A, B, C ...) of the filling beverage 31.

[0080] Therefore, when an operator determines the fill-

ing beverage 31, a button corresponding to the type thereof in a filling amount control device (not illustrated) which determines the filling amount is pressed. In this manner, a compensating amount of the beverage 31 for the insufficient filling amount is filled.

[0081] The insufficient filling amount can be determined by several methods.

[0082] For example, since it is known that the volume of bubbles generated at the throttle 110 is significantly dependent on the amount of carbon dioxide contained in the beverage 31 and the sugar content, the amount of carbon dioxide contained in the beverage 31 and the value of the sugar content are measured in advance, and the volume of the bubbles, that is, the insufficient filling amount, are calculated.

[0083] Otherwise, after measuring the weight of an empty container 3 in advance, the container 3 is filled with a predetermined amount of the beverage 31, and the weight of the container 3 after the filling is measured. From the difference between the weights, the insufficient filling amount is calculated.

[0084] The insufficient filling amount calculated as described above is stored in a database as a set value for each of the types of beverages. In addition, the set value of the database is set as the filling amount of the beverage. In this manner, the container 3 is filled with the set filling amount, that is, the regular filling amount of the beverage 31.

[0085] In the filling method of this embodiment, the volume of bubbles incorporated into the container 3 is calculated in advance, and a corresponding amount to the volume is added to the regular filling amount to perform filling. Therefore, a filling amount which is insufficient due to the incorporation of the bubbles can be compensated for, and thus the container 3 can be filled with the regular filling amount of the beverage 31.

[0086] In addition, the set value may be used as the filling amount on the basis of the database, and thus another operation is unnecessary. Therefore, time and effort is not needed for the filling operation.

[0087] While the embodiments of the present invention have been described above, additionally, the configurations exemplified in the above-described embodiments may be selected or may be appropriately changed to other configurations without departing from the concept of the present invention.

[0088] For example, in the first embodiment, the inside of the filling valve 100 only needs to be sealed. Therefore, by providing a member which can seal the tip end of the filling valve 100 other than the CIP cap 40, the effects of the present invention can be exhibited.

[0089] In addition, in the third embodiment, the database may also be created by calculating the insufficient filling amount from the relationship between the size of the bubbles and the temperature of the filling beverage 31. Reference Signs List

[0090]

| | |
|----|-------------------------------------|
| | 01 supply conveyor |
| | 02 transfer wheel |
| | 03 liquid filling apparatus |
| | 04 transfer wheel |
| 5 | 05 capper |
| | 06 discharge wheel |
| | 07 discharge conveyor |
| | 2 turning table |
| | 3 container |
| 10 | 15 filling nozzle |
| | 20 holder |
| | 30 liquid storage tank |
| | 31 liquid (beverage) |
| | 35 counter valve |
| 15 | 37 pipe |
| | 40 clean-in-place cap (CIP cap) |
| | 50 air cylinder (drive cylinder) |
| | 100 filling valve |
| | 101 body block |
| 20 | 101A member |
| | 102 flow passage |
| | 102a valve seat |
| | 102b discharge port |
| | 102c supply port |
| 25 | 103 liquid valve |
| | 104 valve rod |
| | 104A member |
| | 105 seal member |
| | 105a upper flange 105b lower flange |
| 30 | 109 flow rate adjusting portion |
| | 110 throttle |
| | 120 liquid supply pipe |
| | G turning axis |
| | P gap |
| 35 | R1, R2 region |
| | X upward direction |

Claims

- 40
1. A beverage filling method of filling a container with a beverage containing carbonic acid using a filling valve that includes a discharge port through which the beverage is discharged and a throttle which is formed upstream of the discharge port, the beverage filling method comprising:

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a cleaning process of cleaning an inside of the filling valve;

a pressure drain process of pressurizing and discharging air on the inside of the filling valve to the outside, filling the inside of the filling valve with the beverage, and allowing the discharge port and the throttle to be in a closed state;

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a bubble removing process of, after the pressure drain process, removing bubbles generated on the inside of the filling valve during the pressure drain process; and

a beverage filling process of filling the container with the beverage after the bubble removing process.

2. The beverage filling method according to claim 1, wherein, in the bubble removing process, a tip end of the filling valve is obstructed, the inside of the filling valve is pressurized, and after the discharge port and the throttle are allowed to be in an opened state, the tip end of the filling valve is opened.

3. The beverage filling method according to claim 1 or 2, wherein, in the bubble removing process, the throttle is allowed to be in a state of being opened by a pre-determined distance.

4. A beverage filling method of filling a container with a beverage containing carbonic acid using a filling valve, which includes a discharge port through which the beverage is discharged and a throttle which is formed upstream of the discharge port, the beverage filling method comprising:

a cleaning process of cleaning an inside of the filling valve;

a pressure drain process of pressurizing and discharging air on the inside of the filling valve to the outside, filling the inside of the filling valve with the beverage, and allowing the discharge port and the throttle to be in a closed state; and

a beverage supply process of, after the pressure drain process, filling the container with the beverage by postulating a volume of bubbles generated during the pressure drain process and compensating for an insufficient filling amount.

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FIG. 1

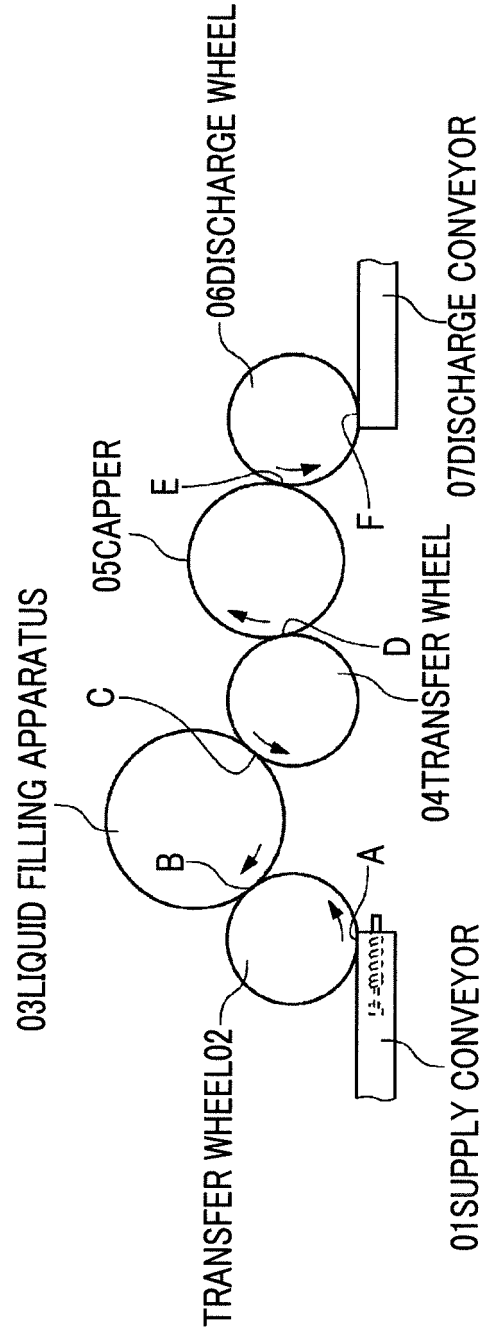


FIG. 2

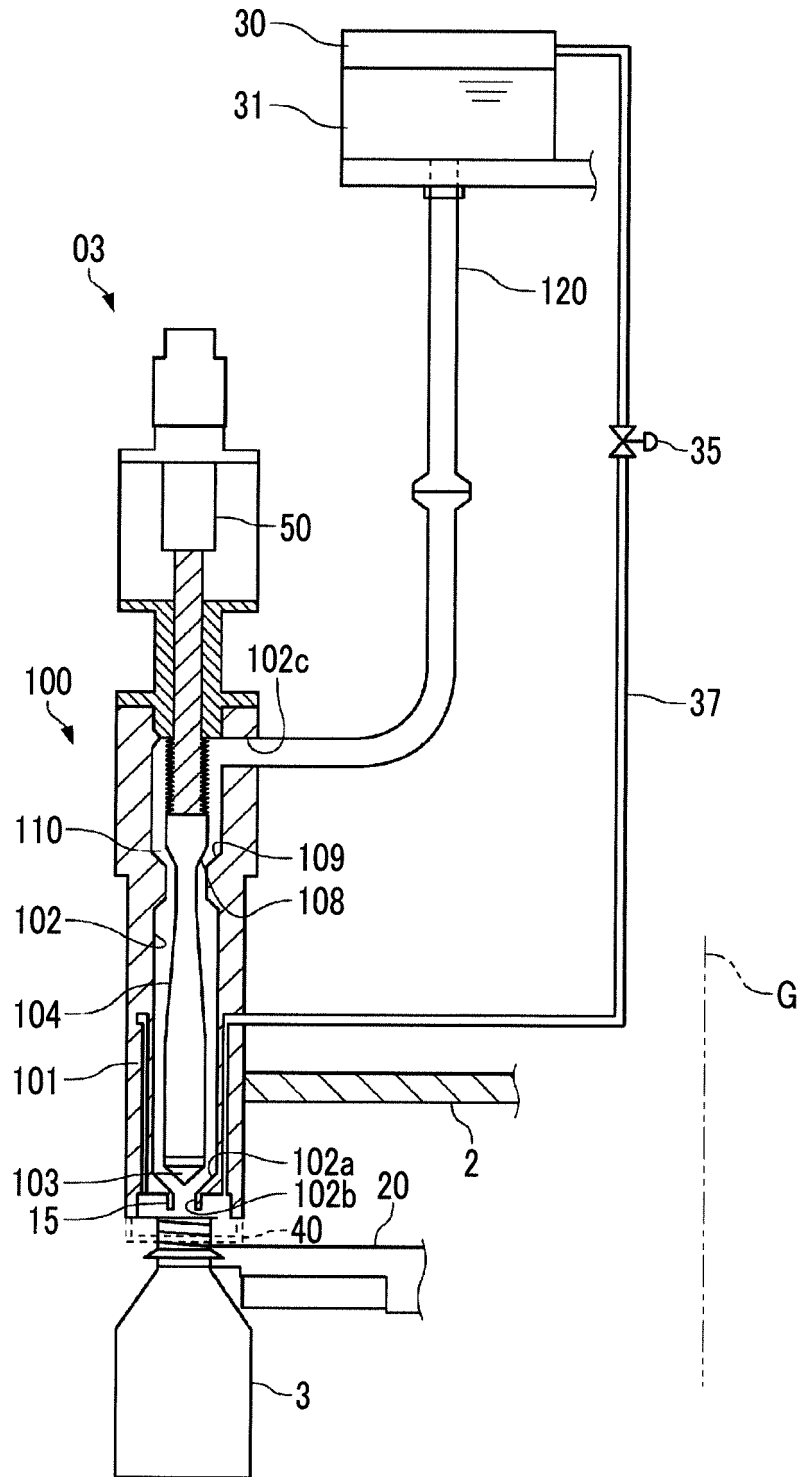


FIG. 3

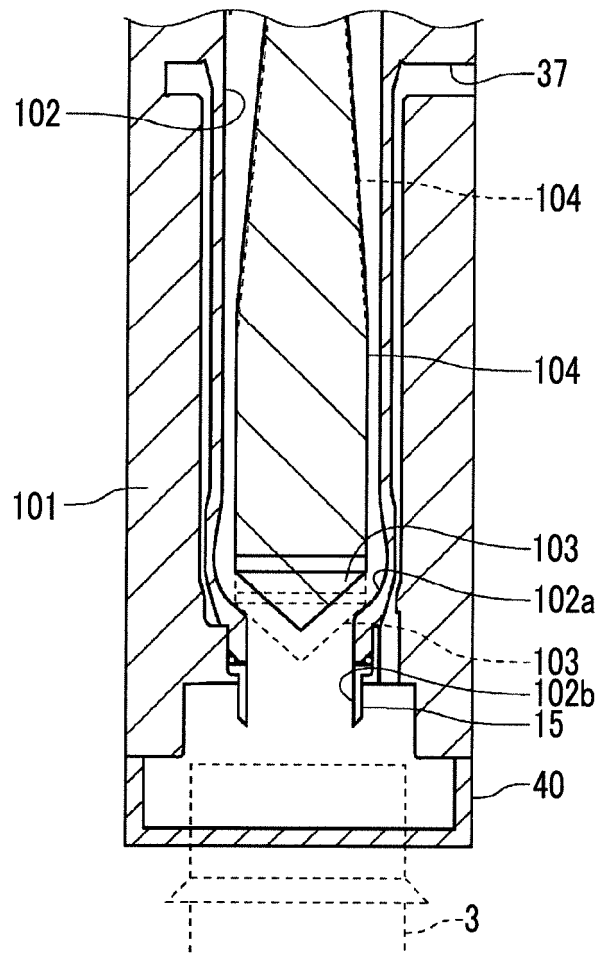


FIG. 4

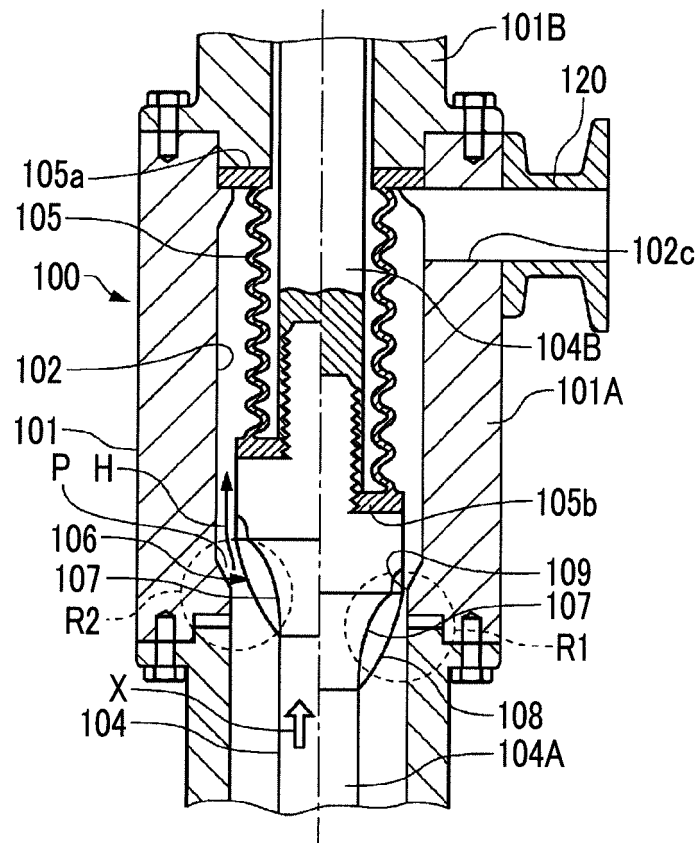
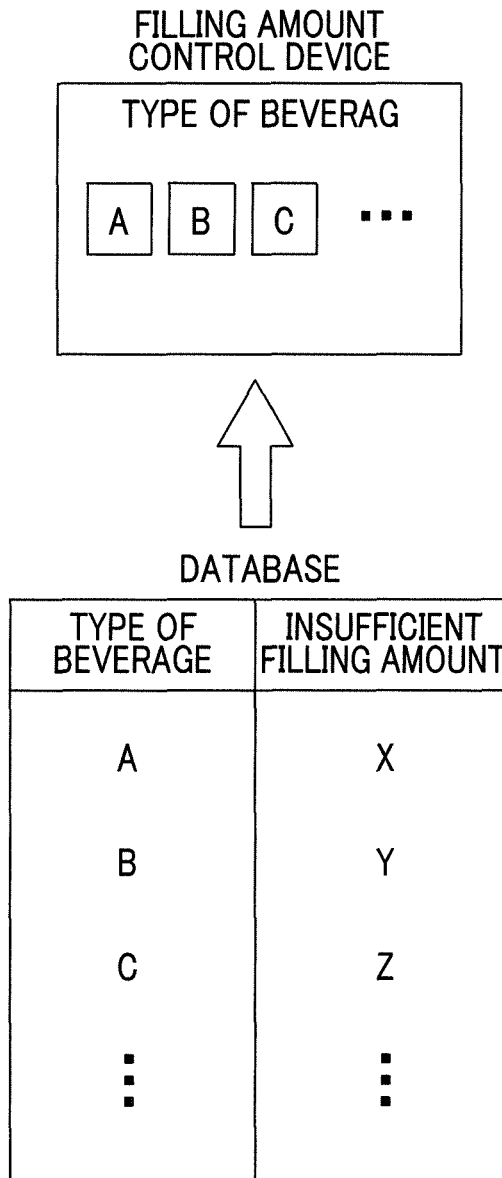


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/004566

A. CLASSIFICATION OF SUBJECT MATTER

B67C3/28(2006.01) i, B67C3/00(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B67C3/28, B67C3/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

| | | | |
|---------------------------|-----------|----------------------------|-----------|
| Jitsuyo Shinan Koho | 1922-1996 | Jitsuyo Shinan Toroku Koho | 1996-2014 |
| Kokai Jitsuyo Shinan Koho | 1971-2014 | Toroku Jitsuyo Shinan Koho | 1994-2014 |

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A | JP 2010-189035 A (Mitsubishi Heavy Industries Food & Packaging Machinery Co., Ltd.), 02 September 2010 (02.09.2010), entire text; all drawings (Family: none) | 1-4 |
| A | JP 3921133 B2 (Kirin Brewery Co., Ltd.), 30 May 2007 (30.05.2007), entire text; all drawings (Family: none) | 1-4 |
| A | JP 7-291395 A (Mitsubishi Heavy Industries, Ltd.), 07 November 1995 (07.11.1995), entire text; all drawings (Family: none) | 1-4 |

 Further documents are listed in the continuation of Box C.
 See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search
01 December, 2014 (01.12.14)Date of mailing of the international search report
09 December, 2014 (09.12.14)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/004566

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A | JP 3649517 B2 (Mitsubishi Heavy Industries, Ltd.), 18 May 2005 (18.05.2005), entire text; all drawings (Family: none) | 1-4 |

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010189035 A [0006]