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Yatsushiro et al.

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[45] **Sept. 24, 1974**

[54] **METHOD AND MEANS FOR FILLING BEER OR THE LIKE INTO CONTAINERS WITHOUT INTRODUCTION OF AIR**

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[52] **U.S. Cl.** ..... **53/22 R,** 141/11, 141/70

[51] **Int. Cl.** **B65b 31/06**

[58] **Field of Search** ..... 141/4–7, 11, 141/64, 70; 53/12 R, 22 R

[56] **References Cited**

UNITED STATES PATENTS

2,199,565 5/1940 Kantor 141/64

Primary Examiner—Houston S. Bell, Jr.

Attorney, Agent, or Firm—Holman & Stern

[57] **ABSTRACT**

A centering bell adapted to hold a container in register with a filling valve during filling operation is bored to receive with clearance a tube extending from the filling valve to be inserted into the container. A flexible tube extends between the centering bell and a gas valve mounted on or within the filling valve to provide communication between the latter and the interior of the container through the bore of the centering bell. The gas valve is opened upon completion of a filling operation so that while the filling tube is being gradually removed out of the container after the same has been filled to capacity with the liquid delivered through the filling tube, an inert gas such as carbon dioxide or nitrogen gas is introduced through the bore of the centering bell into an empty space created within the container by the gradual removal of the filling tube.

6 Claims, 5 Drawing Figures

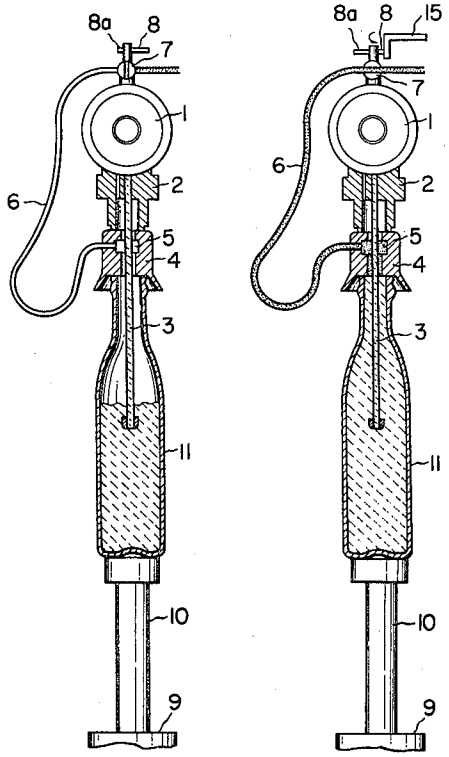


FIG. 1(A)

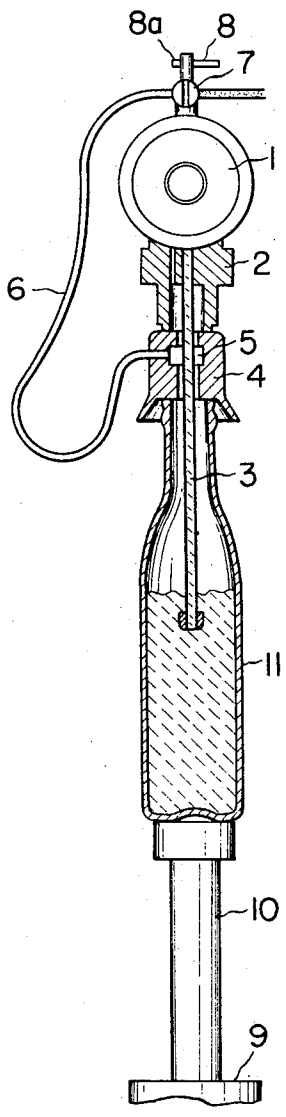


FIG. 1(B)

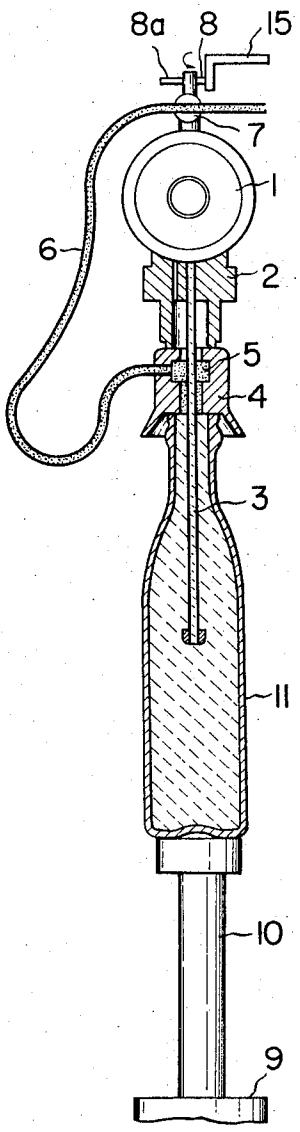


FIG.1(C)

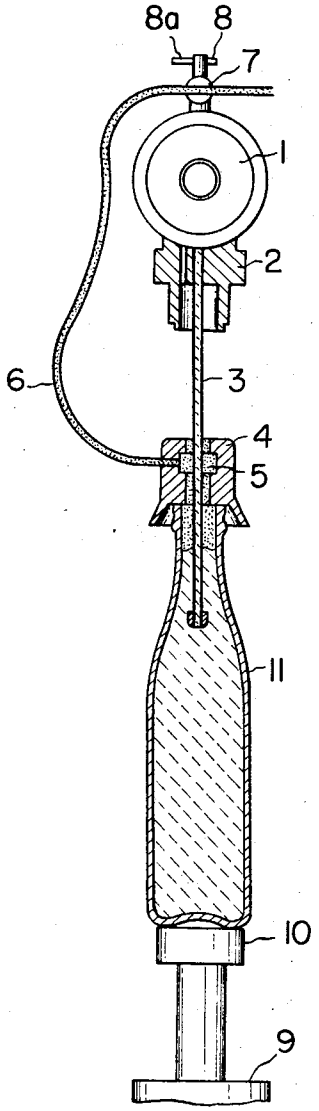


FIG.1(D)

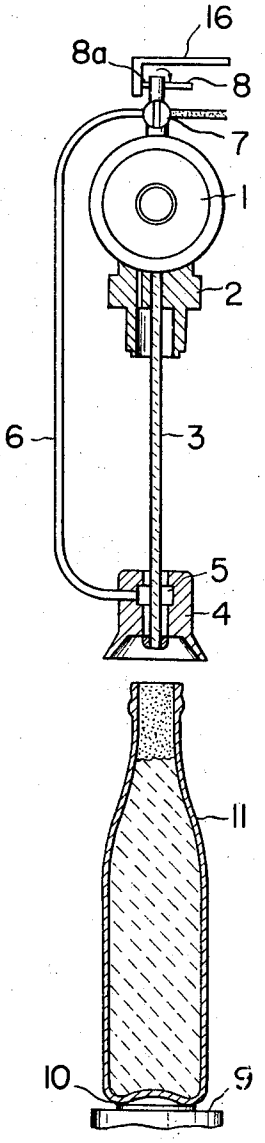
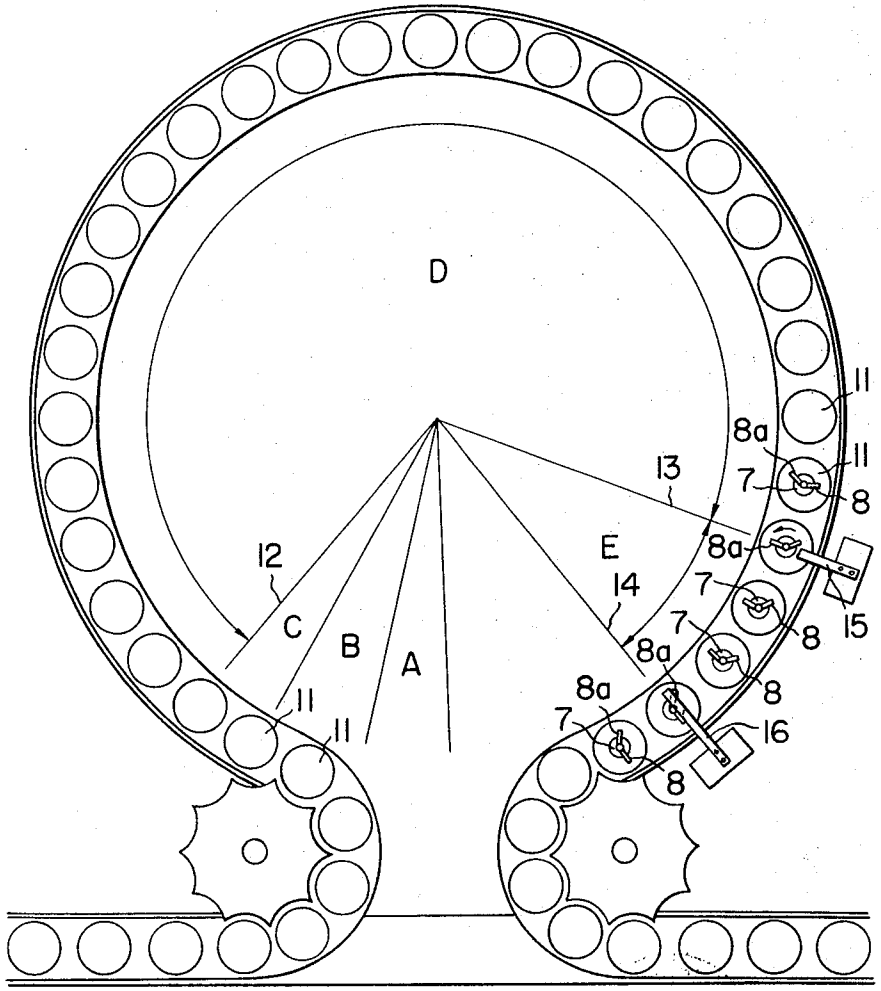


FIG. 2



METHOD AND MEANS FOR FILLING BEER OR THE LIKE INTO CONTAINERS WITHOUT INTRODUCTION OF AIR

BACKGROUND OF THE INVENTION

This invention relates generally to the art of filling containers such as bottling and canning and is more specifically directed to a method and means for filling a liquid such as beer and various other beverages into containers such as bottles and cans in such a manner that the air content of the filled containers is minimized.

PRIOR ART

In apparatus presently in general use for the bottling of beer or like beverages, a tube extending from a filling valve is inserted into each of the bottles mounted on their respective platforms which are vertically movable. The filling valve is closed when the bottle has been filled to capacity with the beer or the like delivered through the tube. The platform is then lowered to remove the tube from within the bottle, with the result that an empty space or "headspace" is created within the neck of the bottle in accordance with the tube displacement.

While this headspace is of absolute necessity to prevent the succeedingly crowned bottles from rupturing due to the possible expansion of the liquid contained therein, it must also be taken into account that the air entrapped in the headspace can cause oxidation of the liquid thereby degrading the quality or taste thereof. In order to avoid this, auxiliary operations known to the specialists as jetting, knocking, or the application of ultrasonic waves have been practiced conventionally to cause the bottled beer or the like to foam slightly and hence to expel the air in the neck. There has also been practiced an operation known as after-gassing in which a suitable volume of inert gas such as carbon dioxide is injected into the filled bottles as they travel from filler to crowner. However, all these prior techniques can cause incomplete elimination of air due to insufficient foaming. If, on the other hand, the foaming is so excessive as to cause overflow, the contents of the bottles may become irregular or fall short of the stipulated quantity.

It has also been proposed to inject carbon dioxide or other inert gases into the empty bottles before filling as a means of air expulsion. This technique is also unsatisfactory in that an uneconomically large volume of such inert gas must be used to fill the bottles to such an extent as to reduce the air content of the headspace to a desired minimum.

SUMMARY OF THE INVENTION

In view of the noted inefficiencies of the prior art, it is an object of this invention to provide a novel and improved method of filling beer or other beverages into containers such as bottles or cans while substantially preventing the introduction of air into the headspace of the containers.

It is also an object of this invention to provide means for carrying out the improved method of the invention, such that the means can be easily and inexpensively incorporated in automatic filling machines of conventional construction.

Briefly summarized, the improved method of the invention comprises the steps of inserting a filling tube into a container, filling the container to capacity with a liquid delivered through the filling tube, and gradually removing the filling tube out of the container while simultaneously introducing an inert gas into an empty space created within the container by the gradual removal of the filling tube.

The means for carrying out this improved method according to the invention comprise a member such as a centering bell positioned between a filling valve and a container to hold the latter in register with the former during the filling operation, with the member having a bore therethrough to receive with clearance a filling tube extending from the filling valve to be loosely inserted into the container. A flexible tube extends from a gas valve to the aforesaid member to provide communication between the former and the interior of the container through the bore of the member. The gas valve is opened upon completion of the filling operation so that while the filling tube is being gradually removed out of the container, the inert gas is simultaneously introduced through the bore of the member into the empty space created within the container.

In this manner, the objective of air expulsion from the headspace of the filled containers can be accomplished by use of a minimum volume of inert gas such as carbon dioxide or nitrogen gas without the need for the intentional foaming operation of the prior art, which can result in a wasteful use of the liquid to be bottled or canned. The utility of this invention is amply evidenced by the fact that the air content of bottles of standard size filled with beer according to the teachings of the invention averages from about 1 to 2 milliliters as compared with from about 10 to even 20 milli-liters of air contained in beer bottles of the same size filled in accordance with the conventional practice and caused to foam insufficiently.

The features which are believed to be novel and characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its method and the means for carrying out the same, as well as further objects and advantages thereof, will be best understood from the following description read in conjunction with the accompanying drawings in which like reference numerals denote like parts throughout the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A, 1B, 1C and 1D are side elevations, partly in vertical section, showing progressive steps in a beer bottling operation in accordance with the concepts of this invention; and

FIG. 2 is a schematic top plan view of explanatory nature showing a rotary beer bottling apparatus incorporating the concepts of the invention.

DETAILED DESCRIPTION

The invention is hereinafter described more specifically as adapted for the bottling of beer. With particular reference to FIG. 1A, a filling valve **1** is fixedly mounted on a valve seat **2**. A centering bell **4** is provided below the valve seat **2**, and a filling tube **3** extending downward and coaxially therethrough from the filling valve **1** is loosely inserted into and through a bore formed axially through the centering bell **4**. An annular groove **5** is formed in the inner wall surface of

this bore of the centering bell 4 and is communicates, through a flexible tube 6, with a gas valve 7 mounted on top of the filling valve 1 and thence with a pressure cylinder or vessel in which is held a compressed inert gas such as for example, carbon dioxide or nitrogen gas. The gas valve 7 may be housed within the filling valve 1 as required.

A pair of angularly spaced arms 8 and 8_a are affixed to the stem of the gas valve 7 approximately at a right angle to its axis. The gas valve 7 is operable by turning these arms in the manner hereinafter set forth. During the filling operation, a bottle 11 is held in a raised position on a platform 10 vertically movable on a table 9 which revolves in step with the valve support structure not shown in the drawings.

FIG. 2 illustrates the revolving table 9 together with the bottles 11 carried substantially in an annular arrangement thereon, with the bottles being revolved clockwise as seen in the drawing by the table 9 and being further moved vertically by the aforesaid platforms 10 during the filling operation. In the arc A of the circle defined by the table, the foam created by the previous filling operation in the filling valve and so forth is removed by means such as a foam blow-out known in the art. In the arc B the bottles are engaged by and sealed under the centering bells 4 of the filling valves 1 shown in FIG. 1A, while in the arc C the necessary counterpressure is established within the bottles. The actual beer filling operation starts as the successive bottles reach position 12 and continues throughout the arc D until the bottles reach position 13. As the filled bottles further travel from the position 13 to position 14 through the arc E, the filling tubes 3 are removed therefrom. This filling sequence is conventional and in itself does not constitute this invention.

For turning the arms 8 and 8_a of the gas valve 7 in the positions 13 and 14 of the revolving table in accordance with the invention, there are fixedly provided two arm operating members 15 and 16 of different lengths as in FIG. 2 which have their forward ends bent downward for engagement with the arms. The shorter arm operating member 15 engages the arm 8 and the longer arm operating member 16 the arm 8_a, in order to operate the gas valve 7 as hereinafter described in more detail.

When traveling through the arc D from the position 12 to the position 13, each bottle 11 is held in its raised or filling position by the platform 10. The bottle 11 thus raised by the platform receives the filling tube 3 through its mouth and lifts the centering bell 4 into close contact with the valve seat 2 as shown in FIG. 1A. The beer port of the filling valve 1 is then opened in an accordance with the prior art, and bulk beer in a tank or the like is admitted into the bottle 11 through the filling tube 3.

When the bottle 11 arrives at the position 13, the beer port of the filling vlave 1 is closed as then the bottle has been filled to capacity as seen in FIG. 1B. Simultaneously with the closure of the filling valve beer port, the arm 8 of the gas valve 7 becomes engaged with the arm operating member 15 and is thereby turned counterclockwise as seen in FIG. 2 as the gas valve continues moving clockwise on the table 9 together with the bottle 11. The gas valve 7 has its port opened by the counterclockwise turn of its arm 8 thereby permitting the gas stored under pressure in the bomb to flow to the mouth of the bottle through the tube 6 and the centering bell 4. This condition is illustrated in FIG. 1B.

During the travel of the bottle from the position 13 to the position 14, however, the platform 10 is gradually lowered to cause the bottle together with the centering bell to move downward from the valve seat 2 as shown in FIG. 1C. As the filing tube 3 is thus pulled out of the bottle, the gas in introduced into the empty space created within the neck of the bottle in accordance with the filling tube displacement.

As shown in FIG. 1D, the platform 10 becomes substantially flush with the surface of the revolving table 9 when the bottle has arrived at the position 14. The filling tube 3 is now completely removed from within the bottle 11, while the centering bell 4 is separated from the mouth of the bottle by means of a stop provided at the lower extremity of the filling tube. The headspace formed by the removal of the filling tube is completely filled with the gas. The arm 8_a of the gas valve 7 is then engaged by the other arm operating member 16 and, as the gas valve is further revolved clockwise with the bottle, is turned clockwise so that its port is closed to terminate the supply of the gas to the bottle. Each bottle thus filled with beer and gas is then conveyed to the crowner, (not shown) in accordance with the prior art.

Although the invention has been shown and described hereinabove in terms of a specific embodiment thereof, it will be easy for those skilled in the art to devise many modifications thereof. For example, instead of turning the arms 8 and 8_a of the gas valve 7 by the arm operating members 15 and 16 in relation with the revolution of the table, the gas valve may be operated by suitable means actuated by the vertical motion of the platform 10. It is further understood that the invention is adaptable not only for the bottling of beer as in the foregoing example but also for the bottling or canning of other beverages as well as liquids marked by affinity for oxygen. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the fair meaning or proper scope of the invention as disclosed herein.

We claim:

1. A method of filling a liquid into a container, comprising the steps of inserting a filling tube into the container through a bore provided in a centering bell serving to hold the container in position during a filling operation, filling the container to capacity with a liquid delivered through said filling tube, removing said filling tube after filling up of the container with the liquid and flooding an inert gas at the centering bell top, and attaching a crown onto the container upon the removal of the filling tube from the container, the improvement being that the removal of the filling tube from the container is gradually carried out after causing closing of a liquid filling valve and the communication of a gas feeding tube with an inert gas source upon completion of filling of the container with the delivered liquid, thus to introduce the inert gas through the bore of the centering bell into an empty space created within the container by the removal of the filling tube during only the removal process of the filling tube from the filled container, thereby causing complete removal of air from the filled container.

2. An apparatus for filling a liquid into a container without the introduction of air, comprising, in combination, a filling valve for regulating the flow of the liq-

uid into the container, a liquid filling tube communicating with and extending from the filling valve so as to be loosely inserted into the container and removed from the container after completion of filling the container with the liquid, a centering bell positioned between said filling valve and the container serving to hold the container in position during a liquid filling operation, said centering valve having a bore therethrough to receive said filling tube with a clearance, gas flooding means for flooding an inert gas at the centering bell top and provided with an inert gas valve, and a crowner for attaching a crown onto the container, the improvement being that as said gas valve is used an exchange valve adapted to provide communication of the gas flooding means with an inert gas source upon completion of the filling of the container with the liquid and to close said valve after gradual removal of the filling tube from the filled container.

3. The apparatus for filling a liquid into a container as claimed in claim **2,** in which the exchange valve communicates with the interior of the centering bell.

4. the apparatus for filling a liquid into a container as claimed in claim **2,** in which the filling tube is provided at its extreme lower end with a member for supporting the centering bell when said filling tube is completely removed from the container.

5. The apparatus for filling a liquid into a container as claimed in claim **2,** in which the exchange valve is mounted on the filling valve and provided with a pair of spaced first and second arms to be turned, and arms operating first and second members, said first arm being exchanged by said arm operating first member to open said valve upon completion of the filling of the container and said second arm being exchanged by said arm operating second member to close said valve upon complete removal of the filling tube from the container.

6. The apparatus for filling a liquid into a container as claimed in claim **5** in which when said apparatus is applied to a system including a revolving table upon which a plurality of containers are successively mounted, said arm operating members are fixedly mounted with angularly spaced relationship against the revolving table so as to be engaged respectively by one of said arms so that the first arm is turned in one direction to open the gas valve as the same is revolved past said arm operating first member and said second arm is turned in the opposite direction to close said valve as the same is revolved past said arm operating second member, said arm operating members being so positioned relative to said revolving table that said gas valve is opened upon completion of a filling operation whereby while the container is being moved to a lowered position after having been filled to capacity with the liquid delivered to remove the filling tube from the container, the insert gas is simultaneously introduced into an empty space cerated within the container by the gradual removal of said filling tube, and said gas valve is closed when the container therebelow has been moved to said lowered position.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,837,137 Dated September 24, 1974

Inventor(s) Toyohiko Yatsushiro, et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

[30] Foreign Priority Data:

Japan No. 6437/1972 of January 14, 1972

Signed and sealed this 17th day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.