United States Patent

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[54] **RECEPTACLE FILLING METHOD**
9 Claims, 2 Drawing Figs.

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[51] **Int. Cl.** **B65b 3/18**
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39—41, 47, 49, 59, 69, 114—116, 119, 126

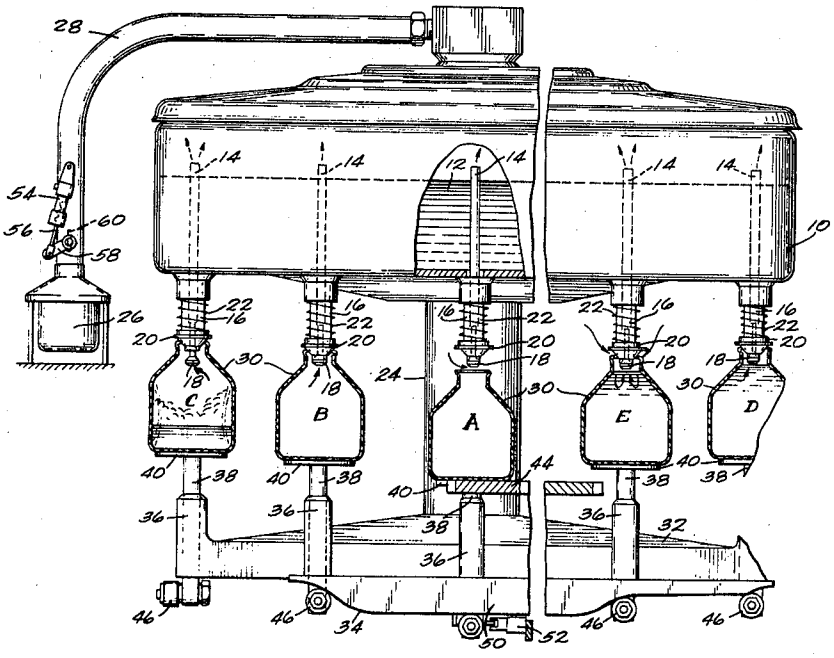
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ABSTRACT: A rotary type filling machine having a plurality of filling heads spaced about is periphery. The filling heads have vent tubes for communicating the interior of flexible walled containers, which are to be filled by the machine, with a gas storage area within the machine. This area is subjected to a pulsing vacuum which vacuum is communicated to the containers via the vent tubes and which operates on said containers to prevent overfilling of the same.



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Fig. 2

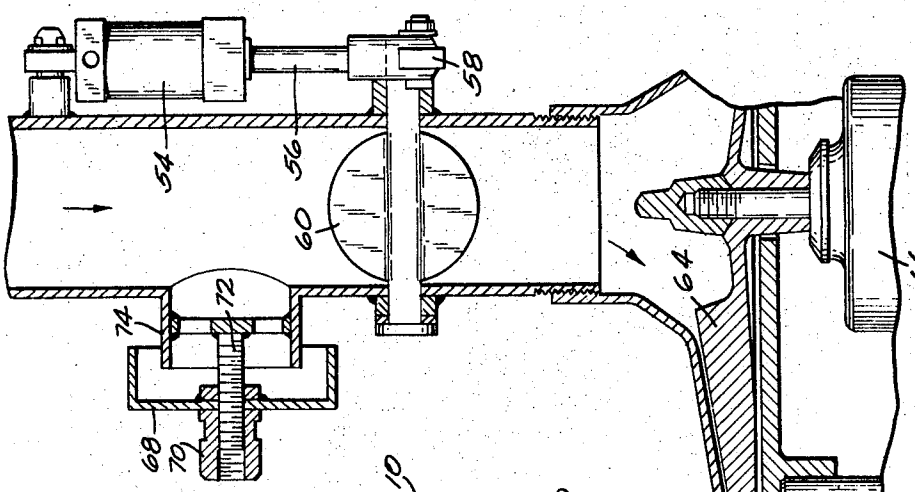
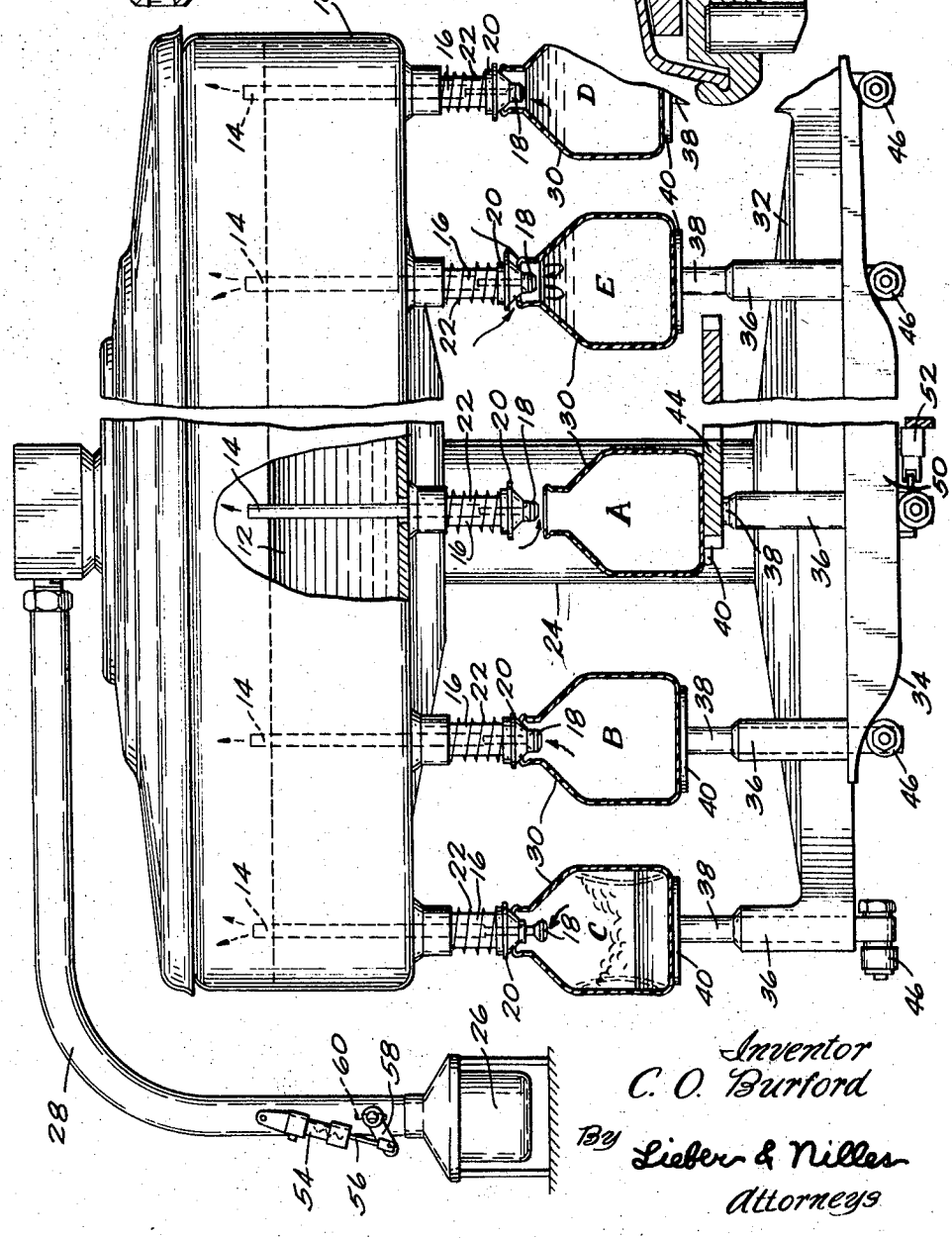


Fig. 1



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RECEPTACLE FILLING METHOD

BACKGROUND AND PRIOR ART

Various types of nozzles for dispensing liquid from a supply tank to successive receptacles movable along a definite predetermined path have heretofore been proposed and used commercially with varying degrees of success. One type of liquid dispensing nozzle which has enjoyed good commercial acceptance due to its ability to function effectively with a variety of liquids having different characteristics and to its ability to feed liquid to and accurately fill receptacles of various types in rapid and efficient manner is that shown and described in U.S. Pat. No. 2,620,113, dated Dec. 2, 1952. The dispensing nozzle disclosed in this patent comprises generally a vertical open-ended vent tube fixedly mounted on the supply tank with its upper end located above the level of the liquid in the tank, and a sleeve surrounding and spaced from the vent tube and communicating at its upper end with the supply tank below the liquid level so as to fill the space between the vent tube and the sleeve with liquid to be dispensed, the sleeve being resiliently urged downwardly to normally seat the lower end thereof against a valve seat carried by the lower end of the vent tube. Thus, by bringing the bottle or other receptacle to be filled into position under the nozzle and then raising the receptacle against the lower end of the sleeve to move the sleeve upwardly away from the valve seat, the liquid is permitted to flow into the receptacle to fill the same.

It is also customary in these filling systems to maintain the filler bowl or supply tank under an operating vacuum during the filling operations. Accordingly, since the vent tube is open at its upper end to the low pressure area of the tank, air is drawn from the receptacle through the vent tube when the receptacle is positioned under the nozzle and in sealing engagement therewith, reducing the pressure in the receptacle to that existing in the tank. Thus, as the receptacle is raised to open the dispensing valve, the product flows downwardly through space between the vent tube and the sleeve and into the receptacle by gravity, the air remaining in the receptacle being displaced by the product and being evacuated through the vent tube. Foam is generally created during the filling operation, and this foam is forced up the vent tube due to the differences in the specific gravity of the liquid and the foam, the foam being discharged above the liquid level in the tank where it dissipates.

Upon termination of the filling operation, the filled bottle or other receptacle is lowered, and upon withdrawal of the receptacle from the nozzle, the sleeve is returned by spring action to its seat on the valve part at the lower end of the vent tube. The filling port or dispensing valve is thus closed, and as the seal between the receptacle and valve part carried by the lower end of the sleeve is broken, the foam and product trapped in the vent tube are drawn into the low pressure area of the supply tank by the inrush of air through the open vent tube. This eliminates messy afterdrip from the vent tube and aids in maintaining uniform fill height in the receptacles.

While the liquid dispensing system hereinabove described has proven satisfactory in the filling of regularly shaped rigid receptacles such as glass bottles, considerable difficulty has been encountered in the filling of relatively flexible containers having various irregular shapes such as plastic bottles which incorporate reduced gripping portions or which are otherwise contoured for aesthetic appearance or the like. In the filling of these flexible and irregularly-shaped receptacles, a considerably greater amount of foam is developed as the product being dispensed flows into the receptacle, and this generation of foam materially increases the filling time during which the receptacle must be maintained in contact with the liquid dispensing valve. In addition, if vacuum is being employed for evacuation of air and foam from the receptacles as hereinabove described, it is necessary to reduce the vacuum in order to prevent collapse of the bottle or other receptacle at the time it is exposed to the vacuum at the start of the filling operation. Also, upon completion of the filling operation, the product head in the supply tank or bowl to which the receptacle is exposed through the dispensing valve causes the flexible receptacle to expand beyond its normal capacity. This causes the liquid in the receptacle to overflow as the receptacle is withdrawn from the filling nozzle and recovers its normal shape.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a liquid dispensing and receptacle filling method which obviates the aforesaid disadvantages and objections of prior systems.

Another object of this invention is to provide an improved liquid dispensing and filling system which is especially adapted for use in uniformly filling relatively flexible containers of regular or irregular shape in a rapid and highly efficient manner.

Still another object of the invention is to provide a novel and improved method for filling plastic and other nonrigid containers with desired quantities of liquid with the aid of vacuum without collapsing the container and without loss of liquid due to excessive filling and resultant overflow.

A further object of the present invention is to provide an improved system of filling self-supported, flexible-walled and open-mouthed receptacles with liquid, which comprises, initially applying a filler nozzle to the receptacle mouth sealing the mouth, commencing the supply of liquid to the receptacle, advancing the receptacle along a predetermined path to a discharge zone while continuing to supply liquid thereto, then ceasing to supply liquid to the receptacle, and finally establishing a controlled low vacuum condition in the receptacle while removing the nozzle from the receptacle mouth.

It is an additional object of the invention to draw the vacuum through a vent tube placed in communication with the interior of the receptacle and to subject the interior of the receptacle to a vacuum of alternately increased and decreased magnitude to thereby flex the receptacle walls in a pulsating manner as liquid is supplied thereto while also providing a momentary high vacuum immediately upon removal of the nozzle following the filling operation to thus clear the vent tube and prevent backflow therefrom.

Additional objects and advantages of the invention will become apparent from the following detailed description:

THE DRAWINGS

A clear conception of the features constituting the present improvements, and of typical apparatus used in the improved filling system, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

FIG. 1 is a more or less schematic view of a typical bottle filling apparatus embodying the features of the present invention and illustrating the bottles in their various positions before, during and immediately following the filling operations, parts being shown in section for purposes of clarity; and

FIG. 2 is a somewhat enlarged fragmentary section of the vacuum apparatus and controls therefor.

DETAILED DESCRIPTION

While the invention has been specifically shown and described herein as being embodied in a particular type of liquid dispensing apparatus adapted to fill plastic bottles with a relatively heavy liquid such as milk, it should be understood that the improvements may be incorporated with equal effectiveness in different types of dispensers utilized for filling other types of receptacles which are self-supporting but relatively flexible with various type of liquids. It is furthermore contemplated that specific descriptive terms used herein shall be given the broadest possible interpretation consistent with the disclosure.

Referring to the drawings, FIG. 1 schematically shows a dispensing apparatus which includes a supply tank or filler

bowl 10. The supply tank 10 contains a quantity of liquid to be dispensed, the liquid within the tank being normally maintained with the liquid 12 to a predetermined level. Communicating with the interior of the supply tank or bowl 10 above the level of the liquid 12 is an annular series of vent tubes 14 open at both ends. Surrounding and spaced from each of the vent tubes 14 is a sleeve 16 which cooperates with its respective vent tube to provide a filling nozzle. Each 18,20 14 has an outwardly flared lower head 18 providing a valve seat. In turn, each of the sleeves 16 is provided with a rubber head 20 forming a valve part seatable upon the seal 18 to form the dispensing valve. The sleeves 16 are each resiliently urged downwardly as by means of springs 22 to seat the valve part 20 upon the valve seat 18. The upper ends of the sleeve 16 are open to the lower portion of the supply tank 10 below the level of the liquid 12 therein, and thus, the space between each of the vent tubes 14 and its sleeve 16 is maintained full of liquid to be dispensed, the liquid being confined therein by the valve formed by the parts 18, 20 when under the influence of the spring 22. For a more detailed description of the dispensing nozzles as formed by the vent tube 14, sleeve 16, and valve parts 18 and 20, reference is made to U.S. Pat. No. 2,620,113.

The supply tank or bowl 10 may be conveniently supported on a column 24 for rotation during the filling operation as will hereinafter more fully appear. In addition, a vacuum is created within the upper portion of the tank 10 above the level of the liquid 12, and for this purpose, a suitable vacuum pump 26 may be provided. The vacuum pump 26 communicates with the upper interior of the tank 10 by way of a conduit 28, and in accordance with this invention, means are provided for varying the vacuum within the tank as hereinafter described.

The column 24 is supported on a suitable base and is provided with means for receiving and advancing bottles or similar receptacles 30 to, through and away from the filling zone. In the apparatus shown, an outwardly extending support 32 having a cam track 34 is provided for receiving successive bottle carriers 36. These bottle carriers are advanced in succession in any suitable manner along the cam track 34 so as to be movable toward and away from the dispensing nozzles at different stations in the filling process, and each of the supports 36 includes a vertically reciprocal member 38 provided with a platform 40 for receiving a bottle 30. Thus, as the bottles 30 are fed to the successive bottle supports 36, 38, 40 in the zone 44, the mechanism is so timed that the bottle will be disposed immediately below and in vertical alignment with one of the dispensing nozzles as illustrated by the letter A. As the cam follower 46 of each of the bottle supports 36, 38, 40 proceeds along the cam surface 34, the supply tank or bowl 10 is rotated in timed relation therewith, and as each of the successive bottles 30 advances from the initial zone A to the zone B, the mouth of the bottle is brought into engagement with the rubber valve part 20 carried by the lower end of the tube 16. Upon making initial contact with the valve part 20, air is evacuated from the bottle 30 in zone B by reason of the vacuum existing in the upper portion of the tank or bowl 10 and which is drawn through the tube 14. As the bottle is advanced to the next station, C, it is raised by the member 38 carrying the cam follower 46, and this in turn, raises the sleeve 16 against the action of the spring 22 to lift the valve part 20 off of the seat 18. Liquid is thus dispensed through the sleeve 16 about the vent tube 14 and past the valve formed by the parts 18, 20. During this filling operation, the air evacuation of the bottle 30 is continued with means being provided to alternately increase and decrease the vacuum as will hereinafter more fully appear. This variable vacuum evacuation of air from the bottle 30 is continued throughout the filling process and causes the flexible walls of the bottle 30 to flex in a pulsating manner as shown in phantom at station C.

The vacuum may be varied as hereinabove described from low vacuum at Station B where the bottle 30 is initially brought into contact with the valve part 20 to a variable vacuum of increasing and decreasing magnitude throughout the filling operation C in any suitable manner, but in the embodiment shown, the lower end of the rotatable shaft carrying the tank or bowl 10 is provided with a cam 50 which causes follower 46 to contact and operate an air valve or a microswitch 52. This valve or switch 52 is, in turn suitably connected to an air cylinder 54 having its piston 56 operably connected through a lever 58 to a butterfly valve 60 or the like located within the vacuum conduit 28. Thus, as the bowl 10 revolves, the cam 50 causes follower 46 to actuate the air valve 52 to open and close the butterfly valve 60 in the conduit 28 to thereby increase and decrease the amount of vacuum created by the pump 26 in the upper portion of the tank or bowl 10. It is therefore apparent that the timing of the valve-actuating cam with the advancement of the bottles 30 along the cam track 34 is critical, and this timing should be such that the vacuum drawn through the vent tube 14 at station B is of relatively low grade so as not to collapse the flexible walls of the bottle 30. Similarly, as the bottle 30 is advanced through the filling zone C the vacuum being drawn through the tube 14 should be variable.

Immediately upon completion of the filling operation, the bottle 30 is lowered as in zone D, and the cam track 34 along which the cam follower 46 rides should be so designed that the bottle arrives at station D simultaneously with the existence of a low vacuum condition within the tank or bowl 10. Upon further advancement of the bottle 30 from station D to station E, the bottle is lowered by the reciprocal carrier 38 to break its seal with valve part 20. Again, the variation in vacuum caused by the action of the cam 50, follower 46, air valve 52, air cylinder and piston unit 54, 56 and butterfly valve 60 is timed to provide a momentary high vacuum within the upper portion of the tank 10 and within the vent tube 14 immediately after the bottle 30 has been withdrawn from the nozzle at station E. This relatively high pressure condition causes foam and any residue liquid in the vent tube 14 to be drawn into the upper portion of the tank or bowl 10 where it is dissipated, and undesirable dripping of foam and liquid is thereby eliminated. The successive filled bottles are then lowered further by the cam follower 46 riding along cam track 34 and are unloaded at zone 48.

The vacuum pump 26 is shown as being of a centrifugal type wherein blades 64 are rotated by a motor 66 to draw air from the conduit 28 into a hub portion of the impeller while exhausting the same at the outer peripheral portion thereof. However, this vacuum pump may be of any suitable and available type. Also, it is desirable to be able to a adjust vacuum created within the conduit 28 by the pump, and for this purpose, an adjustable air bleed is illustrated. As shown, this air bleed consists of a cap 68 adjustable through an adjustment nut 70 along a threaded shaft 72 to move the cap 68 toward or away from a bleed vent 74. This permits more or less atmospheric air to enter the conduit 28 through the vent 74 and to thereby vary the vacuum normally drawn through the conduit 28. Adjustment of the vacuum-creating device to a normal operation condition is therefore possible, and the butterfly valve 60 as controlled by the cam 50, follower 46 and air valve or switch 52 creates a variable condition within the conduit 28 and the tank 10.

The improved system has proven highly satisfactory in actual use with rapid filling being accomplished without undesirable and messy overflow. By subjecting the interior of the container alternately to high and low vacuum, the walls of the receptacle are flexed in a pulsating manner, and foam created during the filling process is effectively removed and all areas of the container are rapidly filled despite any irregularity in contour of the container. Also, by timing the variation in vacuum so that there is a constant uniform vacuum at the moment the filled bottle breaks contact with the valve, uniform fill is assured and the bottle is not overfilled. It should be noted that this controlled low vacuum condition is established at the final stage of the filling operation, and a sufficient vacuum should be established at this point to return the bulging walls of the receptacle to a substantially normal condition to thereby prevent overfilling. Then, by timing the variation in

vacuum to provide a momentary high vacuum immediately upon removal of the filling nozzle from the mouth of the bottle, any excess foam or liquid in the vent tube **14** is effectively removed and undesirable afterdrip is prevented. It is should be noted that the flow of air and/or foam caused by and resulting from the vacuum is illustrated by means of arrows in the drawing.

I claim:

1. A method of filling self-supported, flexible-walled and open-mouthed receptacles with liquid, which comprises, initially applying a filler nozzle to the receptacle mouth, sealing the receptacle mouth, commencing the supply of liquid to the receptacle, advancing the receptacle along a predetermined path to a discharge zone while continuing to supply liquid thereto and at the same time applying a vacuum of alternately increased and decreased magnitude to the interior of the receptacle to thereby flex the receptacle walls in a pulsating manner as liquid is being supplied thereto, ceasing to supply liquid to the receptacle, then establishing a controlled low vacuum condition in the receptacle and finally providing a momentary high vacuum and immediately removing the nozzle from the receptacle mouth.

2. A method of filling receptacles according to claim **1**, wherein the interior of the receptacle is initially subjected to a controlled vacuum of a sufficiently low magnitude to prevent collapse of the receptacle walls as the filler nozzle is applied to the receptacle mouth.

3. A method of filling receptacles according to claim **1**, wherein the increases and decreases in vacuum and the resulting pulsations of the receptacle walls are timed proportionately to the speed of advancement of the receptacles.

4. A method of filling receptacles according to claim **1**, wherein the vacuum is drawn through a vent tube in the filler nozzle placed in communication with the interior of the receptacle prior to supplying liquid thereto and withdrawn from communication with the interior of the receptacle after the receptacle has been filled.

5. A method of filling receptacles according to claim **4**, wherein the vent tube is subjected to a high vacuum immediately upon removal of the nozzle from the receptacle mouth.

6. A method of filling receptacles according to claim **4**, wherein the liquid is dispensed through a sleeve surrounding and spaced from the vent tube.

7. A method of filling receptacles according to claim **6**, wherein the sleeve is mounted for reciprocal movement and is normally seated under resilient pressure at its lower end on a sealing member carried by the vent tube.

8. A method of filling receptacles according to claim **6**, wherein the sleeve is actuated by the receptacle to be filled, and means is provided for advancing the receptacle to a position under the sleeve and through the filling zones along with the sleeve and vent tube.

9. A method of filling receptacles according to claim **4**, wherein the receptacle and the vent tube are advanced along a defined path from an initial low vacuum zone, through the zone of alternately increasing and decreasing vacuum and the subsequent zone of uniform low vacuum.