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APPLICATION NUMBER: 62/327,808

FILING DATE: April 26, 2016

RELATED PCT APPLICATION NUMBER: PCT/US16/51345

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS US62/327,808



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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SBUX1.388PR2
		Application Number	
Title of Invention	BEVERAGE DISPENSING SYSTEMS AND METHODS		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

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☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
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Inventor 1		Remove	
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Prefix	Given Name	Middle Name	Family Name
	Dan		Apone
Residence Information (Select One) • US Residency Non US Residency Active US Military Service			
City	Seattle	State/Province	WA
Country of Residence		US	
Mailing Address of Inventor:			
Address 1		722 12th Avenue East	
Address 2			
City	Seattle	State/Province	WA
Postal Code	98102	Country i	US
Inventor 2		Remove	
Legal Name			
Prefix	Given Name	Middle Name	Family Name
	Izaak		Koller
Residence Information (Select One) • US Residency Non US Residency Active US Military Service			
City	Seattle	State/Province	WA
Country of Residence		US	
Mailing Address of Inventor:			
Address 1		7355 - 23rd Avenue NW	
Address 2			
City	Seattle	State/Province	WA
Postal Code	98117	Country i	US
Inventor 3		Remove	
Legal Name			
Prefix	Given Name	Middle Name	Family Name
	Michael		Cummer
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		Application Number	
Title of Invention	BEVERAGE DISPENSING SYSTEMS AND METHODS		

City	Seattle	State/Province	WA	Country of Residence ⁱ	US
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Mailing Address of Inventor:

Address 1	4124 Meridian Avenue N				
Address 2					
City	Seattle	State/Province	WA		
Postal Code	98103	Country ⁱ	US		
Inventor	4				Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Rick		Riday	

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City	Seattle	State/Province	WA	Country of Residence ⁱ	US
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Mailing Address of Inventor:

Address 1					
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City		State/Province			
Postal Code		Country ⁱ			
Inventor	5				Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	William		Crossland	

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Mailing Address of Inventor:

Address 1					
Address 2					
City	Seattle	State/Province	WA		
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SBUX1.388PR2	
		Application Number		
Title of Invention	BEVERAGE DISPENSING SYSTEMS AND METHODS			
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Email Address	efiling@knobbe.com		Add Email	Remove Email

Application Information:

Title of the Invention	BEVERAGE DISPENSING SYSTEMS AND METHODS			
Attorney Docket Number	SBUX1.388PR2	Small Entity Status Claimed ☐		
Application Type	Provisional v			
Subject Matter	Utility v			
Total Number of Drawing Sheets (if any)	13	Suggested Figure for Publication (if any) v		

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For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SBUX1.388PR2
		Application Number	
Title of Invention	BEVERAGE DISPENSING SYSTEMS AND METHODS		

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Prior Application Status		Remove
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- ☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SBUX1.388PR2
		Application Number	
Title of Invention	BEVERAGE DISPENSING SYSTEMS AND METHODS		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

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NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SBUX1.388PR2
		Application Number	
Title of Invention	BEVERAGE DISPENSING SYSTEMS AND METHODS		

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If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section. Clear			
☒ Assignee	Legal Representative under 35 U.S.C. 117		Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	Starbucks Corporation dba Starbucks Coffee Company		
Mailing Address Information For Applicant:			
Address 1	2401 Utah Avenue South		
Address 2			
City	Seattle	State/Province	WA
Country	US	Postal Code	98134-1435
Phone Number		Fax Number	
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SBUX1.388PR2
		Application Number	
Title of Invention	BEVERAGE DISPENSING SYSTEMS AND METHODS		

Assignee	1
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See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Jason R. Swartz/		Date (YYYY-MM-DD)	2016-04-26
First Name	Jason	Last Name	Swartz	Registration Number
				64420

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SBUX1.388PR2
		Application Number	
Title of Invention	BEVERAGE DISPENSING SYSTEMS AND METHODS		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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BEVERAGE DISPENSING SYSTEMS AND METHODS**BACKGROUND**Field

[0001] The present disclosure relates to systems and methods for dispensing beverages, such as systems and methods for dispensing servings of espresso.

Description of Certain Related Art

[0002] Espresso is a coffee beverage brewed by forcing steam or hot water through ground coffee. Espresso is typically of thicker consistency than drip coffee, having a higher amount of dissolved solids than drip coffee per relative volume, and a serving size that is usually measured in shots. When producing a serving of espresso (called a “shot”), ground coffee is subjected to high pressure in a beverage preparation machine. This transforms the ground coffee into a firm puck. Hot water is then forced through the puck to produce the espresso, which typically flows directly from the machine into a cup. The cup with the espresso is then removed from the machine for consumption, sale, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] Various embodiments are depicted in the accompanying drawings for illustrative purposes, and should in no way be interpreted as limiting the scope of the embodiments. Various features of different disclosed embodiments can be combined to form additional embodiments, which are part of this disclosure.

[0004] Figure 1 schematically illustrates an embodiment of a beverage dispensing system.

[0005] Figures 2A-2F illustrate portions of the beverage dispensing system of Figure 1 in various operational states.

[0006] Figure 3 illustrates an embodiment of a double-shot beverage dispensing assembly.

[0007] Figure 4 schematically illustrates another embodiment of a beverage dispensing system, such as a system that includes the assembly of Figure 3.

[0008] Figure 5 illustrates a cross-sectional view of an example of the double-shot beverage dispensing assembly of Figure 3.

[0009] Figure 6 schematically illustrates an embodiment of a method related to certain of the beverage dispensing systems.

[0010] Figure 7 schematically illustrates another embodiment of a beverage dispensing system, such as a system comprising a base that is configured to engage with, and introduce fluid through, a bottom of a container.

[0011] Figure 8 illustrates a cross-sectional view of an example of the base of the system of Figure 7 engaged with the container.

[0012] Figure 9 depicts further examples of a base and container that can be used with the system of Figure 7, with the container in an upright position.

[0013] Figure 10 depicts the base and container of Figure 9, with the container in an inverted position.

[0014] Figure 11 depicts a close-up view of the base of Figure 10.

[0015] Figure 12 depicts a close-up view of a bottom of the container of Figure 10.

[0016] Figure 13 depicts an example of tubing that can be used with the system of Figure 7.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

[0017] Various beverage dispensing systems and methods are described below to illustrate various examples that may achieve one or more desired improvements. These examples are only illustrative and not intended in any way to restrict the general disclosure presented and the various aspects and features of this disclosure. The general principles described herein may be applied to embodiments and applications other than those discussed herein without departing from the spirit and scope of the disclosure. Indeed, this disclosure is not limited to the particular embodiments shown, but is instead to be accorded the widest scope consistent with the principles and features that are disclosed or suggested herein.

[0018] Although certain aspects, advantages, and features are described herein, it is not necessary that any particular embodiment include or achieve any or all of those aspects, advantages, and features. Some embodiments may not achieve the advantages described herein, but may achieve other advantages instead. Any structure, feature, or step in any embodiment can be used in place of, or in addition to, any structure, feature, or step in any other embodiment, or omitted. This disclosure contemplates all combinations of features

from the various disclosed embodiments. No feature, structure, or step is essential or indispensable.

Overview (Figure 1)

[0019] Figure 1 schematically illustrates an embodiment of a beverage dispensing system 10. To facilitate presentation, the system 10 is discussed in connection with dispensing an espresso beverage, such as a shot of espresso. But various embodiments can be applied in many other contexts as well, such as in dispensing brewed-coffee, tea, juice, alcohol, and other types of beverages.

[0020] As illustrated, the system 10 can include a dispensing unit 12 and a beverage preparation machine 14, such as a machine for preparing espresso. The dispensing unit 12 can be connected with tubing 16, such as flexible or rigid piping, to enable delivery of the beverage from the beverage preparation machine 14 to the dispensing unit 12. As shown, the dispensing unit 12 can be spaced apart from the beverage preparation machine 14. For example, the dispensing unit 12 can be positioned above a counter and/or generally visible from a front side and a rear side of the counter, and the beverage preparation machine 14 can be positioned below the counter, inside a cabinet, and/or otherwise generally obscured from view from at least one of the front and rear sides. In various embodiments, the dispensing unit 12 is not received in, part of, and/or coupled directly to the beverage preparation machine 14.

[0021] The dispensing unit 12 can receive the beverage from the beverage preparation machine 14 via a fluid communication path through the tubing 16. In some embodiments, the dispensing unit 12 is configured to hold and/or dispense the beverage. For example, the dispensing unit 12 can receive a shot of espresso, hold the espresso for a period, and dispense the espresso into a cup or other vessel. In certain implementations, the dispensing unit 12 is configured to contain a single serving of a beverage, such as a single shot of espresso. In some variants, the dispensing unit 12 is configured to contain multiple servings of a beverage.

[0022] In some embodiments, the dispensing unit 12 comprises a generally elongate hollow member. The dispensing unit 12 can be open on one end and closed on the other end. For example, the dispensing unit 12 can include a hollow tube that is open on a first end 18 and closed on a second end 20. In certain implementations, such as is

schematically illustrated in Figure 1, when the dispensing unit 12 is in an upright configuration, the first end 18 is the upper or uppermost end of the dispensing unit 12 and the second end 20 is the lower or lowermost end of the dispensing unit 12. In some embodiments, the dispensing unit 12 is transparent or semi-transparent. For example, the dispensing unit 12 can be made of transparent or semi-transparent plastic or glass.

[0023] As illustrated, the dispensing unit 12 can be configured to pivot about a rotation point 22. For example, the dispensing unit 12 can be pivotally connected to a base or support member (not shown). As will be described in further detail below, such pivoting can enable the dispensing unit 12 to rotate between various operational states, such as dispensing the beverage from the dispensing unit 12 into a cup or other vessel. The system 10 can include one or more position sensors configured to detect the location of the dispensing unit 12. For example, the system 10 can detect when the dispensing unit 12 is in a receiving (e.g., upright) position, a dispensing position, and/or a cleaning (e.g., inverted) position. In some embodiments, the system 10 can determine whether the dispensing unit 12 is in a position to receive beverage from the beverage preparation machine 14 and/or to receive cleansing fluid from a source.

[0024] The system 10 can include a flow control device, such as a check valve 24. The check valve 24 can be located in the second end 20 of the dispensing unit 12. The check valve 24 can allow fluid to flow through the second end 20 and into the dispensing unit 12 and/or can inhibit or prevent fluid from passing out of the second end 20 of the dispensing unit 12. In certain implementations, the check valve 24 is configured to close in certain orientations of the dispensing unit 12. For example, the check valve 24 can close (e.g., due to the force of gravity acting on a movable sealing component of the check valve 24) when the dispensing unit 12 is in the upright configuration and there is less than a minimum amount of fluid pressure in the tubing 16. In certain embodiments, the check valve 24 is configured to removably couple with, and close, the second end 20 of the dispensing unit 12, as will be discussed in more detail below. In some implementations, the check valve 24 is a ball check valve, diaphragm valve, duckbill valve, or otherwise. In certain embodiments, the check valve 24 is rotatably connected with the tubing 16, such as with a rotatable coupling. This can allow the check valve 24 and the dispensing unit 12 to rotate relative to the tubing 16.

[0025] In some embodiments, the system 10 includes a pump 26, such as a peristaltic pump. The pump 26 can encourage the beverage from the beverage preparation machine 14 to the dispensing unit 12. Some embodiments do not include a pump 26. For example, in certain variants, pressure that occurs during the beverage preparation process (e.g., the pressure that occurs during the preparation of espresso) is used to encourage the beverage from the beverage preparation machine 14 to the dispensing unit 12 without the need for a pump 26.

[0026] As also illustrated, certain embodiments include a control valve 28, such as a three-way valve. The control valve 28 can be adapted to switch between a first position and a second position. In the first position, the control valve 28 can permit beverage to flow into the dispensing unit 12. In the second position, the control valve 28 can permit cleansing fluid (e.g., potable water) to flow into the dispensing unit 12. In some implementations, the flow of cleansing fluid flushes or otherwise cleanses some or all of the tubing 16, control valve 28, check valve 24, container 12, and/or other components of the system 10. In some implementations, the control valve 28 is an electronic valve, such as a solenoid valve.

[0027] As shown, certain embodiments include a controller 30, such as a processor and a memory. The controller 30 can be electrically coupled with various other components of the system 10, such as through one or more cables or wires 32. In some embodiment, the controller 130 communicates with one or more other components wirelessly, such as via wi-fi, Bluetooth®, etc. The controller 30 can control aspects of certain components of the system 10. For example, the controller 30 can control operation of the control valve 28 and/or pump 26. In some embodiments, the controller 30 can instruct the beverage preparation machine 14 to prepare a type of beverage, size of beverage, strength of beverage, etc. In some embodiments, the controller 30 and the beverage preparation machine 14 can communicate bi-directionally. For example, the controller 30 can send instructions to the beverage preparation machine 14 and can receive information from the beverage preparation machine 14, such as status information (e.g., number of espresso shots produced in a certain period, bean hopper status, etc.), health information (e.g., fault codes and/or descriptions), etc.

Certain Methods Of Dispensing A Beverage (Figures 2A-2F)

[0028] Figures 2A-2F depict illustrative operational states of the beverage dispensing system 10. As will be described in more details, the system 10 can be configured to introduce beverage B through the bottom of the dispensing unit 12 when the unit 12 is in an upright configuration. Certain embodiments are configured to rotate, or to at least allow rotation of, the dispensing unit 12 to dispense the beverage contained in the dispensing unit 12 into a cup C or other vessel. Some embodiments are configured to introduce cleansing fluid through the top of the dispensing unit 12 when the unit is in an inverted configuration.

[0029] Figure 2A illustrates an example of introducing the beverage B into the dispensing unit 12. In some embodiments, during the introduction operation, beverage from the beverage preparation machine 14 can flow through the tubing 16 (e.g., in response to the encouragement by the pump 26) and the control valve 28 can be toggled to allow the beverage to flow toward the dispensing unit 12. The flow of beverage can open the check valve 24, thereby allowing the beverage to flow into the dispensing unit 12.

[0030] As shown, the dispensing unit 12 can receive the beverage in the upright configuration (e.g., an orientation in which a longitudinal axis of the dispensing unit 12 is generally parallel with vertical). For example, the beverage can enter the dispensing unit 12 through the second end 20, which is the bottom end of the dispensing unit 12 in the upright configuration. In some implementations, the beverage is introduced into the dispensing unit 12 through a lower or lowermost portion of the dispensing unit 12. During the course of the beverage being introduced into the dispensing unit 12, the top surface of the beverage in the dispensing unit 12 can be seen to progress upwardly towards the top of the dispensing unit 12. This can provide a visual appearance of the beverage welling-up, growing, and/or rising within the dispensing unit 12.

[0031] As shown in Figure 2B, the dispensing unit 12 can be partially, substantially, or completely filled with the beverage. For example, in some embodiments, the dispensing unit 12 is substantially filled after receiving a shot of espresso. In certain implementations, the beverage preparation machine 14 is configured to provide an amount of beverage that is less than, or substantially equal, to the volume of the dispensing unit 12. In some embodiments, after a certain amount of time has elapsed and/or a certain volume of

beverage has been introduced into the dispensing unit 12, the flow of beverage ceases or decreases and/or the check valve 24 closes. For example, the controller 30 can instruct the beverage preparation machine 14 to stop preparation of the beverage. In some embodiments, the beverage can be maintained in the dispensing unit 12 for a period of time. This can allow modifications to the beverage in the dispensing unit 12. For example, additives can be introduced into the beverage held in the dispensing unit 12, such as sugar, flavoring (e.g., cinnamon, chocolate, vanilla extract, etc.), dairy products, ice, etc. Certain embodiments include a cap (e.g., a removable stopper) that can be used to close the first end 18 of the dispensing unit 12, so that the dispensing unit 12 can be shaken and/or pivoted to facilitate mixing.

[0032] As mentioned above, the dispensing unit 12 can be rotated to facilitate pouring the beverage from the dispensing unit 12 into a cup C or other vessel. For example, as shown in Figures 2C and 2D, the dispensing unit 12 can be pivoted in a first direction about the rotation point 22, such as at least about: 90°, 120°, 150°, 170°, 180°, 190°, 210°, values between the aforementioned values, or otherwise. In some embodiments, the rotation point 22 is positioned at or near the lower or lowermost portion of the dispensing unit 12. In certain variants, the rotation point 22 is positioned at about the middle of the longitudinal length of the dispensing unit 12. Some embodiments pivot about an axis that is generally parallel with horizontal and/or that passes through the second end 20 of the dispensing unit 12. In various embodiments, the dispensing unit 12 is configured to pour beverage directly into the cup or other vessel, without intervening tubing 16 or other structures.

[0033] In some embodiments, the system 10 includes a drain or catch basin, which can collect splashes and spills that occur during the course of pouring. The drain or catch basin can be covered with a grate, on which the cup or other vessel is placed to receive the beverage. The grate can include indicia (e.g., words or symbols) that indicate to a user where to position the cup or other vessel to receive the beverage from the dispensing unit 12.

[0034] In certain embodiments, the system 10 is configured to wash the dispensing unit 12. For example, as shown in Figure 2E, the dispensing unit 12 can be rotated to an approximately inverted position. In some embodiments, the control valve 28 is toggled to allow cleansing fluid to pass into the dispensing unit 12, for example to allow potable water to flow through the tubing 16 and check valve 24 and into the dispensing unit 12. As

shown, in some embodiments, the cleansing fluid enters the second end 20 of the dispensing unit 12, which is the top end of the dispensing unit 12 when in the inverted position. The cleansing fluid can pass down the interior walls of the dispensing unit 12. In some embodiments, the cleansing fluid can be discharged out of the first end 18 of the dispensing unit 12 and into the drain or catch basin.

[0035] Certain implementations are configured to spray, or otherwise distribute, the cleansing fluid around the entire, or at least substantially the entire, internal circumference of the shell of the dispensing unit 12. This can increase the likelihood that cleansing fluid will reach substantially the entire internal surface area of the dispensing unit 12. Some embodiments include a diffuser configured to direct the cleansing fluid around substantially the entire internal circumference of the dispensing unit 12. In certain implementations, the cleansing fluid is sprayed against the internal surface of the dispensing unit 12 at a substantially perpendicular angle and/or at or near the second end 20 of the dispensing unit 12. Some embodiments are configured to spray the cleansing fluid in a downward direction.

[0036] In some variants, the system 10 includes jets and/or nozzles adapted to spray cleansing fluid into the dispensing unit 12. For example, the jets and/or nozzles can spray cleansing fluid generally upwardly into the first end 18 of the dispensing unit 12. The cleansing fluid can fall downward via force of gravity into the drain or catch basin. Some embodiments do not include jets or nozzles configured to spray cleansing fluid upwardly into the dispensing unit 12.

[0037] Some implementations include drying functionality. For example, some embodiments include an active drying feature, such as a blower. The blower can be configured to direct a flow of air around and/or into the dispensing unit 12 (e.g., through the first end 18) to facilitate drying of the dispensing unit 12. Some implementations include a passive drying feature, such as a rest period. For example, movement and/or use of the dispensing unit 12 can be stopped for a period to facilitate drying, such as for at least about: 5 seconds, 10 seconds, or otherwise. In some embodiments, the rest period occurs when the dispensing unit 12 is in the inverted position.

[0038] As shown in Figure 2F, the dispensing unit 12 can be rotated (e.g., in a second direction opposite the first direction), such as to about the upright position shown in

Figure 1. This can put the dispensing unit 12 in a position to be ready to receive another amount of beverage from the beverage preparation machine 14, and to progress again through some or all of the above-described operational states.

Multi-Shot Dispensing Assembly (Figures 3 and 4)

[0039] Certain beverage preparation machines are adapted to produce multiple servings of a beverage at a time, such as two shots of espresso. Thus, it can be advantageous for a beverage preparation system to be configured to receive, hold, and/or dispense multiple servings of the beverage, such as being configured to receive, hold, and dispense two shots of espresso. An example of a double-shot beverage dispensing assembly 111 is illustrated in Figure 3 and an example of a system 110 including the assembly 111 is illustrated in Figure 4. As shown, the assembly 111 can include a first dispensing unit 112A and a second dispensing unit 112B.

[0040] Many of the features of the system 110 are the same as, or similar to, the features described above in connection with the system 10. To illustrate such correspondence, many of the numerals used to identify features of the system 110 are incremented by a factor of one hundred relative to the numerals used in connection with the system 10. The system 110 can include one, some, or all of the features of the system 10, including all combinations and sub-combinations. Moreover, any of the components of the system 110 can be similar to the corresponding components of the system 10. For example, the first dispensing unit 112A and the second dispensing unit 112B can each be similar to the dispensing unit 12 discussed above, including all combinations and sub-combinations. Any component or step disclosed in any embodiment in this specification can be used in other embodiment.

[0041] As illustrated, the first and second dispensing units 112A, 112B can each include an open first end 118A, 120A and a closed second end 118B, 120B. The second end 118B, 120B of the first and second dispensing units 112A, 112B can be connected to a rotating member 134, which in turn can be supported by a base 136. The rotating member 134 can enable the first and second dispensing units 112A, 112B to rotate relative to the base 136. In some embodiments, the rotating member 134 is coupled with tubing 116 through which beverage from the beverage preparation machine 14 can be delivered to the first and second dispensing units 112A, 112B. For example, as shown, the rotating

member 134 can connect with the tubing 116 via an elbow connector. In various embodiments, the rotating member 134, as well as the dispensing units 112A, 112B, can rotate relative to the tubing 116.

[0042] As shown, the base 136 can project upwardly, which can raise the dispensing units 112A, 112B above a countertop CT on which the base 136 is positioned. This can position the dispensing units 112A, 112B at an elevation that is higher than the top of the cup or vessel in which the beverage is to be poured, thereby allowing the beverage to flow by force of gravity into the cup or other vessel when the dispensing units 112A, 112B are rotated downward. In some embodiments, raising the dispensing units 112A, 112B above the countertop provide space to allow the dispensing units 112A, 112B to rotate without contacting the countertop. For example, in certain embodiments, the dispensing units 112A, 112B can be inverted without hitting, impacting, and/or physically touching the countertop.

[0043] In some embodiments, the dispensing units 112A, 112B include a handle 140 or other type of grip. The handle 140 can enable a user to rotate the first and second dispensing units 112A, 112B manually. In certain embodiments, the first and second dispensing units 112A, 112B rotate together. In some embodiments, the first and second dispensing units 112A, 112B rotate independently, such as the first dispensing unit 112A being able to rotate relative to the second dispensing unit 112B and vice versa. In some embodiments, the first and second dispensing units 112A, 112B each have a handle 140 or grip. In certain variants, the assembly 111 includes one or more motors or actuators (e.g., springs) configured to rotate the first and second dispensing units 112A, 112B, either together or independently. For example, certain variants include one or more motors or actuators configured to return one or both of the dispensing units 112A, 112B to the upright position, such as after one or both of the dispensing units 112A, 112B have been rinsed with cleaning fluid and/or after a period has elapsed. Some implementations include a mechanism (e.g., a releasable detent) that holds one or both of the dispensing units 112A, 112B in a lower position, such as in a pouring position or the inverted position.

[0044] Figure 4 schematically illustrates an embodiment of a beverage dispensing system 110 that includes the double-shot beverage dispensing assembly 111 of Figure 3. As shown, and similar to the discussion above in connection with the system 10, the system 110 can include a controller 130 and a beverage preparation machine 14. Some embodiments

include a pump 126 configured to encourage a flow of beverage from the beverage preparation machine 14 to the dispensing unit. Certain embodiments include a control valve 128 that is configured to switch between allowing the beverage to be communicated into the dispensing unit and allowing a cleansing fluid to enter the tubing 116 and be communicated into the dispensing unit. In some embodiments, the control valve 128 is a solenoid or other electronically operated valve.

[0045] In some embodiments, the system 110 includes a selector valve 142 configured to direct flow between the first and second dispensing units 112A, 112B. For example, as shown in Figure 4, the system 110 can include a three-way valve that toggles between allowing beverage to flow to the first dispensing unit and the second dispensing unit 112A, 112B. In some embodiments, the selector valve 142 is a solenoid or other electronically operated valve. The selector valve 142 can be controlled by the controller 130 or can be manually operated. In some implementations, the system 110 automatically alternates the flow of beverage between the dispensing units 112A, 112B, such as directing a first serving of beverage to the first dispensing unit, a second serving of beverage to the second dispensing unit, a third serving of beverage to the first dispensing unit, etc.

[0046] In various embodiments, the dispensing unit is readily visible. For example, in a retail environment, such as a coffee shop, the dispensing unit can be readily visible to a customer. In this regard, as mentioned above, in some embodiments, the dispensing unit is positioned on a countertop. In certain variants, the dispensing unit is visible from a first side of the countertop (e.g., a user side) and from an opposite second side of the countertop (e.g., a customer side). In some implementations, some or all other components of the system 110 are positioned below the countertop and/or otherwise out of sight from at least the second side of the countertop. For example, the beverage preparation machine 14, controller 130, control and/or selector valve 142, and pump 126 can be located below the countertop, inside of a cabinet, and/or otherwise out of view from at least the second side of the countertop. In some embodiments, during an operation of the filling of the dispensing units 112A, 112B, the beverage can appear to a customer to materialize in the dispensing units 112A, 112B, as if from nowhere. The customer can view the beverage welling-up from the bottom of the upright dispensing unit and/or progressively collecting inside the dispensing unit. In some implementations, the customer can view the dispensing unit being

rotated and the beverage being poured into a cup or other vessel. In some embodiments, the customer can view the dispensing unit being inverted and/or the washed, such as from the top down.

Removable Dispensing Unit (Figure 5)

[0047] Figure 5 illustrates a cross-sectional view of the first dispensing unit 112A and an associated check valve 124. Similar or identical components can be used in the system 10. In various embodiments, the dispensing unit 112A is separable from other components of the system 110. For example, the dispensing unit 112A can be configured to be removed from the check valve 124. This can facilitate cleaning or replacement of the dispensing unit 112A and/or the check valve 124.

[0048] As shown, the dispensing unit 112A can include a generally elongate hollow body with an open first end 118A and a generally closed second end 120A. The second end 120A can include an aperture 144, such as a hole in about the center of the second end 120A. As illustrated, the aperture 144 can be adapted to receive a projection 146 of the check valve 124. The check valve 124 or the dispensing unit 112A can include a sealing member 148 (e.g., an O-ring, gasket, or other type of seal) configured to provide a generally liquid-tight seal between the dispensing unit 112A and the check valve 124. For example, the aperture 144 can include a rubber or plastic O-ring that seals against an outer wall of the projection 146 of the check valve 124 when the projection 146 of the check valve 124 is received in the aperture 144 of the dispensing unit 112A.

[0049] As mentioned above, the dispensing unit 112A can be configured to be removed from the check valve 124. For example, in some embodiments, the dispensing unit 112A can be separated from the check valve 124 by applying a pulling force generally along the longitudinal axis A of the dispensing unit 112A, thereby slidably disconnecting the dispensing unit 112A and the check valve 124. In some embodiments, the dispensing unit 112A is configured to be disconnected by translating (e.g., sliding) the dispensing unit 112A generally parallel with the longitudinal axis A. In some embodiments, the dispensing unit 112A is configured to be disconnected by rotating the dispensing unit 112A around the longitudinal axis A. For example, in some embodiments, the dispensing unit 112A is threadably connected with the check valve 124 and/or the rotating member 134, and is configured to be disconnected by rotating the dispensing unit 112A around the longitudinal

axis A. Certain implementations are configured to connect and/or disconnect the dispensing unit 112A and the check valve 124 without relative rotation of the dispensing unit 112A and the check valve 124. In some embodiments, the dispensing unit 112A is configured to contain fluid after being disconnected from the check valve 124. For example, the dispensing unit 112A can include a closure mechanism (e.g., a flapper valve, umbrella valve, duckbill valve, etc.) configured to close the aperture 144, thereby inhibiting liquid in the dispensing unit 112A from being discharged through the aperture 144. In certain implementations, the dispensing unit 112A can be disconnected from the check valve 124 and contents of the dispensing unit 112A can be poured by hand into a cup or other vessel. In some embodiments, extent of travel of the dispensing unit 112A is limited. For example, the dispensing unit 112A can be tethered to the base 136 or other component of the system 110, such as with a cord, chain, cable, or otherwise.

[0050] As illustrated, in some embodiments, the check valve 124 includes a housing 150 with an inner chamber 152 that includes a tapered wall 154. The chamber 152 can include a sealing member, such as a ball 156, which can seat against the tapered wall. In some embodiments, the ball 156 is glass, plastic, or metal. As shown, in the upright orientation of the dispensing unit 112A, the ball 156 can seal against the tapered wall 154, such as by the force of gravity. When fluid is encouraged through the tubing 116, fluid can displace the ball 156, thereby opening the check valve 124 and allowing the fluid to flow into the dispensing unit 112A. When the flow of fluid decreases or ends, the ball 156 can again seat against the tapered wall 154, thereby inhibiting or preventing fluid from flowing in the opposite direction.

[0051] In certain embodiments, as the dispensing unit 112A is pivoted, gravity displaces the ball 156 from being seated against the tapered wall 154, thereby opening the check valve 124. In certain embodiments, such opening of the check valve 124 does not occur until a certain amount of rotation of the dispensing unit 112A has occurred, such as at least about: about: 30°, 60°, 70°, 80°, 85°, 90°, 95°, values between the aforementioned values, or otherwise. In some variants, such opening of the check valve 124 does not occur until a majority, or at least some, of the beverage in the dispensing unit 112A has been poured out of the first end 118A of the dispensing unit 112A.

[0052] In various embodiments, opening of the check valve 124 can result in and/or facilitate automatically clearing a portion of the tubing 116. For example, opening of the check valve 124 can permit ambient air to enter the tubing 116. This can aid in equalizing the pressure between the inside of the tubing 116 and ambient and/or can reduce or eliminate a pressure differential (e.g., vacuum) in the tubing 116. In some embodiments, permitting air to enter the tubing 116 can allow at least a portion of the beverage in the tubing 116 to flow back into the beverage preparation machine 14, into a container, and/or into the drain or catch basin. In various embodiments, rotating the dispensing unit 112A to pour the beverage into the cup or other vessel automatically results in opening of the check valve 124, such as without requiring additional steps or actions by a user.

[0053] In some embodiments, when the dispensing unit 112A is at or near the inverted position (see Figure 2E), the check valve 124 is open. For example, when the dispensing unit 112A is in the inverted position, the ball 156 can be spaced apart from the tapered wall 154 of the inner chamber 152 and fluid can be allowed to pass through the check valve 124. This can allow cleansing fluid to flow through the check valve 124 and into the inverted dispensing unit 112A, as discussed above.

Certain Methods Related to Beverage Dispensing Systems (Figure 6)

[0054] Figure 6 illustrates an example method 200 related to various beverage dispensing systems. As shown, in some embodiments, the method 200 includes introducing a beverage through a second end of the dispensing unit 202. This can be performed when the dispensing unit is in the upright position, such that the second end is at the bottom of the dispensing unit and/or is below the first end. In certain implementations, the beverage is introduced generally upwardly into the dispensing unit (e.g., upward and generally parallel with a vertical axis). Some embodiments include receiving, in the dispensing unit, at least about 1 shot of beverage and/or at least about 25 ml of beverage. Certain variants include filling a substantial volume of the dispensing unit with the beverage, such as at least about: 75%, 80%, 85%, 90%, 95%, percentages between the aforementioned percentages, or other percentages. Before block 202, some embodiments include preparing the beverage and/or transporting the beverage to the dispensing unit.

[0055] The method 200 can include rotating the dispensing unit to an intermediate position 204. For example, the dispensing unit can be rotated at least about: 60°,

75°, 90°, 105°, 120°, values between the aforementioned values, or otherwise. Some embodiments of the method 200 include dispensing the beverage from the dispensing unit 206, such as by pouring the beverage directly into a cup or other vessel. In some embodiments, all or substantially all of the beverage is dispensed from the dispensing unit 206. For example, of the pre-dispensed volume of beverage contained in the dispensing unit, certain implementations include dispensing at least about: 90%, 95%, 99%, percentages between the aforementioned percentages, or other percentages.

[0056] In some embodiments, the method 200 includes rotating the dispensing unit to a cleansing position, such as an approximately inverted position 208. In some embodiments, the dispensing unit is not perfectly inverted. For example, the dispensing unit can be offset from perfectly inverted by at least about: 1°, 3°, 5°, 10°, values between the aforementioned values, or otherwise. In some embodiments, between block 202 and 208, the method 200 includes rotating the dispensing unit at least about: 120°, 140°, 160°, 180°, 200°, values between the aforementioned values, or otherwise.

[0057] Certain embodiments include introducing the cleansing fluid through a second end of the dispensing unit 210. This can be performed when the dispensing unit is in the inverted position, such that the second end is at the top of the dispensing unit and/or is above the first end. Some embodiments include positioning a control valve to allow cleansing fluid, such as water, to pass through the valve and into the dispensing unit. Certain implementations include flowing the cleansing fluid downward along some or all of the length of the dispensing unit. Some embodiments include carrying-away, with the cleansing fluid, residue from the internal surface of the dispensing unit. Certain implementations include discharging the cleansing fluid from the first end of the dispensing unit, such as into a drain or catch basin.

[0058] In some embodiments, the method 200 includes rotating the dispensing unit 212, such as to the upright position. For example, the dispensing unit can be rotated approximately 180°. In some embodiments, the dispensing unit is rotated in opposite rotational directions when rotating from the upright position to the inverted position, and from the inverted position to the upright position. In some variants, the dispensing unit is rotated in the same rotational direction when rotating from the upright position to the inverted position, and from the inverted position to the upright position. Certain

embodiments include positioning a control valve to allow beverage to pass through the control valve and into the dispensing unit. In some embodiments, such as embodiments with more than one dispensing unit, the method can including positioning a selector valve to change which dispensing unit is configured to receive the next flow of beverage.

[0059] As illustrated, the method 200 can include a decision block 214, which can ask whether there are additional beverage servings to be prepared and/or dispensed. If the answer is yes, then the method 200 can return to block 202 to introduce additional beverage into the dispensing unit and the method 200 can continue. In some embodiments, if the answer to the decision block 214 is no, then the method 200 ends.

Certain Beverage Dispensing Systems with Removable Containers (Figures 7 and 8)

[0060] Figure 7 illustrates an example of a beverage dispensing system 310. Many of the features of the system 310 are the same as, or similar to, the features described above in connection with the systems 10, 110. To illustrate such correspondence, many of the numerals used to identify features of the system 310 are incremented by a factor of one hundred relative to the numerals used in connection with the systems 10, 110. The system 310 can include one, some, or all of the features of the system 10 and/or the system 110, including all combinations and sub-combinations. Moreover, any of the components of the system 310 can be similar to the corresponding components of the systems 10, 110.

[0061] The system 310 can include, and/or engage with, a removable container 312, such as a pitcher, jug, cup, or other vessel. The container 312 can be configured to hold and/or dispense a beverage, such as a coffee drink, dairy drink (e.g., milk, cream, half-and-half, or otherwise), juice, or another beverage. In some embodiments, the container 312 is configured to hold multiple servings of the beverage, such as two, three, four, five, six, or more servings. As illustrated, the container 312 can include an upper end 318 and a lower end 320, which can include the bottom of the container 312. An interior of the container 312 can be in communication with a liquid source through the tubing 316, such as a source of a liquid component of the beverage. For example, a flow of milk from a milk dispenser can pass through the tubing 316 and into the container 312. The interior of the container 312 can hold a volume of liquid L, such as at least about: 250 ml, 500 ml, 750 ml, 1 liter, volumes between the aforementioned volumes, or other volumes. In some

embodiments, the system 310 is configured to introduce steam into the container 312 and/or the tubing 316, as is described in more detail below.

[0062] As shown, the lower end 320 of the container 312 can engage with a base 336 of the system 310. Such engagement can open a fluid passage (also called a port) into an interior of the container. For example, a container port 310 in the container 312 and a base port 372 in the base 336 can be opened, thereby forming the fluid passage therethrough. In some implementations, the fluid passage extends through the base 336 and through the lower end 320 (e.g., the bottom) of the container 312. In some embodiments, the engagement of the container 312 and the base 336, and/or a flow of fluid, opens one or more flow-control valves, such as a check valve 324A in the base port 372 and/or a check valve 324B in the container port 370.

[0063] As mentioned above, the system 310 can be configured to place an interior of the container 312 in communication with a liquid source, such as a source of milk. In some embodiments, the system 310 is configured to heat the liquid (e.g., milk) before the liquid has been introduced into the container 312. For example, certain embodiments include a heater that is configured to heat the liquid passing through the tubing 316. The heater can comprise an in-line heater, heat exchanger, or otherwise. The heated liquid can be introduced into the container 312, such as through the port in the container 312.

[0064] In some embodiments, the system 310 is configured to aerate the liquid, such as after the liquid has been heated. For example, after the heated liquid has been introduced into the container 312, a steam wand can be inserted through an open upper mouth of the container 312 and into the heated liquid. Air and/or steam can be passed through the wand and into the heated liquid. In some embodiments, air is added to the steam to facilitate the aerating operation, such as through an air inlet port in fluid communication with a stream of steam from a steam source. In some variants, air is added to the liquid (e.g., milk), such as through the steam wand before introducing the steam through the wand and/or through an air inlet port in the tubing 316. In certain implementations, air is added to the liquid to aerate the liquid before heating occurs.

[0065] In some embodiments, the system 310 is configured to heat and/or aerate the liquid after the liquid has been introduced into the container 312. For example, the system 310 can be configured to introduce unheated liquid (e.g., milk at a temperature of less

than or equal to about 45°F) into the container 312, and then to heat the liquid (e.g., by introducing steam into the liquid in the container 312). The steam can transfer heat to the liquid and/or can incorporate air or other gases into the liquid. In certain implementations, the introduction of steam can induce movement of the liquid within the container 312, which can facilitate mixing. In some embodiments, heating, aeration, and/or mixing of the liquid occurs substantially concurrently and within the container 312. In certain implementations, the liquid is introduced substantially completely before the steam is introduced. For example, the introduction of the liquid can finish before the introduction of steam begins. In some variants, the introduction of steam begins before the introduction of the liquid finishes.

[0066] In some embodiments, the liquid and steam are introduced through the same port, such as the container port 370. In some embodiments, the liquid and steam are introduced through different ports, such as a dedicated liquid port and a dedicated steam port in the container 312 and/or the base 336. As schematically illustrated, the port or ports can be positioned in the bottom of the container 312. This can allow the liquid to appear to rise and/or emanate from the bottom of the container 312 and/or for the steam to pass through some or all of the depth of the liquid. In some embodiments, the port or ports are configured to provide a minimum flow rate of the liquid and/or a minimum flow velocity of the steam. The minimum flow rate can be a rate that provides at least a certain amount of volume within a period, such as at least about 450 ml of liquid in about 6 seconds. The minimum flow velocity can be a high enough velocity to create sufficient agitation and/or mixing of liquid, and a lower enough velocity to cause substantially no splashing out of the container 312. For example, the flow velocity can be between about 1.0 m/s and 1.5 m/s, such as about 1.2 m/s. In some implementations, the liquid port has a diameter of about 9 mm and/or the steam port has a diameter of about 4 mm. In certain embodiments, the steam port comprises a restricting orifice, such as an orifice with a diameter between about 1 mm and 2 mm. In some embodiments, the orifice can aid in producing satisfactory quality and/or quantity of foam in the liquid, and/or can aid in controlling the amount of air entering the stream of steam.

[0067] As further shown in Figure 7, some variants of the system 310 include a control valve 328, such as a three-way valve. The control valve 328 can be configured to permit a flow of cleansing fluid (e.g., potable water) to enter the tubing 316. In some implementations, the flow of cleansing fluid flushes or otherwise cleanses some or all of the

tubing 316, control valve 328, container 312, and/or other components of the system 310. Certain implementations of the system 310 have additional valves or other components, such as a pump and/or controller. In some embodiments, the system 310 is configured to automatically provide a predetermined amount of liquid to the container 312, such as at least about: 50 ml, 100 ml, 200 ml, 400 ml, 600 ml, 800 ml, 1 liter, volumes between the aforementioned volumes, or other volumes.

[0068] Certain implementations include a steam valve, which can be the control valve 328 or another valve, that controls the flow of steam. In some embodiments, when the steam valve is open, steam can flow from a steam source and into the tubing 316. The steam can flow through the tubing 316, through the port, and into the container 312. In some variants, the steam valve is part of a manifold. Some embodiments include one or more check valves to inhibit or prevent backflow. For example, the system 310 can be configured to inhibit or prevent the liquid, the steam, and/or condensation from flowing upstream toward the milk source and/or the steam source.

[0069] In some embodiments, the steam valve is controlled by a controller. The controller can operate the steam valve to provide a certain amount of steam, such as in terms of volume, elapsed time, desired amount of heating of the liquid (e.g., temperature setpoint), or otherwise. In some variants, the controller operates the steam valve to provide a certain amount of time, or a certain amount of flow, that steam is allowed to flow into the container 312, such as at least about: 2 seconds, 4 seconds, 6 seconds, 8 seconds, 10 seconds, values between the aforementioned values, or other values. In certain implementations, the steam valve is a two-position valve, such as an electronic solenoid valve. In some embodiments, the steam valve is a variable valve, such as a ball or butterfly valve. This can enable adjustment of the volume and/or velocity of steam delivered from the valve. For example, some embodiments are configured to vary (e.g., increase or decrease) the volume and/or velocity of the steam near the beginning and/or the end of the steam introduction process, such as during or near the first and/or last 5 seconds of the process.

[0070] In some implementations, the controller is in communication with a user input device, such as a touch pad, dial, button, lever, or otherwise. In some implementations, after introducing milk into the container 312, the system 310 waits for a user to signal, via the user input device, that the steam introduction process should begin. In certain variants,

after introducing milk into the container 312, the system 310 automatically begins introducing steam into the container 312. The automatic introduction can occur substantially immediately after the introduction of milk finishes, or after a delay has elapsed after the introduction of milk has finished. For example, the delay can be at least about: 1 second, 2 seconds, 3 seconds, or otherwise.

[0071] Figure 8 illustrates a partial cross-sectional view of an example of the base 336 engaged (e.g., mated) with an example of the container 312. As shown, the base 336 can include a platform configured to receive the container 312, such as a generally planar and horizontal tray that stably supports the container 312. Some embodiments include a sealing member 348, such as an O-ring. The sealing member 348 can provide a generally liquid tight seal between the container 312 and the base 336. As shown, the sealing member 348 can be positioned in a groove in an upper face of the base 336. In certain variants, the sealing member 348 is positioned in a groove in the bottom of the container 312.

[0072] The base 336 can include the check valve 324A, such as a duckbill valve, diaphragm valve, umbrella valve, ball check valve, or other type of flow control valve. In various embodiments, the check valve 324A is configured to open in response to fluid flowing in a direction toward the container 312 and to close in response to fluid flow in the opposite direction and/or in response to substantially no fluid flow. Thus, the check valve 324A can inhibit or prevent backflow of fluid.

[0073] As illustrated, the container 312 can include the check valve 324B. The check valve 324B can be configured to inhibit or prevent liquid from exiting the container 312 when the container 312 is disengaged from the base 336. In some embodiments, the check valve 324B includes an inner chamber 352 with a tapered wall 354. The chamber 352 can include a sealing member, such as a ball 356, which can seat against the tapered wall 354. The ball 356 can be engaged with (e.g., pressed against) the tapered 354 wall by a biasing member, such as a helical spring 358. This can close the check valve 324B and provide a generally liquid tight seal. Thus, the liquid L in the interior of the container 312 can be inhibited or prevented from exiting through the check valve 324B.

[0074] In some embodiments, the check valve 324B in the container 312 is automatically opened when the container 312 is engaged with the base 336. For example, as shown, a projection 360 of the base 336 can engage with the ball 356 of the check

valve 324B. This can move the ball 356 against the bias of the spring 358, which can open a flow path through the check valve 324B. In certain embodiments, as shown in Figure 8, when the container 312 is engaged with the base 336 and the flow of fluid (e.g., liquid or steam) is in a direction toward the container 312, the fluid can flow through the check valves 324A, 324B, through the port, and into an interior of the container 312. In various implementations, the system 310 is configured to introduce liquid into the container 312 through the bottom of the container 312.

[0075] In some embodiments, the check valve 324B is automatically closed when the container 312 is disengaged with the base 336. For example, when the container 312 is removed from the base 336, the projection 360 of the base 336 is disengaged from the ball 356 and the bias of the spring moves the ball back into engagement with the tapered wall 354. This can result in the check valve 324B closing and inhibiting or preventing backflow of the liquid L. Thus, the container 312 can be moved to another location without the liquid L spilling out through the bottom of the container 312.

[0076] As mentioned above, in some embodiments, the base 336 includes the projection 360. In certain embodiments, having the projection in the base 336 can allow the container 312 to have a generally planar bottom, which can allow the container 312 to be stably placed on a countertop or other location. In some variants, the container 312 includes the projection 360 and check valve 324A and the base 336 includes the check valve 324B, such as the tapered wall 354 and spring-loaded ball 356.

[0077] Various embodiments include certain other aspects, advantages, or features. For example, in some embodiments, the container 312 does not include a magnetic seal. For example, in some embodiments, the check valve 324A in the container 312 is not a magnetically operated valve. In some embodiments, the check valve 324A is not a valve comprising a diaphragm that is magnetically attracted to a bottom of the container, wherein the diaphragm is spaced apart from the bottom of the container 312 (e.g., by a pillar) when the container 312 is engaged with the base 336, and wherein the diaphragm moves (due to the magnetic attraction) into sealing engagement with the bottom of the container 312 when the container 312 is disengaged with the base 336. In some embodiments, substantially the entire, the entire, or at least the bottom of the container 312 is made of a magnetic material. In certain variants, substantially the entire, the entire, or at least the bottom of container 312

is made of glass or a metal, such as stainless steel. Various embodiments do not require the container 312 to be rotated with respect to the base 336 during engagement and/or disengagement between the container 312 and base 336. In some implementations, the surface of the base 336 that receives the container 312 is generally flat and/or does not comprise an upwardly extending pillar. In various embodiments, the container 312 is configured to be used for preparing a beverage and/or is not the vessel from which the beverage is consumed. In certain embodiments, the system 310 is configured to introduce the liquid into the container 312 in a generally vertical direction and/or not in a substantially radially outward direction in the container 312. In certain embodiments, the system 310 is configured to heat the liquid, such as with a heating element that heats (e.g., to at least about 45°C) the liquid flowing through the tubing. In some implementations, the beverage source is not a pressurized carbonated beverage supply, such as a beer keg.

[0078] Figures 9-12 depict additional non-limiting examples of the base 336 and the container 312. As shown, the base 336 can be positioned in, under, and/or generally flush with a countertop or other surface. For example, as depicted, the base 336 can be positioned in an opening in the countertop such that the top of the base 336 is about flush with the top of the countertop. In various embodiments, the periphery of the base 336 is sealed or otherwise connected with the countertop to inhibit or prevent liquid from passing between the base 336 and the countertop. As shown, in some variants, the base 336 includes a drain channel 362 and a drain outlet 364, which can receive residual liquid and drain it away, such as into a tank floor drain, or otherwise. The drain channel 362 can be positioned around the base port 372 in the base 336 to enable the drain channel 362 to catch residual liquid from the port 372.

[0079] As mentioned above, the container 312 can include an upper end 318 and a lower end 320, which can include the bottom of the container 312. The interior of the container 312 can be in communication with a beverage liquid source, such as a source of milk. The lower end 320 of the container 312 can be configured to mate with the base 336. For example, the container 312 can rest on the base 336. In some embodiments, a projection (e.g., a flange) of the container 312 is received in a recess (e.g., a channel) of the base 336.

[0080] In some implementations, when the container 312 is mated with the base 336, the container port 370 is engaged with the base port 372. For example, the ports 370, 372 can be placed adjacent to and/or in fluid communication with each other. In

certain implementations, the engagement of the ports 370, 372 can open a fluid passage through the base 336 and/or into the container 312, such as to permit liquid to flow through the base 336 and into the container 312.

[0081] In some embodiments, one or both of the ports 370, 372 comprises a flow controller, such as the check valves 324A, 324B. In some variants, the flow controller in the container 312 can comprises a gravity ball valve, such as is described above in connection with Figure 8. In some implementations, the flow controller comprises an umbrella valve, duck bill valve, slot valve, spring valve, or other type of one-way valve.

[0082] In certain variants, the container 312 and base 336 are configured to facilitate mating, such as with one or more mating features in the container 312 and base 336. For example, as depicted, the container 312 can have four mating features 366a-d and the base 336 can have four corresponding mating features 366e-h. In certain variants, the container 312 and/or the base 336 have one, two, three, five, or more mating features. In some embodiments, the mating features 366 comprise magnetic elements, threads, projections (e.g., pins) that fit into recesses (e.g., slots), or otherwise. For example, in some embodiments in which the mating features 366 comprise magnetic elements, the magnetic elements of the container 312 can attract, or be attracted by, the corresponding magnetic elements of the base 336. In various implementations, the mating features 366 can facilitate holding the container 312 and the base 336 together and/or sealing a fluid connection between the container 312 and the base 336.

[0083] Some embodiments are configured to aid in positioning the container 312 relative to the base 336. For example, the container 312 and the base 336 can include ramped surfaces that engage with each other, thereby aiding in positioning (e.g., centering) the container 312 on the base 336. In some variants, a portion of the container 312 is received in the base 336, which can aid in stabilizing the container 312. For example, a lip or shoulder on the bottom of the container 312 can be received in a corresponding recess of the base 336 and/or in the countertop.

[0084] Some embodiments are configured to control, or at least encourage, the orientation container 312 relative to the base 336. This can aid in aligning features of the container 312 with corresponding features of the base 336, such as corresponding steam ports in the container 312 and base 336, corresponding liquid ports in the container 312 and

base 336, and/or corresponding portions of a sensor in the container 312 and base 336. In certain embodiments, the aforementioned mating features facilitate the orientation. For example, in some variants in which the mating features comprise magnetic elements, the arrangement and polarity of the magnetic elements control the orientation of the container 312 relative to the base 336. For example, in some embodiments, the mating feature 366a has a negative polarity and the mating features 366b-d have a positive polarity, and the mating feature 366h has a positive polarity and the mating features 366e-g have a negative polarity. In certain such embodiments, when the container 312 is placed on the base 336, the only orientation of the container 312 relative to the base 336 in which each of the mating features engage with a mating feature of opposite polarity is the orientation in which the features 366a, 366h engage. Accordingly, the orientation of the container 312 relative to the base 336 can be controlled.

[0085] Certain variants use a physical interference to control, or at least encourage, the orientation of the container 312 relative to the base 336. In some embodiments, the container 312 and base 336 can be keyed to mate in only a certain relative orientation. For example, the base 336 can have a protrusion with a shape and the container 312 can have a recess with a corresponding shape, with the shape being such that the protrusion can only be received in the recess in a single certain orientation. In some embodiments, the shape is an irregular polygon. Certain implementations include a protrusion (e.g., a pin) that is offset from the center of the base 336 and a recess (e.g., a slot) that is in a corresponding location offset from the center of the container 312.

[0086] In some embodiments, the base 336 and/or container 312 comprise features configured to transmit a signal, such as a signal related to the temperature of the container 312 and/or the liquid in the container 312. For example, the container 312 can include a probe 368a and the base 336 can include a contact 368b. As depicted, the probe 368a can be positioned inside the container 312, so as to be in physical contact with the liquid in the container 312. When the container 312 and base 336 are mated, the probe 368a can engage the contact 368b to allow the signal from the probe 368a to be transmitted, via the contact 368b, to the controller or other component of the system 310. In some embodiments, the temperature of the liquid in the container 312 is sensed with a contact device, such as the probe 368a, that physically contacts (e.g., is immersed in) the liquid in the container 312. In

certain variants, a non-contact device senses the temperature without physically contacting the container 312 and/or the liquid. For example, some embodiments have an infrared sensor.

[0087] In some embodiments, the system 310 is configured to aid in cleaning the container 312. For example, the system 310 can be configured to partially or completely invert the container 312 and/or to spray cleansing fluid (e.g., water) into the container 312. In some embodiments, this is accomplished by a user removing the container 312 from the base 336 and inverting the container 312 by hand, such as over a separate rinse station. In some variants, the container 312 remains engaged with the base 336 and the base 336 is configured to rotate, such as about an axis that is generally parallel to horizontal. For example, the base 336 can be rotated by a motor, which is controlled by the controller. Rotation of the base 336 can result in the container 312 on the base 336 being moved to a rotated position. In some embodiments, in moving to the rotated position, the container 312 is flipped, such as about 180° and/or inverted (e.g., upside-down). In some embodiments, from an upright position to the rotated position, the container 312 is rotated at least about: 120°, 150°, 180°, 210°, amounts between the aforementioned amounts, or other amounts. In various embodiments, the strength of the engagement between the container 312 and base 336 is sufficient to maintain the container 312 on the base 336, even in the rotated position. In the rotated position, residual liquid, froth, or other material in the container 312 can flow out of the container 312 by force of gravity. Some implementations include a container drain or catch basin under the residual liquid, froth, or other material.

[0088] Certain embodiments include a container cleaning unit, such as one or more nozzles. The nozzles can be configured to spray cleaning fluid (e.g., potable water) into the inverted container. For example, the nozzles can spray generally upwardly into the inverted container 312 to wash the inside of the container 312 and/or the container port 370. The cleaning fluid can fall into, and be received by, the container drain or catch basin. In some implementations, operation of the nozzles is governed by the controller. For example, the controller can control operation of a solenoid or other type of valve that opens to deliver the cleaning fluid to the nozzles. In some variants, the nozzles are part of the separate rinse station and/or are manually controlled.

[0089] In some embodiments, after the container 312 has been washed, the container 312 is returned to an upright orientation. In some embodiments, this is

accomplished manually, such as by a user manually flipping the base 336 and/or the container 312 to the upright orientation. In certain variants, the motor flips the base 336 and/or the container 312 to the upright orientation.

[0090] Figure 13 depicts an example of the tubing 316 that can be used in the system 310. The depicted example is located directly beneath the base 336, though other locations are contemplated as well. As shown, the contact 368b of the base can connect with a cable 374, such as an electrical wire, and the drain 362 can connect with a drainage tube 376.

[0091] As shown, the tubing 316 can include a manifold 378. The manifold 378 can connect with a plurality of tubes, such as two, three, four, five, or more. In some embodiments, the manifold 378 connects with a tube that carries steam and one or more tubes that carry liquid. For example, the manifold 378 can connect with a steam tube 316a, a milk tube 316b, and a water tube 316c. In some implementations, the steam tube 316a carries a mixture of steam and air. In certain variants, the manifold 378 can connect with a tube or tubes that carry other fluids, such as cold milk, hot milk, cold water, hot water, sauces, syrups, pumped (e.g., pressurized) ambient air, pumped heated air, pumped cooled air, or other fluids.

[0092] Each inlet on the manifold 378 can include a backflow prevention feature, such as a check valve. This can enable fluid from each of the tubes to be individually injected through the manifold 378, through the base 336, and into the container 312. In various embodiments, the manifold 378 and/or backflow prevention features can reduce or eliminate the chance of fluid from one tube entering into and/or contaminating the other tubes.

Certain Terminology

[0093] As used herein, the term “beverage” has its ordinary and customary meaning, and includes, among other things, any edible liquid or substantially liquid substance or product having a flowing quality (e.g., juices, coffee beverages, teas, frozen yogurt, beer, wine, cocktails, liqueurs, spirits, cider, soft drinks, flavored water, energy drinks, soups, broths, combinations of the same, or the like).

[0094] Conditional language, such as “can,” “could,” “might,” or “may,” unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain embodiments include, while other embodiments do not

include, certain features, elements, and/or steps. Thus, such conditional language is not generally intended to imply that features, elements, and/or steps are in any way required for one or more embodiments or that one or more embodiments necessarily include logic for deciding, with or without user input or prompting, whether these features, elements, and/or steps are included or are to be performed in any particular embodiment.

[0095] Conjunctive language such as the phrase “at least one of X, Y, and Z,” unless specifically stated otherwise, is otherwise understood with the context as used in general to convey that an item, term, etc. may be either X, Y, or Z. Thus, such conjunctive language is not generally intended to imply that certain embodiments require the presence of at least one of X, at least one of Y, and at least one of Z.

[0096] Unless otherwise explicitly stated, articles such as “a” or “an” should generally be interpreted to include one or more described items. Accordingly, phrases such as “a device configured to” are intended to include one or more recited devices. Such one or more recited devices can also be collectively configured to carry out the stated recitations. For example, “a processor configured to carry out recitations A, B, and C” can include a first processor configured to carry out recitation A working in conjunction with a second processor configured to carry out recitations B and C.

[0097] The terms “comprising,” “including,” “having,” and the like are synonymous and are used inclusively, in an open-ended fashion, and do not exclude additional elements, features, acts, operations, and so forth. Likewise, the terms “some,” “certain,” and the like are synonymous and are used in an open-ended fashion. Also, the term “or” is used in its inclusive sense (and not in its exclusive sense) so that when used, for example, to connect a list of elements, the term “or” means one, some, or all of the elements in the list.

[0098] The terms “approximately,” “about,” and “substantially” as used herein represent an amount close to the stated amount that still performs a desired function or achieves a desired result. For example, in some embodiments, as the context may dictate, the terms “approximately”, “about”, and “substantially” may refer to an amount that is within less than or equal to 10% of the stated amount. The term “generally” as used herein represents a value, amount, or characteristic that predominantly includes, or tends toward, a particular value, amount, or characteristic. As an example, in certain embodiments, as the

context may dictate, the term “generally parallel” can refer to something that departs from exactly parallel by less than or equal to 20 degrees and/or the term “generally perpendicular” can refer to something that departs from exactly perpendicular by less than or equal to 20 degrees.

[0099] Overall, the language of the claims is to be interpreted broadly based on the language employed in the claims. The claims are not to be limited to the non-exclusive embodiments and examples that are illustrated and described in this disclosure, or that are discussed during the prosecution of the application.

Summary

[0100] Although this disclosure describes certain embodiments and examples of beverage dispensing systems and methods, many aspects of the above-described systems and methods may be combined differently and/or modified to form still further embodiments or acceptable examples. All such modifications and variations are intended to be included herein within the scope of this disclosure. Indeed, a wide variety of designs and approaches are possible and are within the scope of this disclosure. For example, although the dispensing units shown in the figures have one or two dispensing units, certain other embodiments include additional dispensing units. Some embodiments have three, four, five, or more dispensing units, as well as one or more appropriate control and/or selector valves to direct the flow of beverage to the various dispensing units, such as in lieu of or in addition to the three-way control and selector valves shown in Figure 4. As another example, although the controller is illustrated as having wired connections to other components, in some embodiments, the controller communicates wirelessly with one or more of the components, such as through radio frequency transmissions. As a further example, although some embodiments have discussed cleaning the dispensing unit in the inverted position, some embodiments are configured to clean the dispensing unit in a non-inverted position. For example, cleaning fluid can be introduced into the dispensing unit in the upright position and the dispensing unit can then be rotated to dump the cleaning fluid out of the dispensing unit. As yet another example, while some embodiments described above include a cleaning operation, certain embodiments do not include a cleaning operation. For example, the dispensing unit can be configured such that substantially all of the liquid (e.g., at least 99.99% by volume) is discharged out of the dispensing unit, thereby reducing or eliminating

a need to clean the dispensing unit. In some implementations, the dispensing unit includes a surface treatment (e.g., a hydrophobic and/or oleophobic coating) on the inside of the dispensing unit. Furthermore, although some embodiments are described as using steam to heat, aerate, and/or mix the liquid in the container, some embodiments include other heating mechanisms (e.g., electrical resistive heaters, electromagnetic induction coils, or otherwise), other aeration mechanisms (e.g., rotating or vibrating members submerged in the liquid, etc.), and/or other mixing mechanisms (e.g., stirrers, etc.). While illustrative embodiments have been described herein, the scope of all embodiments having equivalent elements, modifications, omissions, combinations (e.g., of aspects across various embodiments), adaptations and/or alterations as would be appreciated by those in the art based on the present disclosure. Additionally, note that this application incorporates by reference the entirety of the U.S. provisional patent application No. 62/220,577, titled “BEVERAGE PREPARATION SYSTEMS AND METHODS,” filed September 18, 2015, which is attached as Appendix A.

[0101] Also, although there may be some embodiments within the scope of this disclosure that are not expressly recited above or elsewhere herein, this disclosure contemplates and includes all embodiments within the scope of what this disclosure shows and describes. Further, this disclosure contemplates and includes embodiments comprising any combination of any structure, material, step, or other feature disclosed anywhere herein with any other structure, material, step, or other feature disclosed anywhere herein.

[0102] Furthermore, certain features that are described in this disclosure in the context of separate implementations can also be implemented in combination in a single implementation. Conversely, various features that are described in the context of a single implementation can also be implemented in multiple implementations separately or in any suitable subcombination. Moreover, although features may be described above as acting in certain combinations, one or more features from a claimed combination can, in some cases, be excised from the combination, and the combination may be claimed as a subcombination or variation of a subcombination.

[0103] For purposes of this disclosure, certain aspects, advantages, and features are described herein. Not necessarily all such aspects, advantages, and features may be achieved in accordance with any particular embodiment. For example, some embodiments of

any of the various disclosed systems include the container and/or include pluralities of the container; some embodiments do not include the container. Those skilled in the art will recognize that the disclosure may be embodied or carried out in a manner that achieves one advantage or a group of advantages as taught herein without necessarily achieving other advantages as may be taught or suggested herein.

[0104] Some embodiments have been described in connection with the accompanying drawings. The figures are drawn to scale, but such scale should not be interpreted to be limiting. Distances, angles, etc. are merely illustrative and do not necessarily bear an exact relationship to actual dimensions and layout of the devices illustrated. Components can be added, removed, and/or rearranged. Further, the disclosure herein of any particular feature, aspect, method, property, characteristic, quality, attribute, element, or the like in connection with various embodiments can be used in all other embodiments set forth herein. Also, any methods described herein may be practiced using any device suitable for performing the recited steps.

[0105] Moreover, while components and operations may be depicted in the drawings or described in the specification in a particular arrangement or order, such components and operations need not be arranged and performed in the particular arrangement and order shown, nor in sequential order, nor include all of the components and operations, to achieve desirable results. Other components and operations that are not depicted or described can be incorporated in the embodiments and examples. For example, one or more additional operations can be performed before, after, simultaneously, or between any of the described operations. Further, the operations may be rearranged or reordered in other implementations. Also, the separation of various system components in the implementations described above should not be understood as requiring such separation in all implementations, and it should be understood that the described components and systems can generally be integrated together in a single product or packaged into multiple products.

[0106] In summary, various illustrative embodiments and examples of beverage dispensing systems and methods have been disclosed. Although the systems and methods have been disclosed in the context of those embodiments and examples, this disclosure extends beyond the specifically disclosed embodiments to other alternative embodiments and/or other uses of the embodiments, as well as to certain modifications and equivalents

thereof. This disclosure expressly contemplates that various features and aspects of the disclosed embodiments can be combined with, or substituted for, one another. Accordingly, the scope of this disclosure should not be limited by the particular disclosed embodiments described above, but should be determined only by a fair reading of the claims that follow as well as their full scope of equivalents.

THE FOLLOWING IS CLAIMED:

1. A beverage preparation system configured to dispense a beverage into a cup or other drinking vessel, the system comprising:
 - a beverage preparation machine configured to prepare the beverage;
 - a dispensing assembly comprising:
 - a base;
 - a dispensing unit rotatably coupled to the base, the dispensing unit comprising a hollow elongate shell with an open first end and a closed second end, the second end comprising a check valve; and
 - the dispensing unit configured to pivot between an upright position and an inverted position, wherein the first end is substantially directly above the second end in the upright position and the second end is substantially directly above the first end in the inverted position;
 - a control valve configured to switch between a first state and a second state, wherein a flow of the beverage is allowed to pass through the control valve in the first state and a flow of cleansing fluid is allowed to pass through the control valve in the second state;
 - wherein, when the dispensing unit is in the upright position and the control valve is in the first state, the dispensing unit is configured to receive a portion of the beverage through the second end;
 - wherein, when the dispensing unit is in the inverted position and the control valve is in the second state, the dispensing unit is configured to receive cleansing fluid through the second end and to dispense the cleansing fluid from the first end; and
 - wherein, when the dispensing unit is in an intermediate position between the upright and inverted positions, the dispensing unit is configured to dispense the portion of the beverage through the first end and into the cup or other vessel.
2. The system of Claim 1, wherein the dispensing unit is configured to rotate about a pivot axis that is substantially horizontal.
3. The system of Claim 1, wherein the hollow elongate shell of the dispensing unit is configured to disconnect from the check valve.

4. The system of Claim 1, wherein the dispensing unit further comprises a second dispensing unit.

5. The system of Claim 4, further comprising a selector valve configured to switch between allowing the beverage to flow to the dispensing unit and allowing the beverage to flow to the second dispensing unit.

6. The system of Claim 1, wherein:

the check valve is closed when the dispensing unit is in the upright position and the flow of the beverage is less than or equal to a minimum value; and

the check valve is open when the dispensing unit is in the inverted position.

7. The system of Claim 1, wherein the check valve comprises a housing and a ball, the housing comprising an inner chamber with a tapered wall, the ball being positioned in the inner chamber and configured to seat against the tapered wall to close the check valve.

8. The system of Claim 7, wherein the check valve is configured such that at least one of gravity and a spring seats the ball against the tapered wall when the dispensing unit is in the upright position.

9. The system of Claim 1, further comprising a pump configured to encourage the beverage to flow from the beverage preparation machine to the dispensing unit.

10. The system of Claim 1, further comprising a controller configured to control operation of the control valve between the first and second states.

11. The system of Claim 1, wherein the base of the dispensing assembly is configured to mount on a countertop, the countertop having a customer side and a server side, the dispensing unit being located above the countertop and visible from the customer side and the server side.

12. The system of Claim 11, wherein the beverage preparation machine is located below the countertop.

13. A dispensing assembly configured to receive a flow of beverage from a beverage preparation machine, the dispensing assembly comprising:

a base;

a rotation assembly pivotably coupled to the base and configured to pivot about a pivot axis;

- a dispensing unit comprising a first end and a second end, the second end coupled with the rotation assembly, the dispensing unit configured to pivot about the pivot axis between a first position and a second position;
- the dispensing unit configured such that:
- in the first position, the dispensing unit is adapted to receive the beverage through the second end;
 - during rotation from the first position to the second position, the dispensing unit discharges the beverage through the first end; and
 - in the second position, the dispensing unit is adapted to receive cleansing fluid through the second end and to discharge the cleansing fluid through the first end.
14. The dispensing unit of Claim 13, wherein:
- the first position is an upright position in which a longitudinal axis of the dispensing unit is generally parallel with vertical and the first end is higher than the second end; and
 - the second position is an inverted position in which the longitudinal axis of the dispensing unit is generally parallel with vertical and the second end is higher than the first end.
15. The dispensing unit of Claim 13, wherein the second end of the dispensing unit further comprises a check valve.
16. The dispensing unit of Claim 13, wherein the dispensing unit is configured to rotate at least 150° between the upright and inverted positions.
17. The dispensing unit of Claim 13, wherein the base is spaced apart from the beverage preparation machine and is configured to be mounted on a countertop.
18. The dispensing unit of Claim 13, further comprising a second dispensing unit coupled with the rotation assembly and configured to pivot about the pivot axis.
19. The dispensing unit of Claim 18, wherein the first and second dispensing units are configured to pivot independently of each other.
20. A method of dispensing a beverage from a dispensing unit comprising a first end and a second end, the dispensing unit configured to rotate between a substantially upright position and a substantially inverted position, a longitudinal axis of the dispensing unit being

generally parallel with vertical and the first end being higher than the second end in the upright position, the longitudinal axis of the dispensing unit being generally parallel with vertical and the second end being higher than the first end in the inverted position, the method comprising:

preparing a beverage with a beverage preparation machine;

introducing the beverage through the second end of the dispensing unit when the dispensing unit is in the upright position;

rotating the dispensing unit to an intermediate position between the upright position and the inverted position;

pouring the beverage out of the first end of the dispensing unit when the dispensing unit is in the intermediate position;

receiving the beverage in a vessel;

rotating the dispensing unit to the inverted position;

draining residual beverage from the dispensing unit; and

rotating the dispensing unit to the upright position.

21. The method of Claim 20, wherein:

rotating the dispensing unit to an intermediate position and rotating the dispensing unit to the inverted position occur in a first rotational direction; and

rotating the dispensing unit to the upright position occurs in a second rotational direction that is opposite the first rotational direction.

22. The method of Claim 20, further comprising:

introducing cleaning fluid through the second end of the dispensing unit; and

dispensing the cleaning fluid out of the first end of the dispensing unit.

23. The method of Claim 22, further comprising distributing the cleaning fluid substantially equally around an inside circumference of the dispensing unit.

24. The method of Claim 20, wherein:

introducing the beverage through the second end of the dispensing unit when the dispensing unit is in the upright position is performed when the dispensing unit is rotatably coupled with a base of a beverage dispensing system; and

rotating the dispensing unit to an intermediate position between the upright position and the inverted position is performed when the dispensing unit is coupled with the base.

25. The method of Claim 20, wherein the rotation from the upright position to the intermediate position and from the intermediate position to the inverted position is continuous.

26. A beverage dispensing system comprising:

a base comprising an upper surface and a first check valve;

tubing connected with the first check valve and with a source of a liquid dairy product; and

a container comprising an interior, an upper end, and a lower end, the lower end comprising a second check valve, the container removably engageable with the upper surface of the base;

the container and the base being configured such that:

when the container is engaged with the base, the first and second check valves are open, and the interior cavity of the container is in fluid communication with the tubing through the first and second check valves, thereby allowing liquid dairy product to flow from the liquid dairy product source and into the interior of the container; and

when the container is disengaged from the base, at least the second check valve is closed, thereby inhibiting liquid dairy product in the interior of the container from exiting the container through the second check valve.

27. The system of Claim 26, wherein the first check valve comprises a duckbill valve.

28. The system of Claim 26, wherein the second check valve comprises a ball check valve.

29. The system of Claim 26, wherein the second check valve does not comprise a magnetic sealing valve.

30. The system of Claim 26, wherein the container and the base are further configured such that the liquid dairy product flows out of the second check valve and into the interior of the container in a substantially vertical direction.

31. The system of Claim 26, wherein the liquid dairy product comprises heated milk.
32. A beverage preparation system comprising:
a tubing assembly configured to carry a first fluid and a second fluid;
a base connected with the tubing assembly, the base comprising a base port;
and
a container configured to removably engage with the base, the container comprising an interior, an upper end, a lower end, the lower end comprising a container port;
the system being configured such that, when the container is engaged with the base, the first fluid and the second fluid are able to pass through the base port and the container port and to enter into the interior of the container.
33. The system of Claim 32, wherein the first fluid comprises a liquid and the second fluid comprises a gas.
34. The system of Claim 32, wherein the first fluid comprises milk and the second fluid comprises steam.
35. The system of Claim 32, wherein the container port is positioned on a bottom of the container.
36. The system of Claim 32, wherein the container port comprises a gravity check valve.
37. The system of Claim 32, wherein the system is configured to introduce the first fluid into the interior of the container before introducing the second fluid into the interior of the container.
38. The system of Claim 32, wherein the system is configured to concurrently introduce the first and second fluids into the interior of the container.
39. The system of Claim 32, further comprising a heater configured to heat the first fluid before the first fluid enters the interior of the container.
40. The system of Claim 32, wherein the system is configured to detect the temperature of a liquid in the container.

41. The system of Claim 40, wherein the container comprises a temperature sensor, and the base comprises a contact that is configured to mate with and receive signals from the temperature sensor.

42. The system of Claim 32, wherein the base further comprises a drain channel and a drain outlet.

43. The system of Claim 32, wherein the system is configured to rotationally orient the container, about a longitudinal axis of the container, relative to the base.

44. The system of Claim 43, wherein the system further comprises mating magnetic features in the base and the container that interact to orient the container relative to the base.

45. The system of Claim 43, wherein the system further comprises a protrusion that engages with a mating slot to orient the container relative to the base.

46. The system of Claim 32, wherein the tubing assembly comprises a first tube that carries the first fluid and a second tube that carries the second fluid.

47. The system of Claim 46, wherein the tubing assembly further comprises a manifold comprising a first inlet and a second inlet, the first inlet connected with the first tube and the second inlet connected with the second tube, each of the inlets comprising a check valve.

48. The system of Claim 47, wherein:
the tubing assembly further comprises a third tube that carries a third fluid;
the manifold further comprises a third inlet connected with the third tube; and
the first fluid comprises steam, the second fluid comprises milk, and the third fluid comprises water.

49. A method of producing a heated and aerated liquid, the method comprising:
receiving a container on a base;
opening a fluid passage, the fluid passage extending through the base and through a lower portion of the container;
introducing a liquid through the fluid passage;
collecting the liquid in the container;
introducing a gas through the fluid passage;

passing the gas generally vertically upward through the liquid collected in the container;

heating the liquid with the gas;

aerating the liquid with the gas; and

closing the fluid passage.

50. The method of Claim 49, wherein the liquid comprises milk and the gas comprises a mixture of steam and air.

51. The method of Claim 49, wherein opening the fluid passage comprises opening a port in the base and opening a port in the container.

52. The method of Claim 49, wherein opening the fluid passage occurs automatically and substantially concurrently with receiving the container on the base.

53. The method of Claim 49, wherein closing the fluid passage occurs automatically in response to the container being removed from the base.

54. A beverage preparation system comprising:

a tubing assembly configured to carry a first fluid and a second fluid;

a base connected with the tubing assembly, the base comprising a first base port and a second base port; and

a container comprising an upper end, a lower end, and an interior configured to receive a volume of fluid, the lower end comprising a first container port and a second container port, the container being configured to engage with the base;

the system being configured such that, when the container is engaged with the base:

the first fluid can pass through the first base port and the first container port and can enter into the interior of the container; and

the second fluid can pass through the second base port and the second container port and can enter into the interior of the container.

BEVERAGE DISPENSING SYSTEMS AND METHODS

ABSTRACT OF THE DISCLOSURE

Various beverage preparation systems and methods are disclosed. The beverage preparation system can include a dispensing unit configured to receive beverage, such as a shot of espresso, from a beverage preparation machine. The dispensing unit can include a dispensing unit with a first end and a second end. The dispensing unit can be rotatable between an upright position and an inverted position. The dispensing unit can be configured to receive the beverage through the second end when the dispensing unit is in the upright position, and can be configured to receive cleansing fluid through the second end when the dispensing unit is in the inverted position. In some embodiments, when the dispensing unit is in an intermediate position between the upright and inverted positions, the dispensing unit is configured to dispense the beverage out of the first end and into a cup or other vessel.

APPENDIX A

BEVERAGE PREPARATION SYSTEMS AND METHODS**BACKGROUND**Field

[0001] The present disclosure relates to systems and methods for preparing beverages, such as systems and methods for preparing heated frothed milk.

Description of Certain Related Art

[0002] Certain beverages, such as lattes and cappuccinos, are prepared with heated frothed milk. Heated frothed milk is typically obtained by heating milk while injecting fluid into it. For example, a wand can be inserted into a volume of milk and steam can be passed through the wand and into the milk, thereby heating and frothing the milk. This can yield an upper layer of milk foam and a lower layer of milk liquid with a rich taste.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] Various embodiments are depicted in the accompanying drawings for illustrative purposes, and should in no way be interpreted as limiting the scope of the embodiments. Various features of different disclosed embodiments can be combined to form additional embodiments, which are part of this disclosure.

[0004] Figures 1A and 1B schematically illustrate an embodiment of a beverage preparation system.

[0005] Figures 2A and 2B illustrate top and side views of another embodiment of a beverage preparation system.

[0006] Figures 3-10 illustrate side views of the system of Figures 2A and 2B in various operational states.

[0007] Figure 11 illustrates a perspective view of an embodiment of a wand cleansing unit.

[0008] Figures 12A and 12B illustrate side cross-sectional views of an annular collar of the wand cleansing unit of Figure 11.

[0009] Figure 13 illustrates an embodiment of a method of preparing a heated and/or frothed beverage.

[0010] Figure 14 illustrates an embodiment of a method of cleaning a container.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

[0011] Various beverage dispenser systems and methods are described below to illustrate various examples that may achieve one or more desired improvements. These examples are only illustrative and not intended in any way to restrict the general disclosure presented and the various aspects and features of this disclosure. The general principles described herein may be applied to embodiments and applications other than those discussed herein without departing from the spirit and scope of the disclosure. Indeed, this disclosure is not limited to the particular embodiments shown, but is instead to be accorded the widest scope consistent with the principles and features that are disclosed or suggested herein.

[0012] Although certain aspects, advantages, and features are described herein, it is not necessary that any particular embodiment include or achieve any or all of those aspects, advantages, and features. For example, some embodiments may not achieve the advantages described herein, but may achieve other advantages instead. Any structure, feature, or step in any embodiment can be used in place of, or in addition to, any structure, feature, or step in any other embodiment, or omitted. This disclosure contemplates all combinations of features from the various disclosed embodiments. No feature, structure, or step is essential or indispensable.

Overview (Figures 1A and 1B)

[0013] Figures 1A and 1B schematically illustrate an embodiment of a beverage preparation system 10. As shown, the system 10 can include a wand manipulation assembly 12 and a container manipulation assembly 14. The wand manipulation assembly 12 can include a wand unit 16, such as a steam wand. The wand unit 16 can be configured to be partially submerged in a liquid (e.g., milk) in a container 18 and to introduce a flow of fluid (e.g., steam) into the liquid, thereby heating and frothing the liquid. The container manipulation assembly 14 can be configured to receive and support the container 18, such as a pitcher, cup, or other vessel, which can hold the liquid to be heated and frothed. In some embodiments, the container manipulation assembly 14 is configured to translate and/or rotate the container 14.

[0014] As schematically shown in Figure 1A, in some operational states, the wand manipulation assembly 12 and the container manipulation assembly 14 are disengaged from each other. For example, as illustrated, in some states, the wand unit 16 and the

container 18 are separated (e.g., spaced apart) from each other. As schematically shown in Figure 1B, in certain operational states, the wand manipulation assembly 12 and the container manipulation assembly 14 are engaged (e.g., interfaced) with each other. For example, as illustrated, in some states, a portion of the wand unit 16 can be received in the container 18, such as to facilitate heating and/or frothing of the liquid in the container 18. Some embodiments are configured to cycle between the disengaged and engaged states, such as directly or with one or more additional processes.

[0015] In certain embodiments, the wand manipulation assembly 12 and/or the container manipulation assembly 14 are distinct from, and not a part of, a beverage machine. For example, the wand manipulation assembly 12 can be distinct from (e.g., spaced apart from) an espresso machine. In certain variants, the wand manipulation assembly 12 is spaced apart from an espresso machine, yet is configured to receive steam from the espresso machine via tubing.

Example Beverage Preparation System (Figures 2A and 2B)

[0016] Figures 2A and 2B illustrate another embodiment of a beverage preparation system 110. To facilitate presentation, the system 110 is discussed in connection with preparing a heated frothed milk beverage. However, various embodiments can be applied in many other contexts as well, such as in preparing brewed coffee, tea, juice, alcohol, and other types of beverages. Many of the features of the system 110 are the same as, or similar to, the features described above in connection with the system 10. To illustrate such correspondence, many of the numerals used to identify features of the system 110 are incremented by a factor of one hundred relative to the numerals used in connection with the system 10. The system 110 can include one, some, or all of the features of the system 10, including all combinations and sub combinations. Any component or step disclosed in any embodiment in this specification can be used in other embodiment.

[0017] As illustrated, the system 110 can include a wand manipulation assembly 112 and a container manipulation assembly 114. The wand manipulation assembly 112 and/or the container manipulation assembly 114 can be mounted on a counter, such as a countertop of a coffee shop. In various embodiments, the wand manipulation assembly 112 and/or the container manipulation assembly 114 can be generally visible from both a first side of the counter (e.g., a store employee side) and an opposite second side

(e.g., a customer side). Thus, certain embodiments can enable customers to visually experience the operation of the system 110.

[0018] As is discussed in more detail below, the wand manipulation assembly 112 can be configured to introduce a wand unit 116 into a container 118, such as a pitcher, cup, or other vessel. This can facilitate heating and foaming liquid L (e.g., milk) in the container 118. Some embodiments are configured to withdraw the wand unit 116 out of the container 118, which can facilitate access to the container 118 by a user. In certain implementations, the container manipulation assembly 114 can be configured to support and move the container 118. For example, the container 118 can be moved up and down relative to the wand unit 116 and/or a countertop. In some embodiments, the container manipulation assembly 114 is configured to rotate the container 118, such as to a position to enable washing of the inside of the container 118.

[0019] As illustrated, the wand manipulation assembly 112 can include a wand unit 116 coupled with a linkage 120 that is supported by a base, such as the counter. The wand unit 116 can comprise a generally elongate device with a longitudinal channel. A first end 121 of the wand unit 116 can be connected with a fluid source (not shown), such as a source of steam, and can be configured to convey the fluid through the longitudinal channel. A second end 122 (also called the “tip”) of the wand unit 116 can include an opening through which the fluid may be dispensed. Thus, when the second end 122 of the wand unit 116 is partially or completely submerged in liquid in the container, the fluid (e.g., steam) may be discharged from the wand unit 116 and pass through the liquid to heat and/or froth the liquid. In certain embodiments, the wand unit 116 includes one or more sensors, such as temperature sensors, liquid sensors, proximity sensors, weight sensors, or otherwise. In some embodiments, the wand unit 116 includes one or more heating elements, such as electrical resistance heaters. In some implementations, the wand unit 116 is made of plastic (e.g., polyether ether keton) or metal (e.g., stainless steel).

[0020] The linkage 120 can be configured to move the wand unit 116. For example, the linkage 120 can be configured to introduce and withdraw the wand unit 116 into and out of the container 118. In some embodiments, the linkage 120 is configured to move the wand unit 116 vertically. For example, the linkage 120 can include a piston and/or telescoping member that descends to introduce the wand unit 116 into the container 118 and

ascends to withdraw the wand unit 116 from the container 118. In some embodiments, the linkage 120 is configured to move the wand unit 116 vertically and horizontally. For example, as illustrated, the linkage 120 can move down and toward the container 118 to insert the wand unit 116 into the container 118 and can move up and away from the container 118 to remove the wand unit 116 from the container 118. In some embodiments, during the course of movement from a position outside the container 118 to a position inside the container 118, the tip 122 of the wand unit 116 travels in a curved path, such as an arced path from a side elevation perspective of the system 110 (e.g., as illustrated in Figure 3). In some variants, the tip 122 travels in an arch such that the tip 122 moves upward for a portion of the travel and downward for another portion of the travel.

[0021] In some implementations, the system 110 is configured to move the wand unit 116 with a generally smooth motion. For example, the system 110 can move the wand unit 116 without jerking or distinct changes in direction. In some implementations, the linkage 120 comprises a four-bar linkage or another type of linkage that provides generally smooth motion. As illustrated, the linkage 120 can be operably coupled with a motor 124, such as a stepper motor. In certain implementations, the motor 124 can drive the linkage 120, which in turn can position the wand unit 116.

[0022] As mentioned above, the system 110 can include a container manipulation assembly 114. In some embodiments, the container manipulation assembly 114 can include a container 118 receiving feature and/or support assembly 126, such as a platform. The support assembly 126 can be configured to support the container 118. For example, as illustrated the support assembly 126 can comprise a generally planar tray on which the container 118 can be stably placed. In some implementations, from a top view, the support assembly 126 has a generally circular peripheral shape.

[0023] In some embodiments, the support assembly 126 and container 118 are configured to couple together, such as via magnetic coupling. For example, the container 118 can be secured to the support assembly 126 with one or more permanent magnets located on the container 118 and/or the support assembly 126. The strength of the coupling can be such that a user can readily overcome the coupling force, thereby allowing the container 118 to be removed from the support assembly 126. In certain embodiments, the container 118 is secured to the support assembly 126 by a mechanical coupling or other type of connection.

For example, the container 118 can be clamped to the support assembly 126. In some variants, the support assembly 126 can include pins that are received in corresponding slots in the container 118, such that in a first position the container 118 is secured with the support assembly 126 and in a second position the container 118 can be lifted off the support assembly 126. In some implementations, the container 118 and support assembly 126 can be coupled with a magnetic keyed collar and a fitting. For example, a magnetic keyed collar on the support assembly 126 can be configured to engage with a fitting attached to the side of the container 118. The support assembly 126 can be configured to engage with a top portion, side, and/or the bottom of the container 118.

[0024] In some embodiments, the system 110 is configured to introduce liquid into the interior of the container 118. For example, the system 110 can include at least one dispensing nozzle adapted to receive a flow of liquid (e.g., milk) from a source (e.g., a milk dispenser) and to dispense the liquid into the interior of the container 118. In some embodiments, the nozzle is configured to introduce the liquid through an open upper end of the container 118. In some embodiments, the nozzle is configured to introduce the liquid through a closed bottom end of the container 118. For example, engagement of the container 118 with the support assembly 126 can open a passage in the bottom of the container 118, through which the nozzle can introduce the liquid into the interior of the container 118. The passage can be closed when the container 118 is not engaged with the support assembly 126. In some embodiments in which the container 118 is transparent or translucent, introducing the liquid through the bottom of the container 118 can make it appear to an observer that the liquid is welling-up, growing, and/or rising within the container 118. In certain embodiments in which the container 118 is opaque, introducing the liquid through the bottom of the container 118 can allow the sides of the container 118 to hide, obscure, and/or mask the liquid from certain observers (e.g., a person who does not have a line of sight into the container 118 that is generally parallel to the longitudinal axis of the container 118). This can make it seem as if the liquid magically appeared in the container 118. In some embodiments, the container 118 and/or the nozzle include a backflow inhibitor, such as a check valve (e.g., an umbrella valve, duckbill valve, or otherwise). In various embodiments, the system 110 is configured to automatically introduce the liquid into

the container 118 in response to the container 118 being engaged with the support assembly 126.

[0025] The support assembly 126 can be coupled with a positioning mechanism, such as an elevator 128. In some embodiments, the elevator 128 comprises a linear actuator. The elevator 128 can be configured to move the support assembly 126 relative to the countertop and/or wand unit 116. For example, in certain implementations, the elevator 128 moves the support assembly 126 generally vertically, such as between a lower position, upper position, and one or more intermediate positions.

[0026] As shown, the system 110 can include a controller 130, such as a processor and a memory. The controller 130 communicates with, and can be electrically connected with, other components of the system 110, such as via one or more cables or wires. In some embodiments, the controller 130 communicates with one or more other components wirelessly, such as via wi-fi, Bluetooth®, etc. The controller 130 can be configured to control various components of the system 110. For example, the controller 130 can instruct the motor 124 to drive the linkage 120, can instruct the fluid source to begin or end providing fluid to the wand unit 116, and/or can instruct the elevator 128 to move the support assembly 126 to various positions.

[0027] In some embodiments, the system 110 includes a user interface 132, which can be in communication with the controller 130. For example, the system 110 can include a keypad or other device configured to receive inputs from a user, such as one or more physical or virtual buttons or switches. The user inputs can include operational instructions, such as a command to initiate operation of the system 110. In certain variants, the user inputs include operational setpoints and/or parameters such as a temperature value (e.g., a temperature set point for the heated and/or frothed milk), a level of frothing vigorousness or desired foaminess, a time value, or otherwise. In some embodiments, the user inputs include a type of fluid in the container 118, such as whole milk, reduced fat milk (e.g., milk with 2% fat), soy milk, etc. Some implementations include a customer interface, such as an interface to display information relevant to the customer's beverage order (e.g., beverage type, type of milk, temperature, etc.).

[0028] In some embodiments, the user interface 132 can provide outputs to the user. For example, the user interface 132 can include a display (e.g., a screen), one or more

lights (e.g., light emitting diodes), gages, graphs, timers, symbols or other indicia, or otherwise. The user interface 132 can indicate various information about the system 110, such as an indication of the state of the system (e.g., on or off), the current operational state and/or next operational state, time elapsed and/or remaining during an operational state, total time elapsed and/or remaining for the system 110 to complete a cycle of operational states, or otherwise.

[0029] As will be discussed in more detail below, some embodiments include features to facilitate cleaning of portions of the system 110. For example, in some embodiments, the wand manipulation assembly 112 can include a wand cleaning unit (e.g., a collar 134) and/or a wand drain 136. In some embodiments, the container manipulation assembly 114 includes a container cleaning unit (e.g., one or more nozzles 138) and/or a container drain 140.

Certain Operational States (Figures 3-10)

[0030] Certain embodiments of the system 110 include a preparatory, initial, and/or rest operational state. Such a state can be the operational state that the system 110 is in, and/or reverts to, when deenergized (e.g., turned off), upon being energized (e.g., turned on), and/or when the system 110 is energized and is not performing a task (e.g., a frothing or washing task). In some such embodiments, the preparatory, initial, and/or rest operational state is a state similar to what is shown in Figure 1A and/or Figure 2B. For example, in such a state, the wand manipulation assembly 112 and the container manipulation assembly 114 can be disengaged from each other.

[0031] Figures 3-10 illustrate various other operational states of certain embodiments of the system 110. As will be described in more detail, some implementations are configured to automatically insert the wand unit 116 into a container 118 of liquid (e.g., milk), heat and/or froth the liquid, and remove the wand unit 116 from the heated and/or frothed liquid. Some embodiments are configured to automatically cleanse the wand unit 116 and/or the container 118. The system 110 can include one or more position sensors configured to detect the location of various components, such as the position of the wand unit 116, linkage 120, container 118, support assembly 126, and/or elevator 128.

Engagement

[0032] With regard to Figure 3, the system 110 is shown in an operational state in which the linkage 120 has moved relative to the container 118, such that the tip 122 of the wand unit 116 has been inserted into the container 118. In certain embodiments, this is accomplished by the controller 130 instructing the motor 124 to drive the linkage 120, thereby moving the wand unit 116 laterally (e.g. horizontally) toward the container 118 and/or elevationally (e.g. vertically) towards the container 118. In some embodiments, the tip 122 is positioned in substantially the radial center of the container 118. In certain variants, the tip 122 is offset from the radial center of the container 118, which can facilitate forming a vortex or rolling motion in the liquid during the frothing process. As shown, the longitudinal axis of the wand unit 116 can be parallel with vertical. In certain variants, the longitudinal axis of the wand unit is at an angle compared to vertical, such as being angled at least about: 1°, 3°, 5°, 10°, 15°, angles between the aforementioned angles, or other angles.

[0033] The system 110 can be configured such that the tip 122 of the wand unit 116 clears (e.g., does not impact or otherwise contact) the side and top of the container 118 as the wand unit 116 moves into the container 118. This can reduce or avoid damage to the wand unit 116 and/or spillage of the contents of the container 118. In certain variants, the elevator 128 moves the support assembly 126 to a lower or lowermost position before or during insertion of the wand unit 116 into the container 118. This can lower the position of the top of the container 118 relative to the tip 122 of the wand unit 116, which can facilitate introducing the tip 122 into the container 118.

[0034] Some embodiments are configured to detect, and/or to receive a user input regarding, the presence and/or type of the container 118 on the support assembly 126. This can allow the system 110 to adjust the position of the support assembly 126, so that the wand unit 116 can be safely moved into container 118. For example, in response to determining that a first container 118 with a first height is located on the support assembly 126, the elevator 128 can move the support assembly 126 to a first location, in which the wand unit 116 can be safely moved into the first container 118. And in response to determining that a second container 118 with a second height (greater than the first height) is located on the support assembly 126, the elevator 128 can move the support assembly 126 to a second

location (lower than the first location), in which the wand unit 116 can be safely moved into the second container 118.

[0035] To facilitate the detection of the container 118, the support assembly 126 and/or the elevator 128 can include one or more sensors, such as proximity sensors, optical sensors, magnetic sensors, or other types of sensors. The sensors can be configured to detect the presence and/or aspects of the container 118 when the container 118 is on or near the support assembly 126. For example, in some embodiments, the container 118 includes one or more indicators (e.g., permanent magnets, serial barcode, matrix barcode, etc.), and the support assembly 126 and/or elevator 128 includes one or more sensors configured to detect the indicators. In some embodiments, the support assembly 126 includes an accelerometer to help monitor system level performance. For example, the system 110 can detect, with the accelerometer, when the support assembly 126 tilts more than a certain amount (e.g., more than the support assembly 126 tilts in a new state with a full pitcher on the support assembly 126). This can indicate that a bearing or other component on the support assembly 126 or elevator 128 may need replacement or maintenance. Certain implementations are configured such that, if the acceleration and/or speed of the support assembly 126 (e.g., when moving up or down with a substantially or completely full pitcher) is outside of a normal range and/or is different from a previous movement, then the system can issue an alert that the system 110 may require preventative maintenance.

[0036] In some implementations, based on the detected indicators, or user inputs, the system 110 can access a database to identify characteristics of the container 118. For example, the type, size, strength, number, arrangement, and/or position of the indicators can be detected and cross-referenced (e.g., mapped with a lookup table) to corresponding information in the database. As an example, in some embodiments, in response to detecting that the container 118 has two magnetic indicators, the system 110 can access the database that cross-references two magnetic indicators to indicating a one-liter container. The database can include various information about the container 118, such as the volume, width, height, age, serial number, etc.

[0037] Some embodiments are configured to determine the height of the container 118. For example, some embodiments indirectly determine the height of the container 118, such as by receiving the height from a height field in the database. Certain

embodiments detect the height of the container 118 directly. For example, the elevator 128, or another component of the system 110, can include a sensor (e.g., a sonic or optical transceiver) that can identify the approximate top of the container 118. The controller 130 can receive such information and determine an approximate height of the container 118.

[0038] Certain embodiments are configured to calculate, based at least in part on the height of the container 118, a position of the support assembly 126 at which the tip 122 of the wand unit 116 can be safely inserted into the container 118. In some embodiments, the controller 130 instructs the elevator 128 to move the support assembly 126 to such a position, or lower. In some embodiments, if the system 110 determines that a given container 118 is too tall (e.g., the support assembly 126 cannot be moved low enough to avoid the tip 122 of the wand unit 116 impacting the container 118), the system 110 does not initiate, or halts, attempting to move the wand unit 116 into the container 118. In certain variants, in response to determining that a given container 118 is too tall, the system 110 provides an alert, such as a warning light or a message on the user interface 132.

Heating and/or Frothing

[0039] In some embodiments, when the wand unit 116 is initially inserted into the container 118, the tip 122 of the wand unit 116 is not submerged in the liquid, or is submerged in only an upper portion of the liquid (e.g., in the uppermost quarter of the height of the liquid). As shown in Figure 4, in some implementations, after the wand unit 116 has been inserted into the container 118, the elevator 128 raises the support assembly 126. In some implementations, the support assembly 126 is raised concurrent with the wand unit 116 being inserted into the container 118. In certain variants, the linkage 120 moves the wand unit 116 downward within the container 118 and the support assembly 126 remains stationary or moves upward. In certain implementations, with the tip 122 in the unsubmerged position, fluid (e.g., steam) is discharged from the tip 122. This can aid in breaking any large bubbles on the surface of the liquid in the container 118. In some embodiments, the fluid discharged when the tip 122 is unsubmerged is at a lower velocity than the fluid discharged during the heating and/or frothing operations discussed below.

[0040] Raising the support assembly 126, and/or lowering the wand unit 116, can result in relative movement between the surface of the liquid in the container 118 and the tip 122 of the wand unit 116. This can result in submerging, or further submerging, of the

tip 122 in the liquid. In some embodiments, the tip 122 is submerged to a heating position. In some embodiments, in the heating position, the tip 122 is submerged by at least about: 25% of the depth D of the liquid in the container 118, 50% of D, 75% of D, 90% of D, values between the aforementioned values, or other values. In certain variants, in the heating position, the tip 122 is positioned near or adjacent the bottom inside surface of the container 118. In certain embodiments, fluid (e.g., steam) can flow through the wand unit 116 and be discharged into the liquid L, thereby heating the liquid.

[0041] As illustrated in Figure 5, the tip 122 can be brought to a frothing position, such as at or near the surface S of the liquid L. This can encourage incorporation of air into the liquid, such as by the flow of fluid (e.g., steam) from the wand unit 116 causing turbulence in the liquid, thereby producing froth. Certain embodiments are configured to adjust the wand unit 116 and the flow of fluid in order to affect the frothing operation and the produced froth. For example, the system 110 can be configured to adjust the position of the tip 122 (e.g., relative to the surface of the liquid), the length of time that the tip 122 is maintained in such a position, and/or the pressure of the fluid discharged from the tip 122. This can allow the system 110 to control the amount and character of froth produced, which can be desirable for different beverage types (e.g., a first froth amount and character of froth for a latte, a second amount and character of froth for a cappuccino, etc.). In some embodiments, in the frothing position, the tip 122 is submerged in the liquid by less than or equal to about: 25% of D, 15% of D, 10% of D, 5% of D, 1% of D, values between the aforementioned values, or other values. In various embodiments, to position the tip 122 in the frothing position, the distance between the tip 122 and the surfaces of the liquid L is reduced, compared to the distance in the heating position. For example, the tip 122 can be moved upward by the linkage 120 and/or the support assembly 126 can be moved downward by the elevator 128. In some embodiments, the linkage 120 includes a mechanism configured to move the wand unit 116 vertically without also moving the steam wand horizontally, such as a telescoping element.

[0042] In certain embodiments, the system 110 is configured to maintain the wand unit 116 at or near the frothing position (e.g., at or near the surface of the liquid L). For example, some embodiments are configured to move the wand unit 116 and/or the support assembly 126 during the heating and/or frothing operation. During the course of frothing,

some liquid may be converted to froth, so the depth D of the liquid may decrease. Thus, some embodiments are configured to move the tip 122 downward and/or the container 118 upward to offset such depth change. In certain implementations, due to an increase in overall volume (of the liquid and the froth), some embodiments are configured to move the tip 122 upward and/or the container 118 downward during the frothing operation.

[0043] To aid in positioning the tip 122 relative to the surface of the liquid, certain embodiments are configured to determine the position (e.g., height) of the surface of the liquid in the container 118. In some embodiments, the position of the surface of the liquid is known and generally constant. For example, in some implementations, the container 118 has a recommended fill level, which is the amount up to which the container 118 is to be filled with liquid. The height of the liquid at the fill level can be determined (e.g., empirically) and included in the database. Thus, when the system 110 accesses the database (as discussed above), the system 110 can retrieve the height of the surface of the liquid for the container 118 and can adjust the position of the wand unit 116 and/or the support assembly 126 accordingly, such as to place and/or maintain the tip 122 in the frothing position.

[0044] In some embodiments, the position of the surface of the liquid is unknown and/or variable. For example, certain containers may not have a recommended fill level and/or may not have liquid surface height information in the database. In some embodiments, the system 110 is configured to detect the surface of the liquid, such as with one or more sensors. For example, the wand unit 116 can include one or more temperature sensors that can detect a rapid and/or substantial change in temperature, such as may occur when the wand unit 116 penetrates from ambient air into the liquid. In certain implementations, the system 110 is configured to discern that the surface of the liquid is at or near a location (e.g., less than or equal to about 10 mm away) in which the temperature sensor detects a temperature of less than or equal to about 6° C and/or a temperature change of at least about 10° C over a period of less than or equal to about 1 second. In some embodiments, the wand unit 116 includes liquid sensors at periodic locations along its length. The location of the surface of the liquid can be estimated as being between a sensor that detects the presence of liquid and an adjacent sensor that does not detect the presence of liquid. In some embodiments, the system 110 includes sensors (e.g., sonic or optical transceivers) configured

to determine a position of the surface S, and thus, the height above the support assembly 126. Certain variants can measure the weight of the container 118 and use such a weight in calculating an approximate height of the surface S.

[0045] The system 110 can reduce or stop the discharge of fluid (e.g. steam) from the wand unit 116 in response to a condition being met. In some variants, the condition comprises a temperature set point of the liquid being achieved (e.g., at least about 55°C), a temperature maximum being achieved (e.g., at least about 63°C), a certain amount of time elapsing (e.g., at least about 30 seconds), or otherwise. Certain embodiments include one or more sensors to detect aspects related to the produced froth. For example, some embodiments can detect aspects of the froth from a change in electrical properties (e.g., capacitance), optical properties, acoustic properties, level detection, etc. In some variants, the condition comprises a froth setpoint value, such as a volume of froth reaching a certain value.

[0046] Some implementations are configured to vary the amount and/or pressure of the fluid discharged from the wand unit 116. For example, some embodiments include a proportional valve that adjusts the fluid flow. Adjusting the fluid flow can provide different rates of heating and/or amounts of turbulence in the liquid, which can facilitate creating different amounts and/or types of froth. In some embodiments, the system 110 is configured to reduce the amount and/or pressure of the discharged fluid based on a location of the tip 122. For example, when the tip 122 is at or near the surface of the liquid (e.g., during an aerating operation, such as is shown in Figure 5), the flow rate and/or pressure of the fluid can be reduced compared to when the tip 122 is not at or near the surface of the liquid (e.g., during a heating operation, such as is shown in Figure 4). This can inhibit or prevent splattering during the aerating operation and/or can accelerate heating during a heating operation.

Disengagement

[0047] As indicated in Figure 6, the system 110 can withdraw the wand unit 116 from the container 118. This can facilitate ready access to the container 118 of heated frothed liquid. In some embodiments, withdrawal of the wand unit 116 occurs in response to an input from a user, such as a command issued through the user interface 132. In certain embodiments, the withdrawal of the wand unit 116 occurs automatically, such as in response to one or more of the above-mentioned, or other, conditions being met. As illustrated, in

some embodiments, the elevator 128 moves the support assembly 126 downward, and/or the linkage 120 moves the wand unit 116 upwardly and laterally away from the container 118. In various embodiments, the system 110 is configured to remove the wand unit 116 from the container 118 without the tip 122 contacting container 118.

[0048] As can be seen in Figure 7, in some embodiments, the container 118 can be removed from the support assembly 126. For example, a user can lift the container 118 off the support assembly 126. Removal of the container 118 from the support assembly 126 can facilitate using the heated frothed contents of the container 118 in preparing a beverage. For example, the container 118 can be moved to a mixing area (e.g., an area where espresso and the contents of the container 118 are combined) and/or the contents of the container 118 can be poured out of the container 118. In some embodiments, the system 110 can notify a user that the container is ready to be removed from the support assembly 126. For example, the system 110 can include an audible alert (e.g., tone), visual alert (e.g., flashing light), etc.

Cleaning

[0049] In certain embodiments, the system 110 is configured to cleanse the wand unit 116. For example, the system 110 can include a wand cleaning unit, such as a collar 134. In some embodiments, the collar 134 can receive cleaning fluid (e.g., potable water) and can deliver (e.g., spray) the cleaning fluid onto an outer surface of the wand unit 116. In some embodiments, the system 110 includes a control valve, such as a solenoid valve, that can open and close to permit or inhibit a flow of the cleaning fluid to the collar 134. Operation of the control valve can be controlled by the controller 130. In various embodiments, the collar 134 is positioned at an upper or uppermost portion of the wand unit 116. Thus, as illustrated in Figure 7, by force of gravity, the cleaning fluid can flow down some, a majority, or substantially all of the elongate length of the wand unit 116. This can wash the wand unit 116 of residual foamed liquid or other material on the outer surface of the wand unit 116. In some implementations, the outer surface of the wand unit 116 includes features to promote the flow of cleaning fluid (e.g. spiral or longitudinal channels, a surface treatment, etc.). As shown, the system 110 can include a wand drain 136, which can be positioned under the wand unit 116 in the disengaged (e.g., retracted) position. Thus, the wand drain 136 can receive the cleaning fluid that has flowed down the wand unit 116.

[0050] In some embodiments, the system 110 is configured to automatically purge the wand unit 116. For example, the system 110 can discharge a burst of fluid from the tip 122. This can aid in removing froth or residue from the channel in the wand unit 116. In some embodiments, the purge operation occurs concurrent with, or before, the cleaning operation of the outer surface of the wand unit 116. In certain variants, the purge operation occurs as the wand unit 116 is moving between the positions shown in Figures 5 and 6, and/or substantially immediately after the wand unit 116 has been removed from the container 118.

[0051] In certain embodiments, the system 110 is configured to cleanse the inside of the container 118. As shown in Figure 8, the elevator 128 can raise the support assembly 126 to an upper or uppermost position. This can facilitate further positioning of the container 118 and/or can position the support assembly 126 in a convenient location to receive the container 118 again (e.g., by a user putting the container 118 back on the support assembly 126). In some embodiments, the support assembly 126 is located at a lower position (e.g., as shown in Figure 7), and is raised (e.g., as shown in Figure 8) after the container 118 has been placed on the support assembly 126. In some embodiments, the support assembly 126 is raised to a position in which the distance between the top of the support assembly 126 and the counter is greater than the height of the container 118. As previously mentioned, the support assembly 126 and container 118 can be coupled to one another, such as with permanent magnets. The coupling can allow the container 118 to be secured to the support assembly 126, while still permitting the container 118 to be readily removed.

[0052] As indicated in regard to Figure 9, in some embodiments, the support assembly 126 is configured to rotate, such as about an axis that is generally parallel to horizontal. This can result in the container 118 on the support assembly 126 being moved to a rotated position. In some embodiments, in the rotated position, the container 118 is flipped, such as about 180° and/or inverted (e.g., upside-down). In some embodiments, from an upright position (e.g., a generally vertical position as illustrated in Figure 8) to the rotated position, the container 118 is rotated at least about: 90°, 100°, 120°, 150°, 180°, 210°, amounts between the aforementioned amounts, or other amounts. In various embodiments, the strength of the coupling between the container 118 and support assembly 126 is sufficient

to maintain the container 118 on the support assembly 126, even in the rotated position, as is illustrated. In the rotated position, residual liquid and froth in the container 118 can flow out of the container 118 by force of gravity. As shown, some implementations include a container drain 140 or catch basin to receive such residual liquid and froth.

[0053] As also illustrated in Figure 9, certain embodiments include a container cleaning unit, such as one or more nozzles 138. The nozzles 138 can be configured to spray cleaning fluid (e.g., potable water) into the inverted container 118. For example, the nozzles 138 can spray generally upwardly into the inverted container 118 to wash the inside of the container 118. The cleaning fluid can fall into, and be received by, the container drain 140 or catch basin. In some implementations, operation of the nozzles 138 is governed by the controller 130. For example, the controller can control operation of a solenoid or other type of valve that opens to deliver the cleaning fluid to the nozzles 138.

[0054] As illustrated in Figure 10, in some embodiments, after the container 118 has been washed, the support assembly 126 can rotate again. For example, the container 118 can be returned to an upright orientation. In some embodiments, the elevator 128 can move to a lower or lowermost position during or after the rotation of the support assembly 126. In general, the system 110 can return to a preparatory state, such as is illustrated in Figures 2A and 2B, in which the system 110 is ready to prepare another heated frothed beverage. For example, another amount of liquid can be added to container 118 (e.g., by removing the container 118 from the support assembly 126, adding the liquid into the container 118, and replacing the container 118 on the support assembly 126) and some or all of the operational steps described above can be repeated.

Collar (Figures 11-12B)

[0055] Figure 11 illustrates a perspective view of an embodiment of the collar 134. As shown, the collar 134 can comprise an annular or semi-annular member. The collar 134 can surround a circumference of the wand unit 116. In certain embodiments, the collar 134 does not contact the wand unit 116.

[0056] As mentioned above, the collar 134 can be configured to deliver cleaning fluid to the outer surface of the wand unit 116. For example, the collar 134 can receive a flow of potable water or another cleaning fluid from a fluid source via a tube 142. The collar 134 can dispense the cleaning fluid radially inwardly onto the outer surface of the wand unit 116.

As illustrated, the collar 134 can be positioned at the top or top portion of the wand unit 116. Thus, the cleaning fluid discharged from the collar 134 can flow down some or all of the longitudinal length of the wand unit 116, thereby washing away excess or residual froth or other material on the wand unit 116. In various implementations, the collar 134 is configured to spray cleaning fluid on an end of the wand unit 116 that is opposite the tip 122. In certain embodiments, the system 110 is adapted to clean the wand unit 116 without needing to submerge the tip 122 in a reservoir of cleaning fluid and/or without spraying clean fluid directly on an end of the wand unit 116 that includes the tip 122.

[0057] The collar 134 can include a radially inner surface that is configured to discharge the cleaning fluid. In some embodiments, the radially inner surface has one or more dispensing elements, such as notches or holes, as illustrated in Figure 12A. The dispensing elements can be equally or non-equally distributed around the circumference of the radially inner surface. In some variants, the dispensing element comprises a generally or completely continuous annular gap, such as is illustrated in Figure 12B. In various embodiments, the collar 134 can provide an annular spray of cleaning fluid around substantially the entire circumference of the upper end of the wand unit 116.

[0058] As described above, in some embodiments, the system 110 can be configured to control the cleaning operation. For example, the controller 130 can govern operation of the control valve, such as by sending one or more signals instructing the control valve to open or close in order to, respectively, start or stop the flow of cleaning fluid to the collar 134. In some embodiments, the cleaning operation is initiated by a user input, such as a switch or button on the user interface 132. In some variants, the cleaning operation is automatically initiated in response to positioning the wand unit 116 in a certain position, such as generally vertically over the wand drain 136. In some embodiments, a preset volume of cleaning fluid is dispensed to the wand unit 116, such as at least about: 25 ml, 50 ml, 100 ml, 150 ml, 200 ml, volumes between the aforementioned volumes, or other volumes. Some implementations are configured to dispense cleaning fluid for a certain period, such as at least about: 0.25 seconds, 0.50 seconds, 0.75 seconds, 1.0 seconds, 1.5 seconds, 2.0 seconds, periods between the aforementioned periods, or other periods. In some embodiments, the collar 134 is configured to provide a generally laminar flow of cleaning fluid along some, substantially all, or all of the length of the wand unit 116.

[0059] In some variants, the collar 134 is configured to provide a substantially or completely continuous layer of cleaning fluid to the wand unit 116 during a portion of the cleaning operation. The layer can be provided around substantially all, or all, of the circumference of the wand unit 116 and/or along substantially all, or all, of the length of the wand unit 116. For example, some embodiments are configured to provide a water jacket around and along the wand unit 116 during the course of the cleaning operation. As described above, the cleaning fluid can flow down the surface of the wand unit 116 and flow off a lower end (e.g., the tip) of the wand unit 116. This can wash-away material (e.g., residual froth) on the wand unit 116. The cleaning fluid and washed-away material can be received and/or collected in the wand drain 136.

Certain Methods (Figures 13 and 14)

[0060] Figure 13 illustrates an example method 200 of preparing a heated and/or frothed beverage using a beverage preparation system, such as the system 110. As shown, the method can include receiving a container on a support assembly, such as a platform, of the system 202. Some embodiments include securing the container with the support assembly, such as by a magnetic or mechanical coupling. The container can contain a liquid to be heated and/or frothed, such as milk. Certain embodiments include introducing liquid into the container while the container is on the support assembly, such as by passing the liquid through an open upper end of the container and/or by passing the liquid through a passage in the bottom of the container.

[0061] The method can include moving a wand unit into the container 204. For example, the wand unit can be moved with a mechanical linkage, such as a four-bar linkage. Some implementations include moving the wand unit in a smooth manner, such as without jerking or abrupt changes in direction. In some embodiments, when the wand unit is moved into the container, a tip of the wand unit is not initially submerged in the liquid in the container.

[0062] As illustrated, the method can include submerging the tip in the liquid to a first depth 206 (e.g., a heating depth). For example, the support assembly can be moved upwardly, such as with an elevator. In some variants, the wand unit is moved downwardly, such as by movement of the linkage. In some implementations, the first depth (measured down from the surface of the liquid) is at least about: 20 mm, 25 mm, 30 mm, 40 mm,

50 mm, 60 mm, 75 mm, values between the aforementioned values, or other values. In some implementations, the first depth is at least 50% of the depth of the liquid and/or the tip is positioned approximately at the bottom of the container. In some embodiments, at the first depth, fluid (e.g., heated air or steam) is discharged from the wand unit and into the liquid to heat the liquid.

[0063] The method can include moving the tip to a second depth 208 (e.g., a frothing depth) in the liquid. The second depth can be less than the first depth, such as less than one-half of the first depth. In various embodiments, the second depth is at or just below the surface of the liquid. For example, the second depth (measured down from the surface of the liquid) can be less than or equal to about: 20 mm, 15 mm, 10 mm, 5 mm, 3 mm, 1 mm, values between the aforementioned values, or other values. In some embodiments, the method includes moving the tip of the wand unit above the surface of the liquid, such as less than or equal to about 10 mm above the surface of the liquid. In some embodiments, at the second depth, fluid (e.g., air or steam) is discharged from the wand unit and into the liquid to froth the liquid.

[0064] In various embodiments, the submerging the tip in the liquid to the first depth 206 and/or moving the tip to the second depth 208 can include moving the support assembly, wand unit, or both. For example, in some embodiments, such actions are performed by the support assembly moving the container (e.g., generally vertically), while the wand unit is substantially stationary. In certain variants, such actions are performed by the linkage moving the wand unit, while the container on the support assembly is substantially stationary. In some implementations, such actions are performed by the support assembly moving the container and the linkage moving the wand unit, either in parallel or in series. Some embodiments include moving the tip to the first and/or second depth multiple times (e.g., from the first depth to the second depth and back to the first depth, or vice versa). Certain embodiments include moving the tip to one or more additional depths, such as to a third depth. The third depth can be between the first and second depths, can be a depth that is greater than (more submerged) the first depth, or can be a depth that is less than (less submerged) the second depth.

[0065] As illustrated, the method can include withdrawing the wand unit from the container 210. For example, the linkage can reverse its movement, compared to the insertion

action 204. Withdrawal of the wand unit can facilitate removal of the container from the support assembly 212. For example, the container can be removed from the support assembly by a user and brought to a mixing area, in which the heated and/or frothed beverage can be removed from the container and used in making a beverage, such as a latte or cappuccino. In some variants, the system is configured to remove the heated and/or frothed beverage from the container while the container is on the support assembly, such as via a suction tube. Some embodiments include receiving the container on the support assembly again 214. For example, the user can put the container back on the support assembly. Some embodiments include a wash operation 216, such as an operation to wash the wand unit and/or the container, as is discussed in more detail below. In some implementations, washing the wand unit occurs substantially immediately following withdrawal of the wand unit from the container 210. This can reduce or eliminate adhesion of froth with the outer surface of the wand unit 116. In some embodiments, washing the wand unit occurs before and/or concurrent with removal of the container from the support assembly 212.

[0066] As illustrated, the method 200 can include a decision block 218, which can ask whether there are additional heated and/or frothed beverages to be prepared. If the answer is yes, then the method 200 can include adding liquid (e.g., milk) to the container 220. In some embodiments, the container can have liquid added into it before being placed back on the support assembly (as described above in block 214). Some embodiments include removing the container from the support assembly and adding liquid. In some variants, the system is configured to add liquid to the container while on the support assembly, such as with a tube connected with a source of the liquid (e.g., a milk dispenser). In some embodiments, the support assembly includes a nozzle and/or valve that engages a bottom of the container, such that liquid can be added to the container through the bottom of the container. As shown, the method can return to block 204 to introduce the wand unit into the container and the method 200 can continue. In some embodiments, if the answer to the decision block 218 is no, then the method 200 ends.

[0067] In another embodiment of the method 200, the method includes heating and/or frothing the liquid without moving the tip of the wand unit relative to the surface of the liquid. This can enable faster beverage preparation and/or less motion of the container. In some embodiments, the wand unit can include a lower port for discharging fluid for heating

the liquid and an upper port for fluid for aerating the liquid. For example, the lower port can be at or near the tip 122 and the upper port can be spaced apart from the tip 122 by at least about 20 mm. The method can include introducing the wand unit into the liquid such that the upper port is at or near the surface of the water and the lower port is submerged in the liquid to a greater extent than the upper port. The method can include discharging fluid from the lower port to heat the liquid and/or discharging fluid from the upper port to aerate the liquid to produce froth. Because of the positioning of the upper and lower ports, movement of the tip 122 relative to the surface of the liquid may be unneeded, thus enabling the beverage to be prepared more rapidly and/or with less motion of the container.

[0068] Figure 14 illustrates an example method 300 of a washing operation, such as an operation for washing the container. In some embodiments, the method includes securing the container to the support assembly 302, such as by mechanically or magnetically coupling the container and the support assembly.

[0069] Certain embodiments include rotating the support assembly 304. This can be performed while the container and the support assembly are coupled, such that the bottom of the container remains attached to the support assembly. In some embodiments, the support assembly rotates about an axis that is substantially horizontal. In some embodiments, the method includes rotating the support assembly, and/or the container attached to the support assembly, at least about: 120°, 140°, 160°, 180°, 200°, values between the aforementioned values, or otherwise. In various embodiments, the support assembly is positioned such that rotation of the support assembly does not result in the container contacting a counter, drain, or other structure below the support assembly.

[0070] In some embodiments, the method includes rotating the support assembly to place the container in a cleaning position, such as an approximately inverted position. In some embodiments, the container is not perfectly inverted. For example, the container can be offset from perfectly inverted by at least about: 1°, 3°, 5°, 10°, values between the aforementioned values, or otherwise.

[0071] As shown, the method can include introducing cleaning fluid into the container 306. For example, cleaning fluid can be sprayed upwardly into the inverted container or through a port in the bottom of the container. In some embodiments, the method includes allowing the cleaning fluid and residual material (e.g., residual liquid and froth) to

exit downward out of the container by gravity. Some variants include receiving the cleaning fluid, such as in a drain or catch basin.

[0072] In some embodiments, the method includes rotating the container 308, such as to an upright position. For example, the container can be rotated approximately 180°. In some embodiments, the container is rotated in opposite rotational directions when rotating from the upright position to the inverted position, and from the inverted position to the upright position. In some variants, the container is rotated in the same rotational direction when rotated from the upright position to the inverted position, and from the inverted position to the upright position. In the upright position, the container can be ready for further use, such as to receive additional liquid and to be used in the preparation of additional heated and/or frothed beverage.

Certain Terminology

[0073] As used herein, the term “beverage” has its ordinary and customary meaning, and includes, among other things, any edible liquid or substantially liquid substance or product having a flowing quality (e.g., juices, coffee beverages, teas, milk, beer, wine, cocktails, liqueurs, spirits, cider, soft drinks, flavored water, energy drinks, soups, broths, combinations of the same, or the like).

[0074] Conditional language, such as “can,” “could,” “might,” or “may,” unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain embodiments include, while other embodiments do not include, certain features, elements, and/or steps. Thus, such conditional language is not generally intended to imply that features, elements, and/or steps are in any way required for one or more embodiments or that one or more embodiments necessarily include logic for deciding, with or without user input or prompting, whether these features, elements, and/or steps are included or are to be performed in any particular embodiment.

[0075] Conjunctive language such as the phrase “at least one of X, Y, and Z,” unless specifically stated otherwise, is otherwise understood with the context as used in general to convey that an item, term, etc. may be either X, Y, or Z. Thus, such conjunctive language is not generally intended to imply that certain embodiments require the presence of at least one of X, at least one of Y, and at least one of Z.

[0076] Unless otherwise explicitly stated, articles such as “a” or “an” should generally be interpreted to include one or more described items. Accordingly, phrases such as “a device configured to” are intended to include one or more recited devices. Such one or more recited devices can also be collectively configured to carry out the stated recitations. For example, “a processor configured to carry out recitations A, B, and C” can include a first processor configured to carry out recitation A working in conjunction with a second processor configured to carry out recitations B and C.

[0077] The terms “comprising,” “including,” “having,” and the like are synonymous and are used inclusively, in an open-ended fashion, and do not exclude additional elements, features, acts, operations, and so forth. Likewise, the terms “some,” “certain,” and the like are synonymous and are used in an open-ended fashion. Also, the term “or” is used in its inclusive sense (and not in its exclusive sense) so that when used, for example, to connect a list of elements, the term “or” means one, some, or all of the elements in the list.

[0078] The terms “approximately,” “about,” and “substantially” as used herein represent an amount close to the stated amount that still performs a desired function or achieves a desired result. For example, in some embodiments, as the context may dictate, the terms “approximately”, “about”, and “substantially” may refer to an amount that is within less than or equal to 10% of the stated amount. The term “generally” as used herein represents a value, amount, or characteristic that predominantly includes, or tends toward, a particular value, amount, or characteristic. As an example, in certain embodiments, as the context may dictate, the term “generally parallel” can refer to something that departs from exactly parallel by less than or equal to 20 degrees and/or the term “generally perpendicular” can refer to something that departs from exactly perpendicular by less than or equal to 20 degrees.

[0079] Overall, the language of the claims is to be interpreted broadly based on the language employed in the claims. The language of the claims is not to be limited to the non-exclusive embodiments and examples that are illustrated and described in this disclosure, or that are discussed during the prosecution of the application.

Summary

[0080] Although this disclosure describes certain embodiments and examples of beverage dispensing systems and methods, many aspects of the above-described systems and methods may be combined differently and/or modified to form still further embodiments or acceptable examples. All such modifications and variations are intended to be included herein within the scope of this disclosure. For example, although a single wand unit is illustrated, some embodiments have multiple wand units, such as two, three, four, or more. As another example, while certain embodiments discussed above include the liquid being added to the container before being placed on the support assembly, some variants are configured to introduce liquid into the container after the container has been placed on the support assembly, such as with a nozzle in communication with a source of liquid milk, and with a control valve (e.g., a solenoid valve) configured to open in response to a command from the controller to allow the liquid milk to flow into the container on the support assembly. As another example, although certain embodiments are described with a cleaning unit that moves with the wand unit, in some embodiments the wand unit moves relative to the cleaning unit (e.g., the wand unit passes into a small bath, through a spraying nozzle, etc.). As a further example, although certain embodiments are described with a wand unit that moves horizontally and vertically (e.g., in an arc) to engage the container on the support assembly, in some embodiments the support assembly and container move horizontally and vertically (e.g., in an arc) to engage the wand unit. For example, the support assembly can be connected with the linkage and the wand unit can be connected with the elevator. A wide variety of designs and approaches are possible and are within the scope of this disclosure. While illustrative embodiments have been described herein, the scope of all embodiments having equivalent elements, modifications, omissions, combinations (e.g., of aspects across various embodiments), adaptations and/or alterations as would be appreciated by those in the art based on the present disclosure. Additionally, note that this application incorporates by reference the entirety of the U.S. provisional patent application titled "BEVERAGE DISPENSING SYSTEMS AND METHODS," filed on the same day as this application, attorney reference number SBUX1.388PR.

[0081] Also, although there may be some embodiments within the scope of this disclosure that are not expressly recited above or elsewhere herein, this disclosure

contemplates and includes all embodiments within the scope of what this disclosure shows and describes. Further, this disclosure contemplates and includes embodiments comprising any combination of any structure, material, step, or other feature disclosed anywhere herein with any other structure, material, step, or other feature disclosed anywhere herein. For example, like the wand manipulation assembly and/or the container manipulation assembly of the system 10, in some embodiments, the wand manipulation assembly and/or the container manipulation assembly of the system 110 can be distinct from, and not a part of, a beverage machine (e.g., spaced apart from an espresso machine).

[0082] Furthermore, certain features that are described in this disclosure in the context of separate implementations can also be implemented in combination in a single implementation. Conversely, various features that are described in the context of a single implementation can also be implemented in multiple implementations separately or in any suitable subcombination. Moreover, although features may be described above as acting in certain combinations, one or more features from a claimed combination can, in some cases, be excised from the combination, and the combination may be claimed as a subcombination or variation of a subcombination.

[0083] For purposes of this disclosure, certain aspects, advantages, and novel features are described herein. Not necessarily all such advantages may be achieved in accordance with any particular embodiment. Thus, for example, those skilled in the art will recognize that the disclosure may be embodied or carried out in a manner that achieves one advantage or a group of advantages as taught herein without necessarily achieving other advantages as may be taught or suggested herein.

[0084] Some embodiments have been described in connection with the accompanying drawings. The figures are drawn to scale, but such scale should not be interpreted to be limiting. Distances, angles, etc. are merely illustrative and do not necessarily bear an exact relationship to actual dimensions and layout of the devices illustrated. Components can be added, removed, and/or rearranged. Further, the disclosure herein of any particular feature, aspect, method, property, characteristic, quality, attribute, element, or the like in connection with various embodiments can be used in all other embodiments set forth herein. Also, any methods described herein may be practiced using any device suitable for performing the recited steps.

[0085] Moreover, while components and operations may be depicted in the drawings or described in the specification in a particular arrangement or order, such components and operations need not be arranged and performed in the particular arrangement and order shown, nor in sequential order, nor include all of the components and operations, to achieve desirable results. Other components and operations that are not depicted or described can be incorporated in the embodiments and examples. For example, one or more additional operations can be performed before, after, simultaneously, or between any of the described operations. Further, the operations may be rearranged or reordered in other implementations. Also, the separation of various system components in the implementations described above should not be understood as requiring such separation in all implementations, and it should be understood that the described components and systems can generally be integrated together in a single product or packaged into multiple products.

[0086] In summary, various illustrative embodiments and examples of beverage dispensing systems and methods have been disclosed. Although the systems and methods have been disclosed in the context of those embodiments and examples, this disclosure extends beyond the specifically disclosed embodiments to other alternative embodiments and/or other uses of the embodiments, as well as to certain modifications and equivalents thereof. This disclosure expressly contemplates that various features and aspects of the disclosed embodiments can be combined with, or substituted for, one another. Accordingly, the scope of this disclosure should not be limited by the particular disclosed embodiments described above, but should be determined only by a fair reading of the claims that follow as well as their full scope of equivalents.

THE FOLLOWING IS CLAIMED:

1. A system for preparing a heated frothed beverage in a container, the system comprising:

a container manipulation assembly comprising:

a support assembly configured to engage a bottom of the container;

and

an elevator connected with the support assembly, the elevator configured to move the support assembly along a generally vertical axis, the elevator further configured to rotate the support assembly about a generally horizontal axis between an upright position and an inverted position;

wherein the support assembly is configured to couple with the container such that the container remains engaged with the support assembly in the inverted position; and

a wand manipulation assembly comprising:

a wand unit comprising a longitudinal channel, an upper end, and a lower end with a tip, the wand unit configured to convey a flow of steam through the longitudinal channel and to discharge the flow of steam from the tip; and

a mechanical linkage connected with the wand unit, the linkage configured to move the wand unit between a first wand position and a second wand position;

wherein the tip of the wand unit is positioned outside of the container when the container is positioned on the support assembly, the support assembly is in the upright position, and the wand unit is in the first wand position; and

wherein the tip of the wand unit is received in the container when the container is positioned on the support assembly, the support assembly is in the upright position, and the wand unit is in the second wand position.

2. The system of Claim 1, further comprising a motor configured to drive the linkage to move the wand unit between the first wand position and the second wand position.

3. The system of Claim 1, wherein the wand manipulation assembly further comprises a collar positioned around the upper end of the wand unit, the collar configured to receive a flow of cleaning fluid and to spray the cleaning fluid onto the upper end of the wand unit.

4. The system of Claim 1, wherein the container manipulation assembly further comprises a nozzle configured to receive a flow of cleaning fluid and to spray the cleaning fluid into the container when the container is in the inverted position.

5. The system of Claim 1, wherein the support assembly is configured to magnetically couple with the container.

6. The system of Claim 1, wherein the system is configured such that, when the tip of the wand unit is received in the container, the elevator moves the support assembly vertically, thereby changing a distance between the tip of the wand unit and the bottom of the container.

7. The system of Claim 1, wherein the linkage comprises a four-bar linkage.

8. A system for preparing a frothed beverage in a container, the system comprising:

a container manipulation assembly for mounting on a countertop, the container manipulation assembly comprising:

a support assembly configured to receive the container; and

an elevator connected with the support assembly, the elevator configured to move the support assembly vertically and to rotate the support assembly; and

a wand manipulation assembly for mounting on the countertop, the wand manipulation assembly comprising:

a wand unit comprising a longitudinal channel, an upper end, and a lower end with a tip, the wand unit configured to convey a flow of frothing fluid through the longitudinal channel and to discharge the frothing fluid from the tip;

a mechanical linkage connected with the wand unit, the linkage configured to move the wand unit horizontally and vertically toward the

support assembly and into a position in which the tip of the wand unit is received in the container on the support assembly; and

a motor configured to move the linkage; and

a controller operably connected with the elevator and the motor and configured to govern operation of the elevator and the motor.

9. The system of Claim 8, wherein the linkage is configured to move the tip of the wand unit along an arched path toward the support assembly.

10. The system of Claim 8, further comprising a container cleaning unit comprising a nozzle configured to spray cleaning fluid into the container.

11. The system of Claim 8, further comprising a wand cleaning unit comprising an annular collar positioned around an upper end of the wand unit, the collar configured to spray cleaning fluid onto an outer surface of the upper end of the wand unit.

12. The system of Claim 8, wherein the frothing fluid comprises steam.

13. A method of automatically preparing a heated frothed beverage with a beverage preparation system, the method comprising:

receiving a container into engagement with a support assembly of the beverage preparation system, the container configured to hold a liquid to be heated and frothed;

automatically inserting, with a mechanical linkage of the beverage preparation system, a wand unit of the beverage preparation system into the container;

automatically raising the support assembly or automatically lowering the wand unit, such that a tip of the wand unit is submerged in the liquid to a heating depth;

discharging steam from the tip of the wand unit at the heating depth, thereby heating the liquid;

automatically lowering the support assembly or automatically raising the wand unit, such that the tip of the wand unit is submerged in the liquid to a frothing depth, the frothing depth being less than the heating depth and being such that the tip of the wand unit is positioned at approximately the surface of the liquid;

discharging steam from the tip of the wand unit at the frothing depth, thereby frothing the liquid; and

automatically removing, with the linkage, the wand unit from the container.

14. The method of Claim 13, further comprising:

securing the container to the support assembly;

rotating the support assembly at least 90° to a rotated position; and

washing the container in the rotated position and with the container secured to the support assembly.

15. The method of Claim 14, wherein securing the container to the support assembly comprises magnetically securing the container to the support assembly.

16. The method of Claim 13, further comprising:

spraying, from a collar of the beverage preparation system, cleaning fluid against an outer surface of the wand unit, the collar positioned at an upper end of the wand unit;

flowing the cleaning fluid down at least a majority of the longitudinal length of the wand unit; and

receiving the cleaning fluid in a drain.

17. The method of Claim 13, wherein automatically inserting the wand unit into the container comprises moving the tip of the wand unit in an arched path from the perspective of a side elevation view of the beverage preparation system.

18. The method of Claim 13, further comprising:

determining, with a controller of the beverage preparation system, a location of the surface of the liquid in the container, wherein the controller comprises a processor and a memory; and

determining the amount of movement needed to move the tip from the first depth to the second depth.

19. The method of Claim 18, wherein determining a location of the surface of the liquid in the container comprises:

receiving an identification input regarding the container; and

accessing a database of the beverage preparation system, the database comprising a cross-reference between the identification input and a corresponding location of the surface of the container.

20. The method of Claim 19, wherein the identification input comprises at least one of: a type of the container, a predetermined fill level of the container, and a predetermined fill volume of the container.

21. An apparatus for cleaning an elongate wand unit, the wand unit configured to be inserted into a liquid to prepare a frothed beverage, the wand unit having an upper end and a lower end, the apparatus comprising:

an annular collar configured to receive a flow of cleaning fluid, the annular collar positioned around an outer surface of the upper end of the wand unit, the annular collar comprising an outer face and an inner face, the inner face comprising one or more channels;

the annular collar configured to dispense, through the one or more channels, the cleaning fluid against the outer surface of the upper end of the wand unit, thereby enabling the dispensed cleaning fluid to flow down the longitudinal length of and clean the elongate wand unit.

22. The apparatus of Claim 21, wherein the one or more channels comprise a plurality of holes.

23. The apparatus of Claim 21, wherein the one or more channels comprises a continuous gap around the circumference of the inner face.

24. The apparatus of Claim 21, wherein the annular collar is positioned at the uppermost end of the wand unit.

25. A combination of the apparatus of Claim 21 and the wand unit.

26. A method of cleaning an elongate wand unit, the wand unit having a longitudinal length and being adapted to be inserted into a liquid to prepare a frothed beverage, the method comprising:

introducing cleaning fluid into an annular collar positioned around an upper end of the wand unit;

dispensing the cleaning fluid through a radially inner face of the collar;

contacting an outer surface of the upper end of the wand unit with the cleaning fluid; and

streaming the cleaning fluid down at least a majority of the longitudinal length of the wand unit; and

rinsing the wand unit with the cleaning fluid.

27. The method of Claim 26, further comprising:
discharging the cleaning fluid from a lower end of the wand unit; and
receiving the cleaning fluid in a drain or catch basin.
28. The method of Claim 26, wherein streaming the cleaning fluid down at least a majority of the longitudinal length of the wand unit comprises passing a continuous stream the cleaning fluid along at least 75% of the longitudinal length of the wand unit;
29. The method of Claim 26, wherein dispensing the cleaning fluid through a radially inner face of the collar comprises dispensing the cleaning fluid through a plurality of holes in the radially inner face of the collar.
30. The method of Claim 26, wherein dispensing the cleaning fluid through a radially inner face of the collar comprises dispensing the cleaning fluid through a continuous gap in the radially inner face of the collar.
31. The method of Claim 26, further comprising instructing, with an electronic controller, a valve to open to allow the cleaning fluid to flow from a cleaning fluid source to the collar.
32. A system for preparing a frothed beverage in a container, the system comprising:
a support assembly configured to engage the container;
a wand unit comprising a longitudinal channel, an upper end, and a lower end with a tip, the wand unit configured to convey a flow of steam through the longitudinal channel and to discharge the flow of steam from the tip; and
a mechanical linkage configured to engage and disengage the container and the wand unit such that:
in a first state, the support assembly and the wand unit are spaced apart from each other such that the tip of the wand unit is positioned outside of the container; and
in a second state, the support assembly and the wand unit are engaged with each other such that the tip of the wand unit is received in the container.
33. The system of Claim 32, wherein the support assembly is configured to mechanically engage the container.

34. The system of Claim 32, wherein the support assembly is configured to engage the bottom of the container.

35. The system of Claim 32, wherein the support assembly is configured to engage a side of the container.

36. The system of Claim 32, wherein the support assembly is configured to engage a top portion of the container.

37. The system of Claim 32, wherein the support assembly comprises a clamp.

38. A method of preparing a heated frothed beverage in a container engaged with a beverage preparation system, the method comprising:

receiving a first input via a user interface of the beverage preparation system, the first input being provided to a controller of the beverage preparation system;

in response to the first input, moving a mechanical linkage of the beverage preparation system to insert a wand unit of the beverage preparation system into the container;

receiving a second input via the user interface, the second input being provided to the controller;

in response to the second input, raising the support assembly or lowering the wand unit, such that a tip of the wand unit is submerged in the liquid to a heating depth;

heating the liquid;

receiving a third input via the user interface, the third input being provided to the controller;

in response to the third input, lowering the support assembly or raising the wand unit, such that the tip of the wand unit is submerged in the liquid to a frothing depth, the frothing depth being less than the heating depth and being such that the tip of the wand unit is positioned at approximately the surface of the liquid;

frothing the liquid;

receiving a fourth input via the user interface, the fourth input being provided to the controller; and

in response to the fourth input, moving the linkage to remove the wand unit from the container.

BEVERAGE PREPARATION SYSTEMS AND METHODS

ABSTRACT OF THE DISCLOSURE

Various beverage preparation systems and methods are disclosed. The beverage preparation system can include a container manipulation assembly having a support assembly and an elevator. The support assembly can be configured to receive a container. The elevator can be connected with the support assembly and can be configured to translate and/or rotate the support assembly. In some embodiments, the beverage preparation system includes a wand manipulation assembly having a wand unit and a mechanical linkage. The linkage can be configured to move the wand unit into and out of engagement with the container on the support assembly. The wand unit can provide a flow of fluid, such as steam, to liquid in the container to heat and/or froth the liquid.

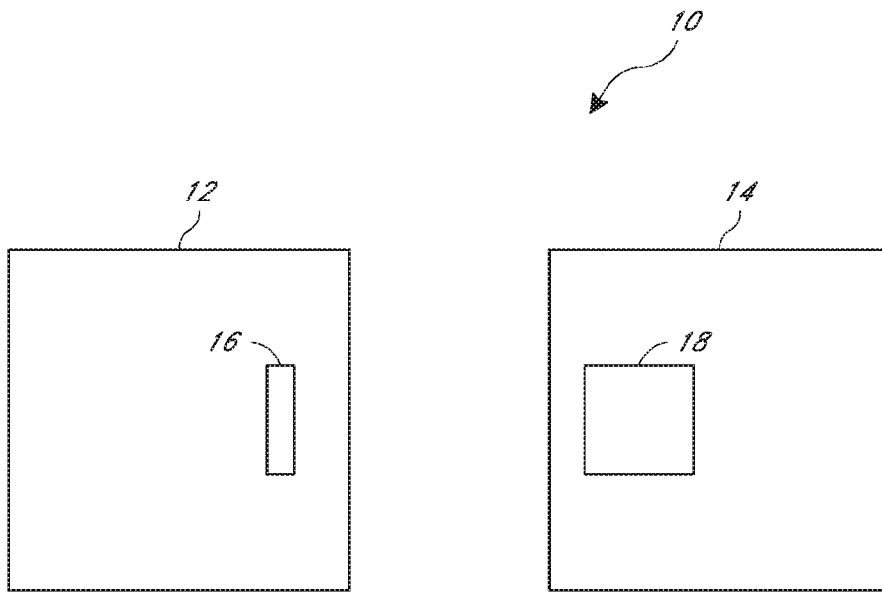


FIG. 1A

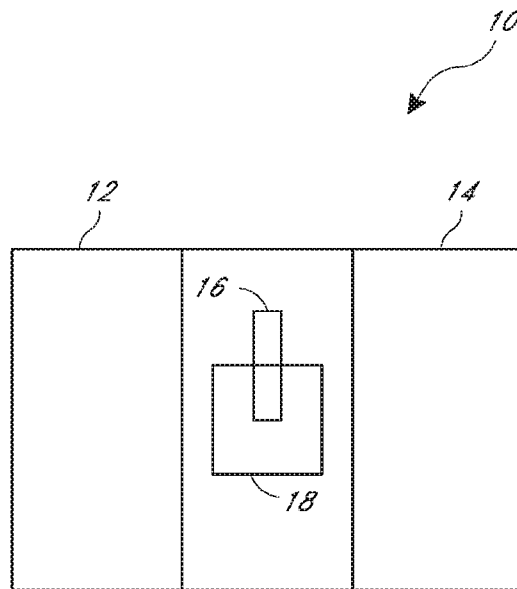


FIG. 1B

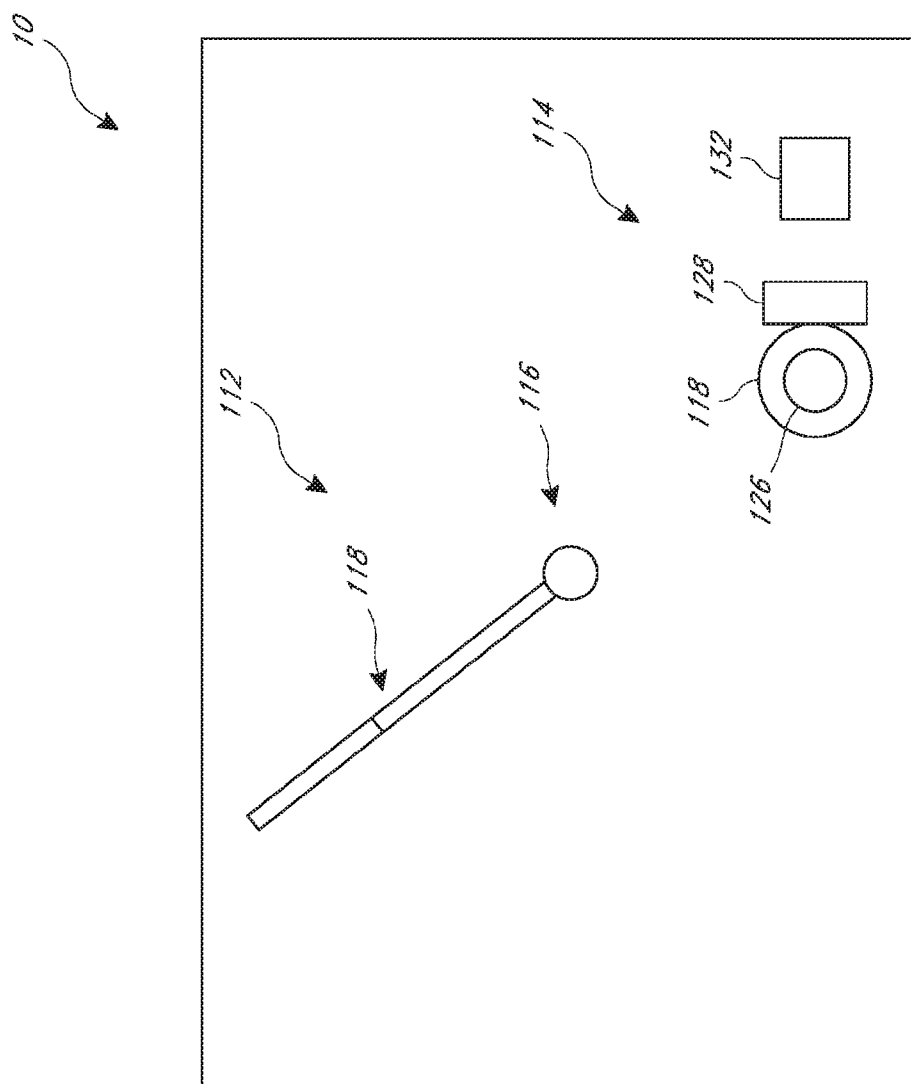


FIG. 2A

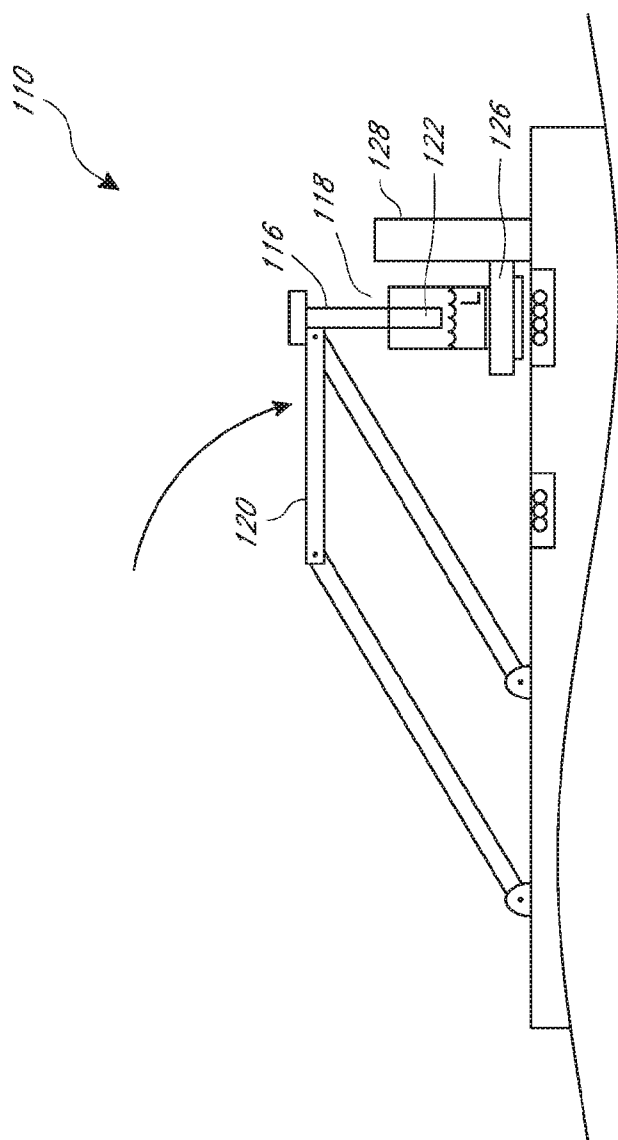


FIG. 3

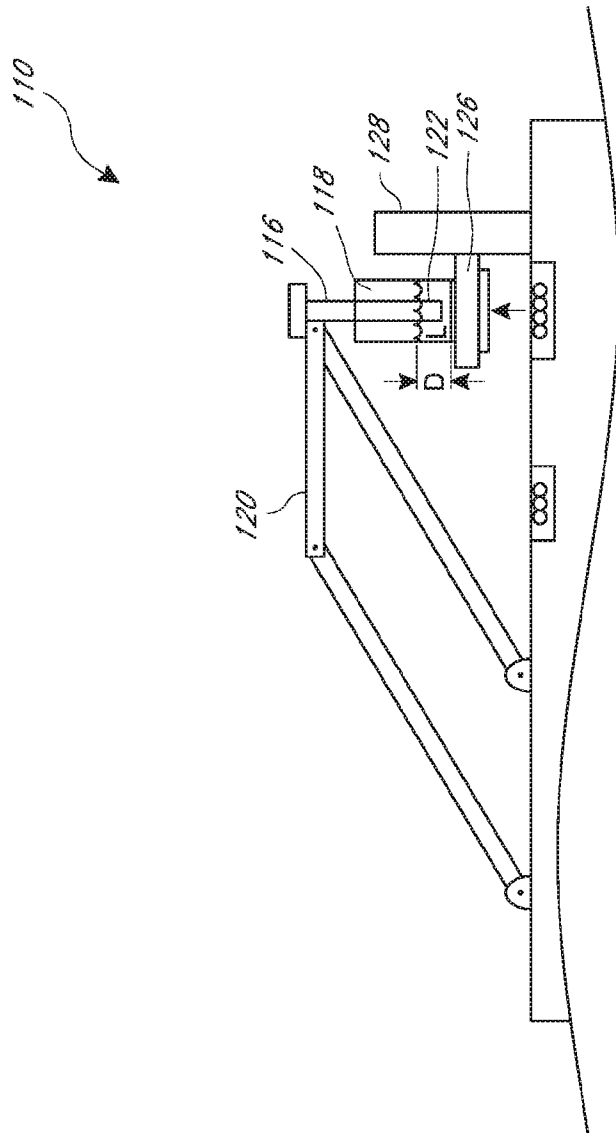


FIG. 4

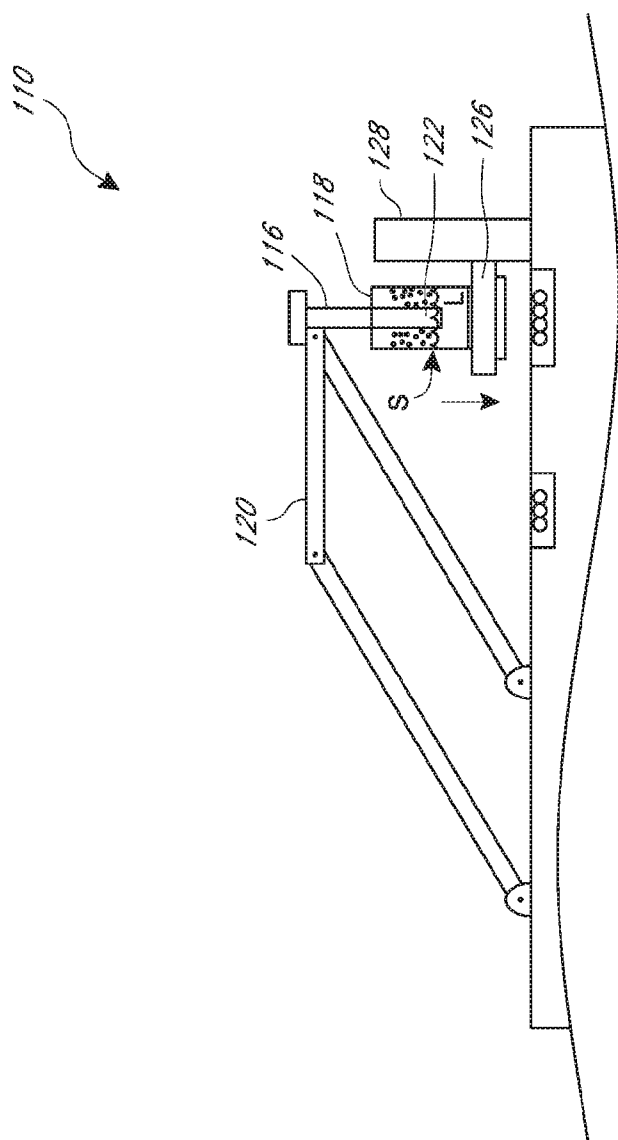


FIG. 5

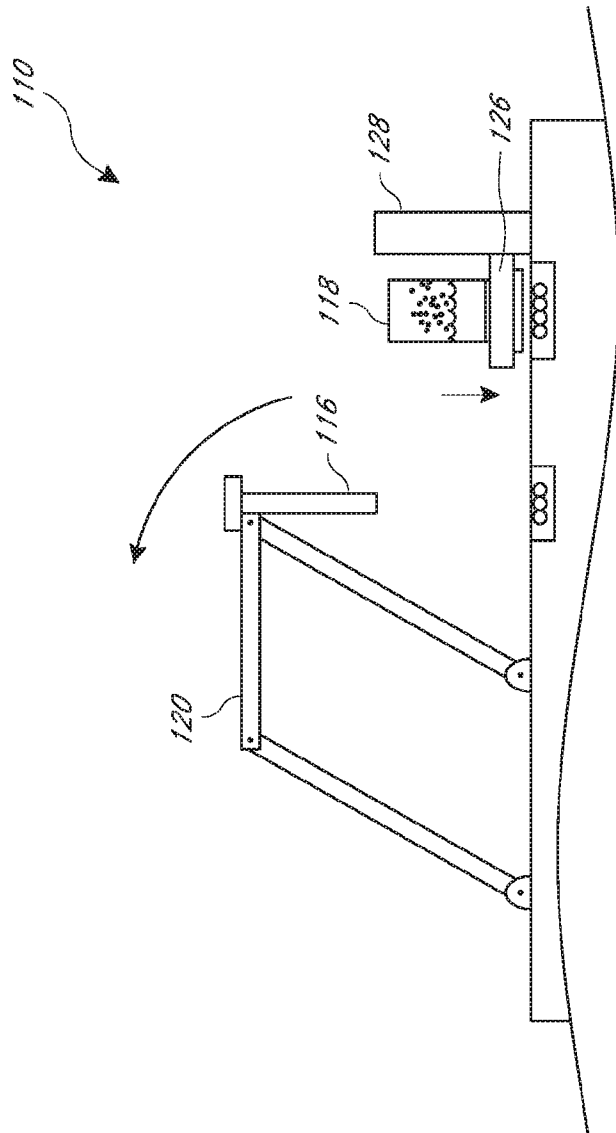


FIG. 6

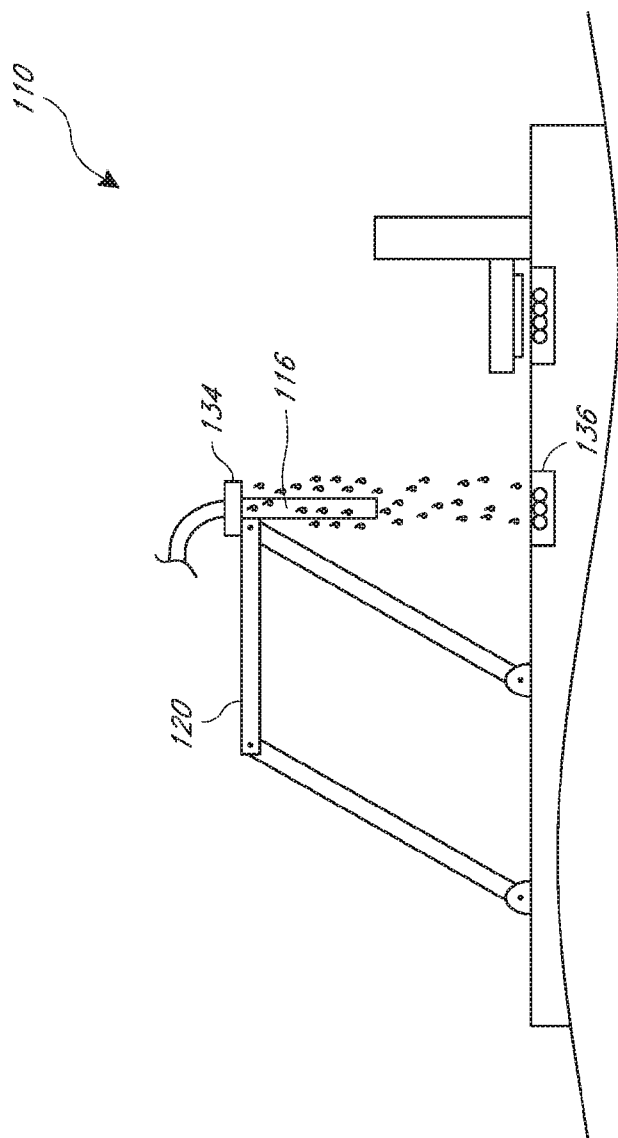


FIG. 7

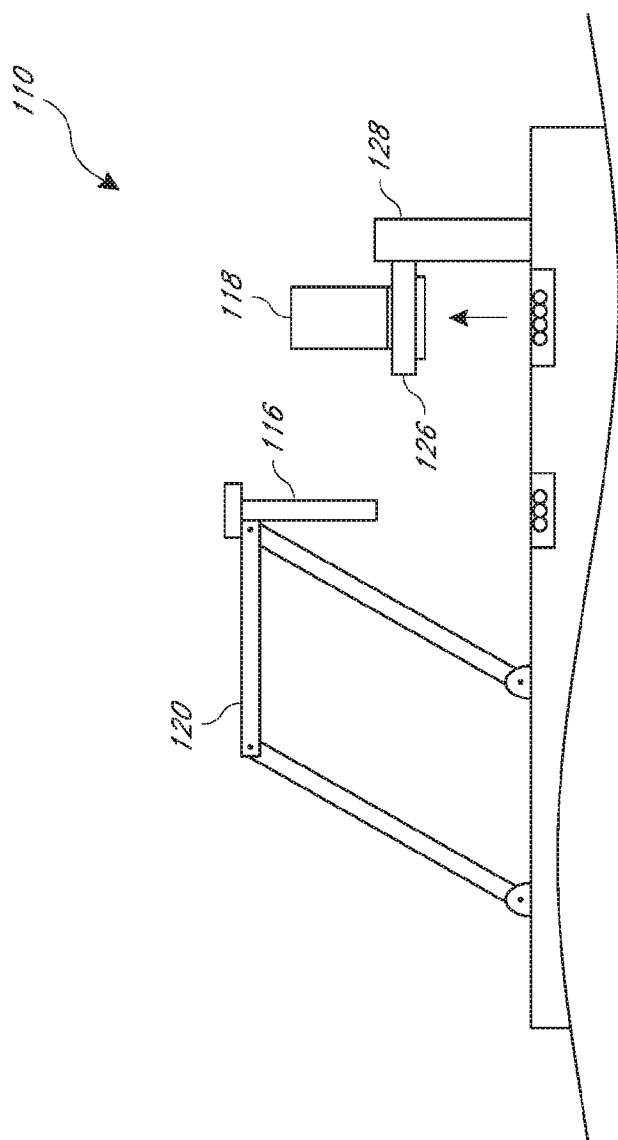


FIG. 8

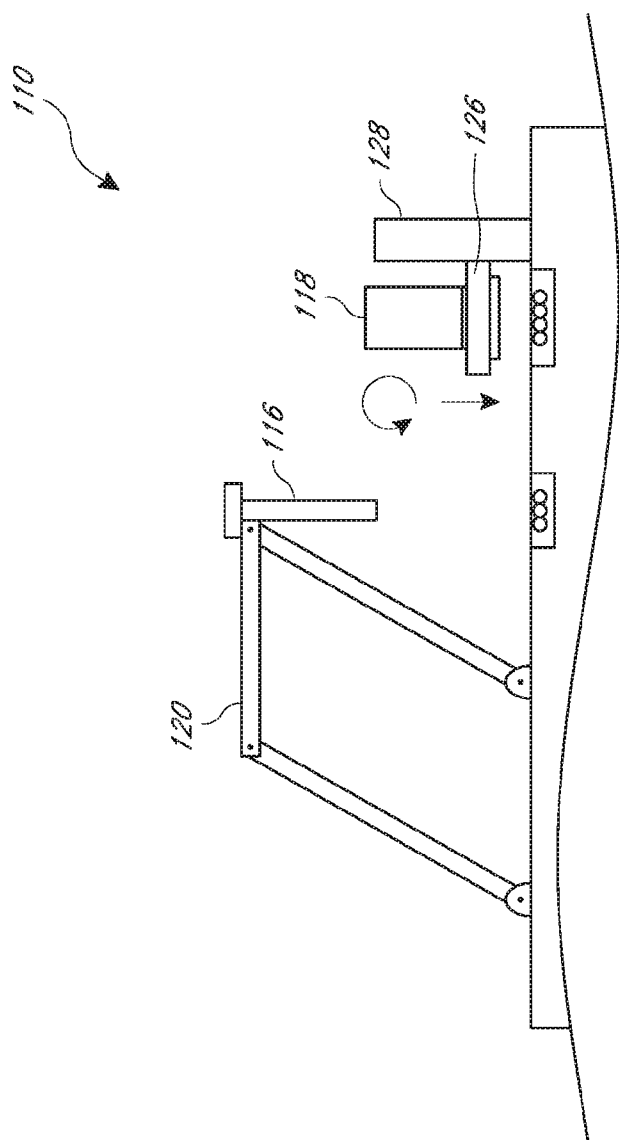


FIG. 10

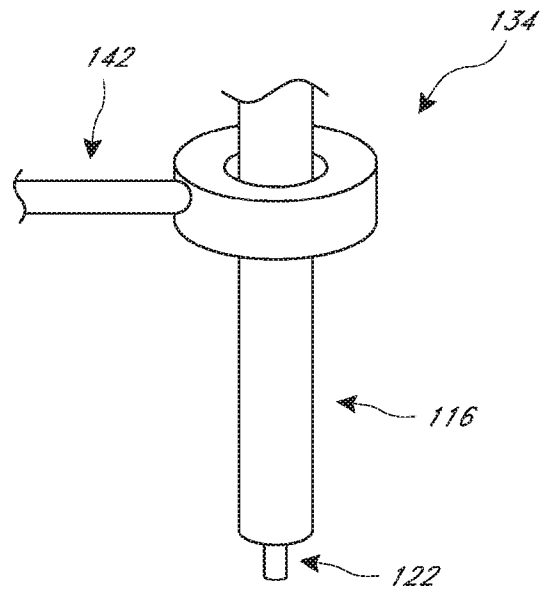


FIG. 11

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FIG. 12B

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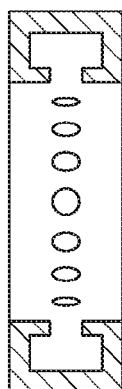


FIG. 12A

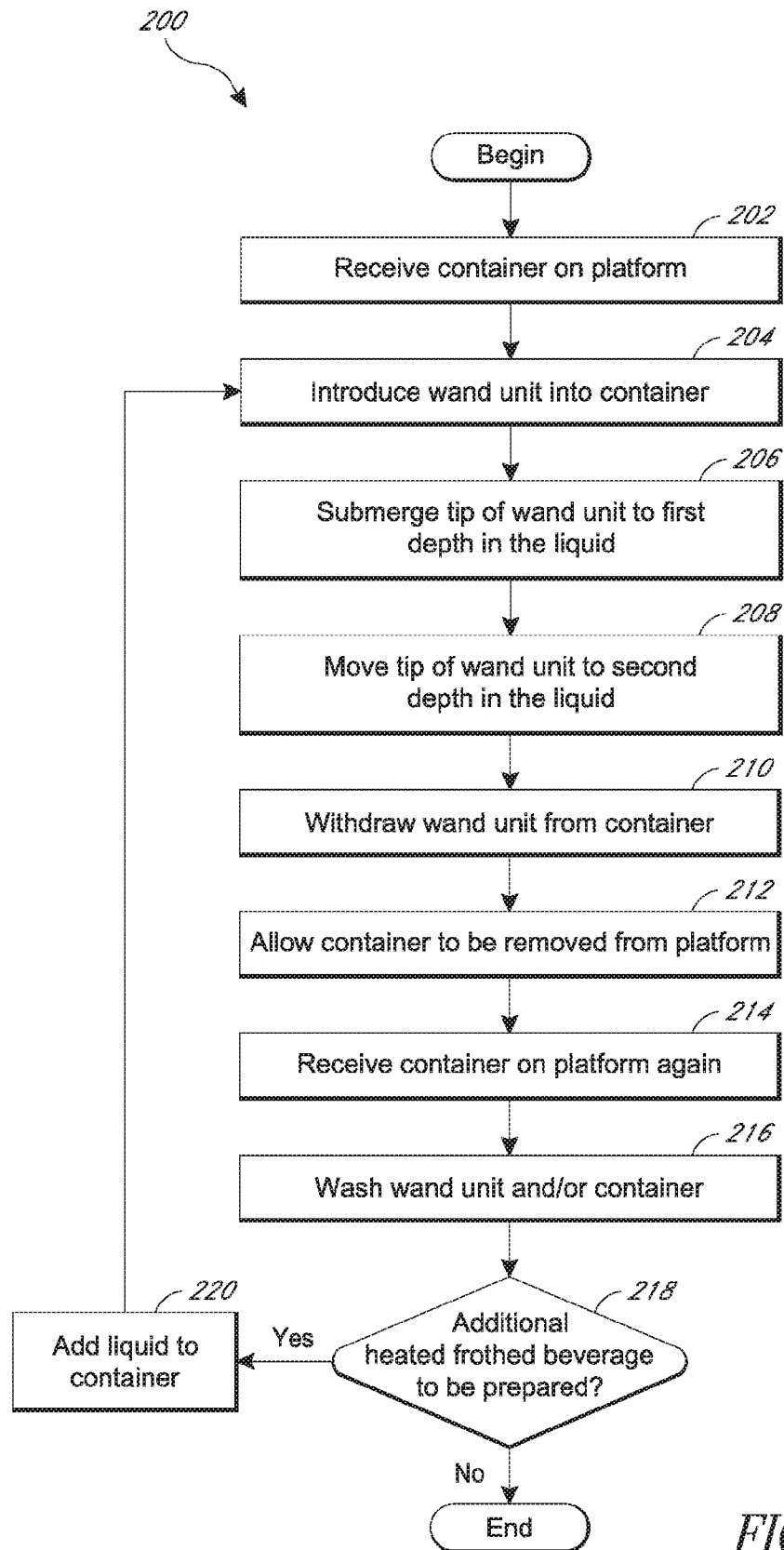
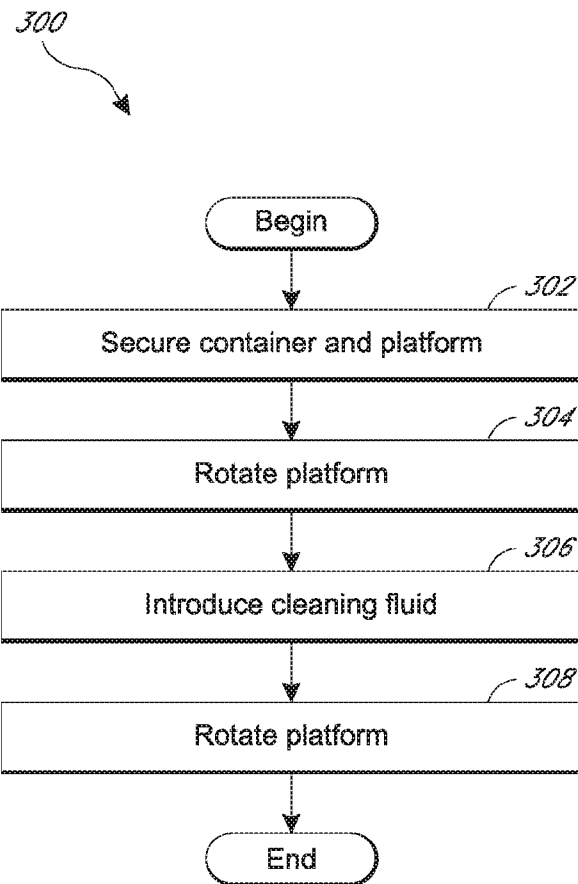
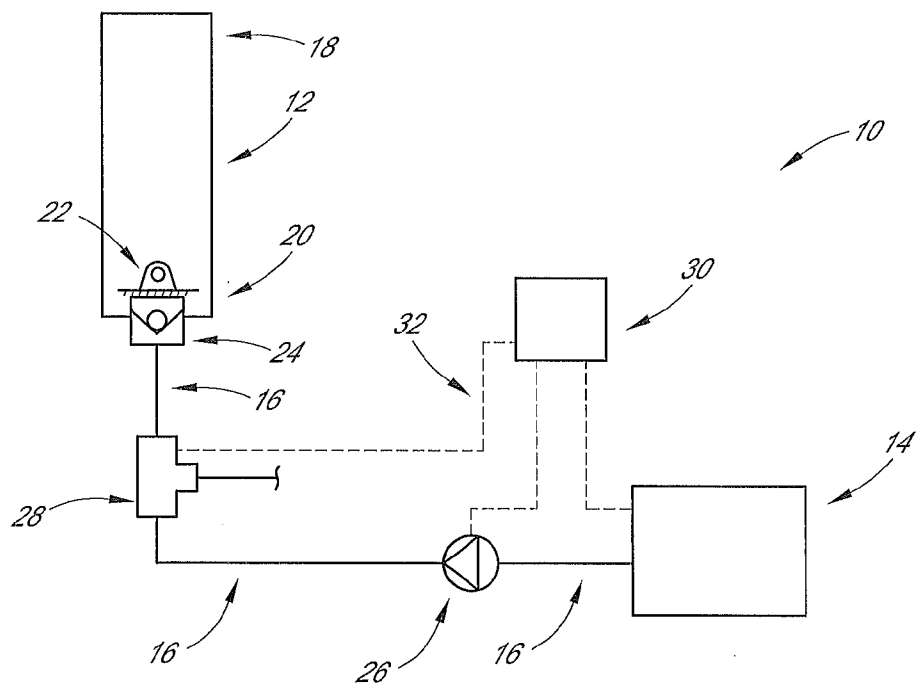


FIG. 13

*FIG. 14*

*FIG. 1*

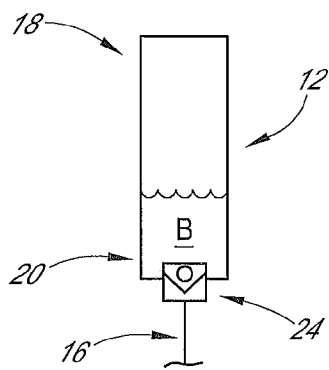


FIG. 2A

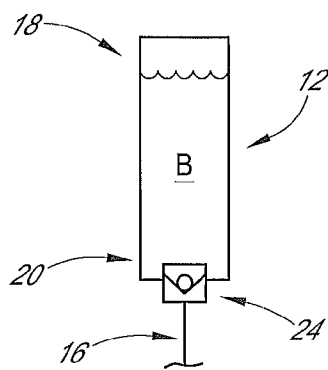


FIG. 2B

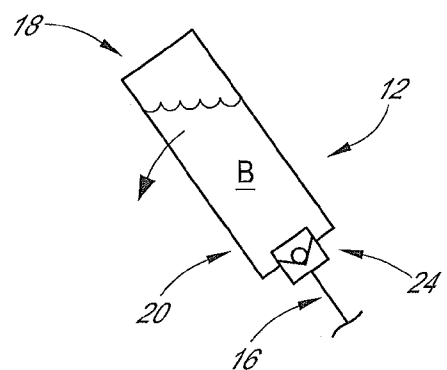


FIG. 2C

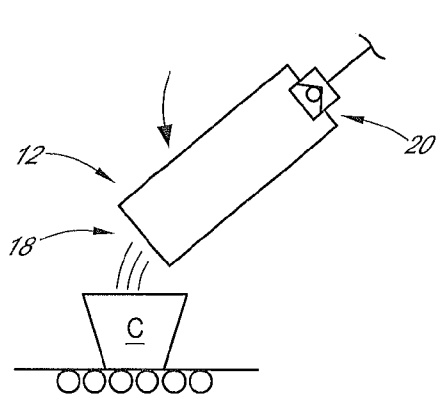


FIG. 2D

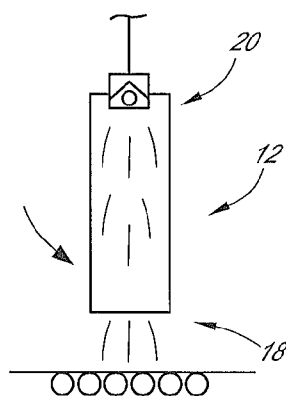


FIG. 2E

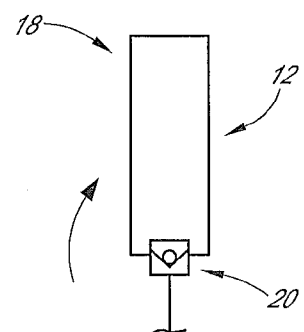
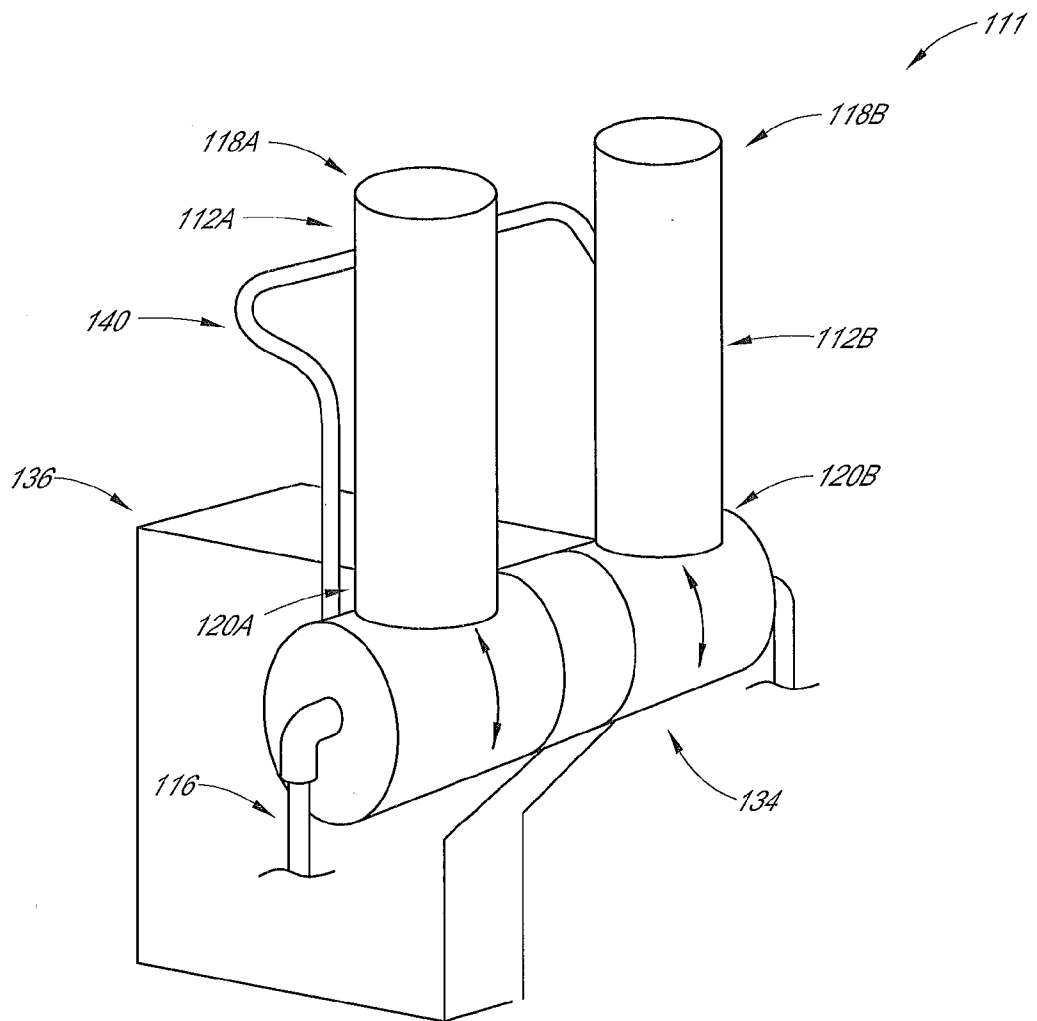


FIG. 2F

*FIG. 3*

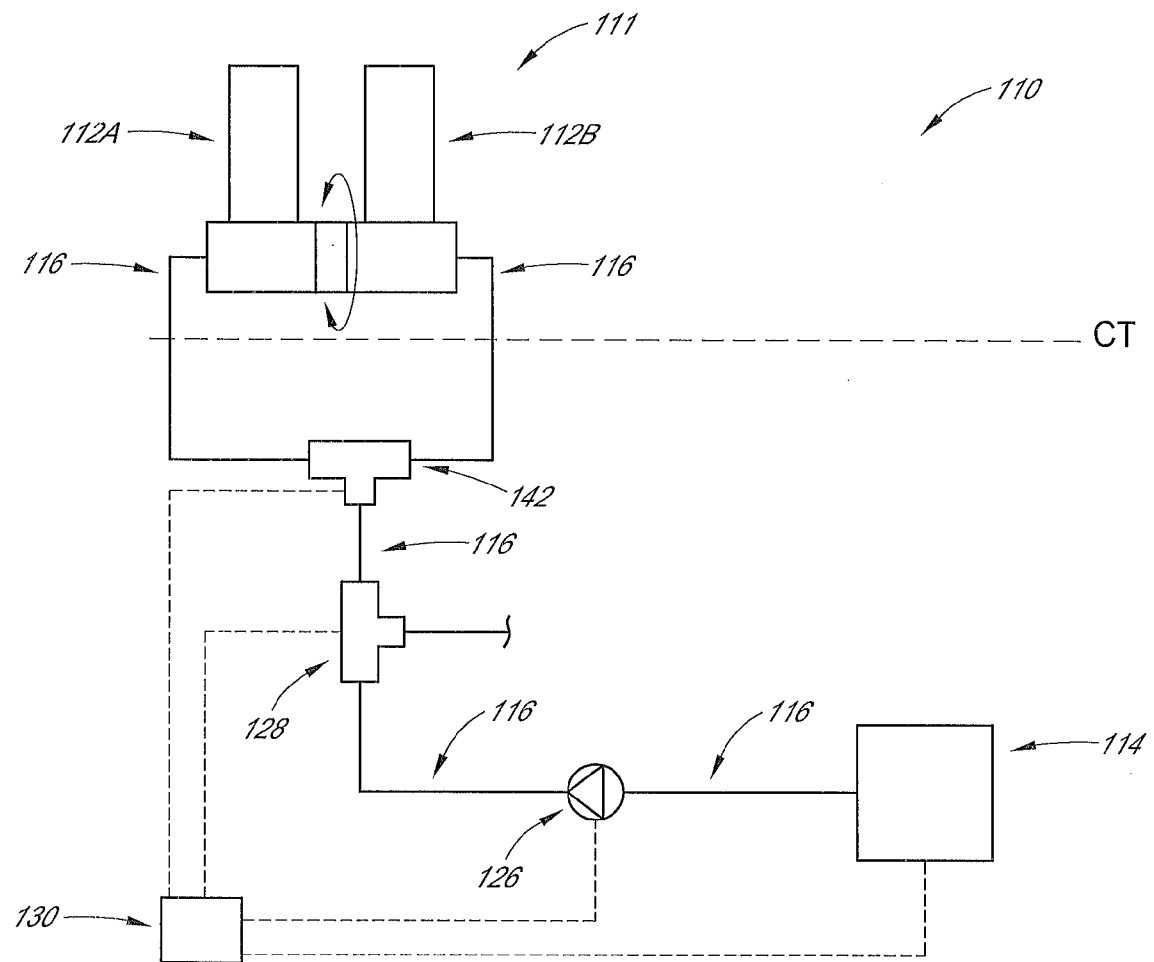
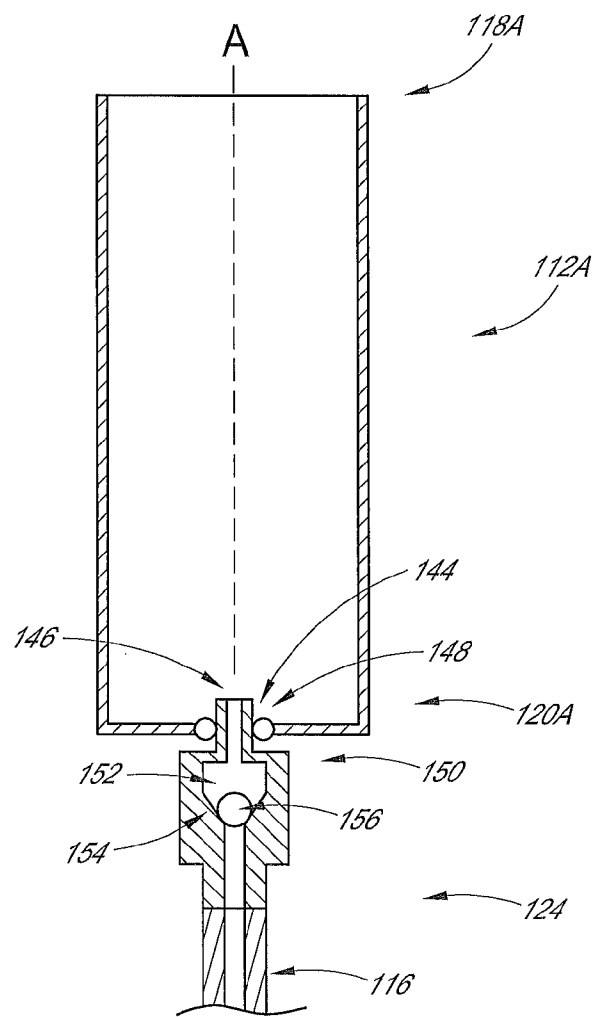
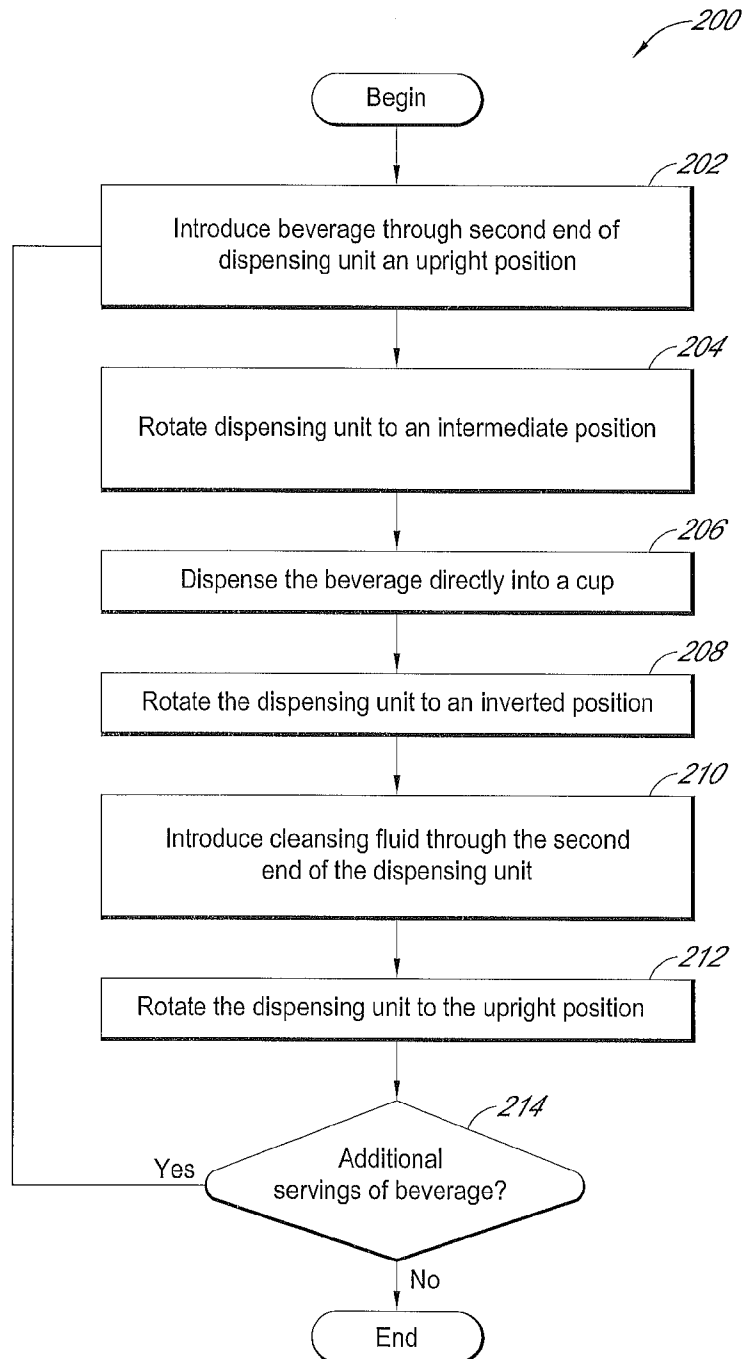
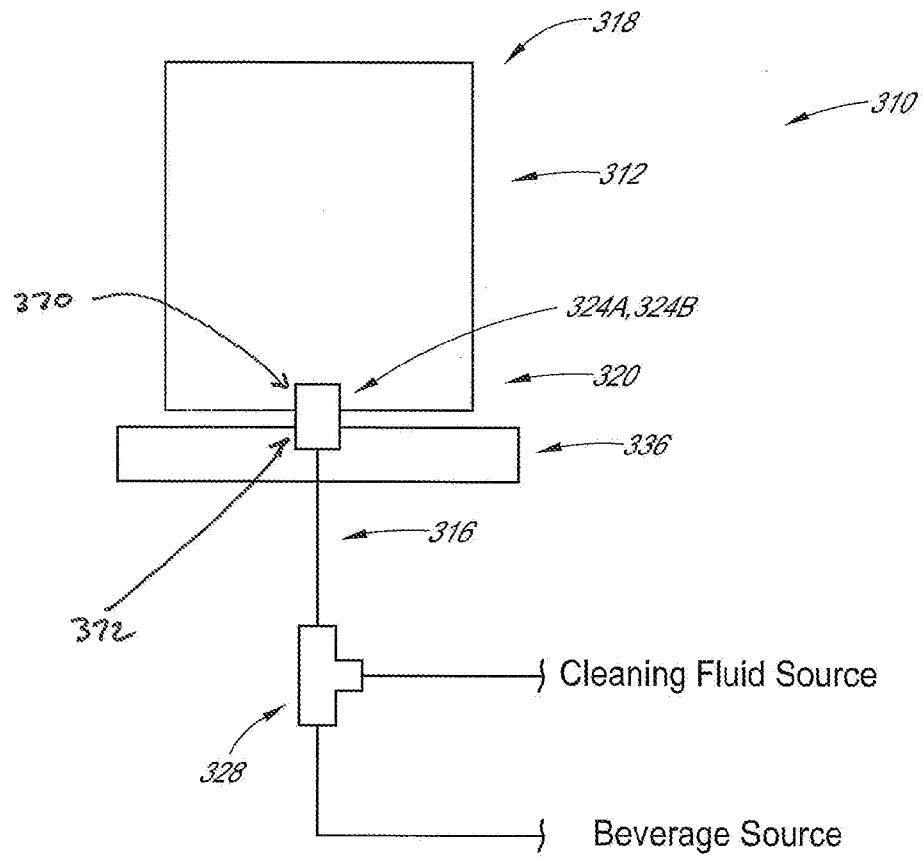
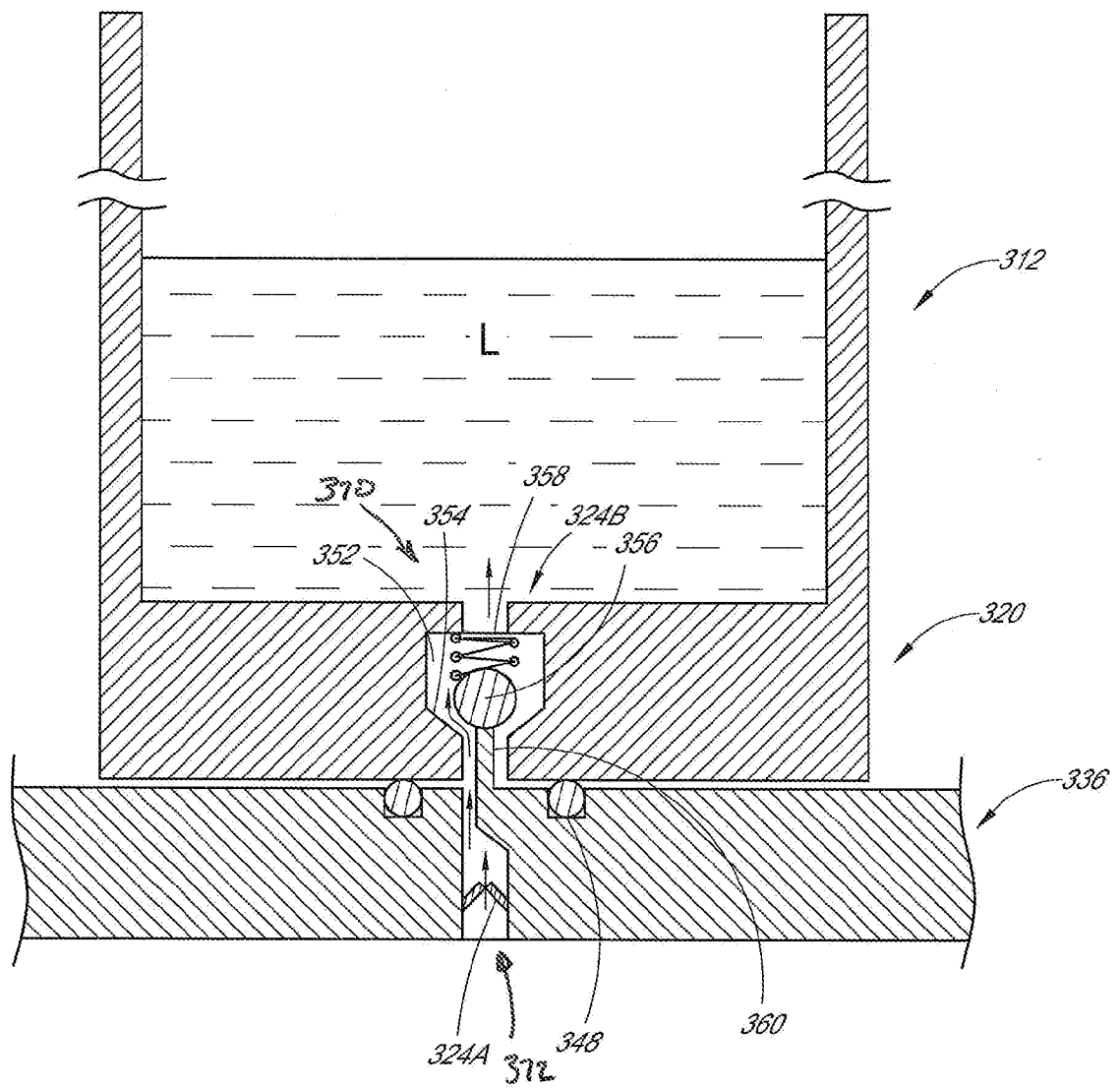


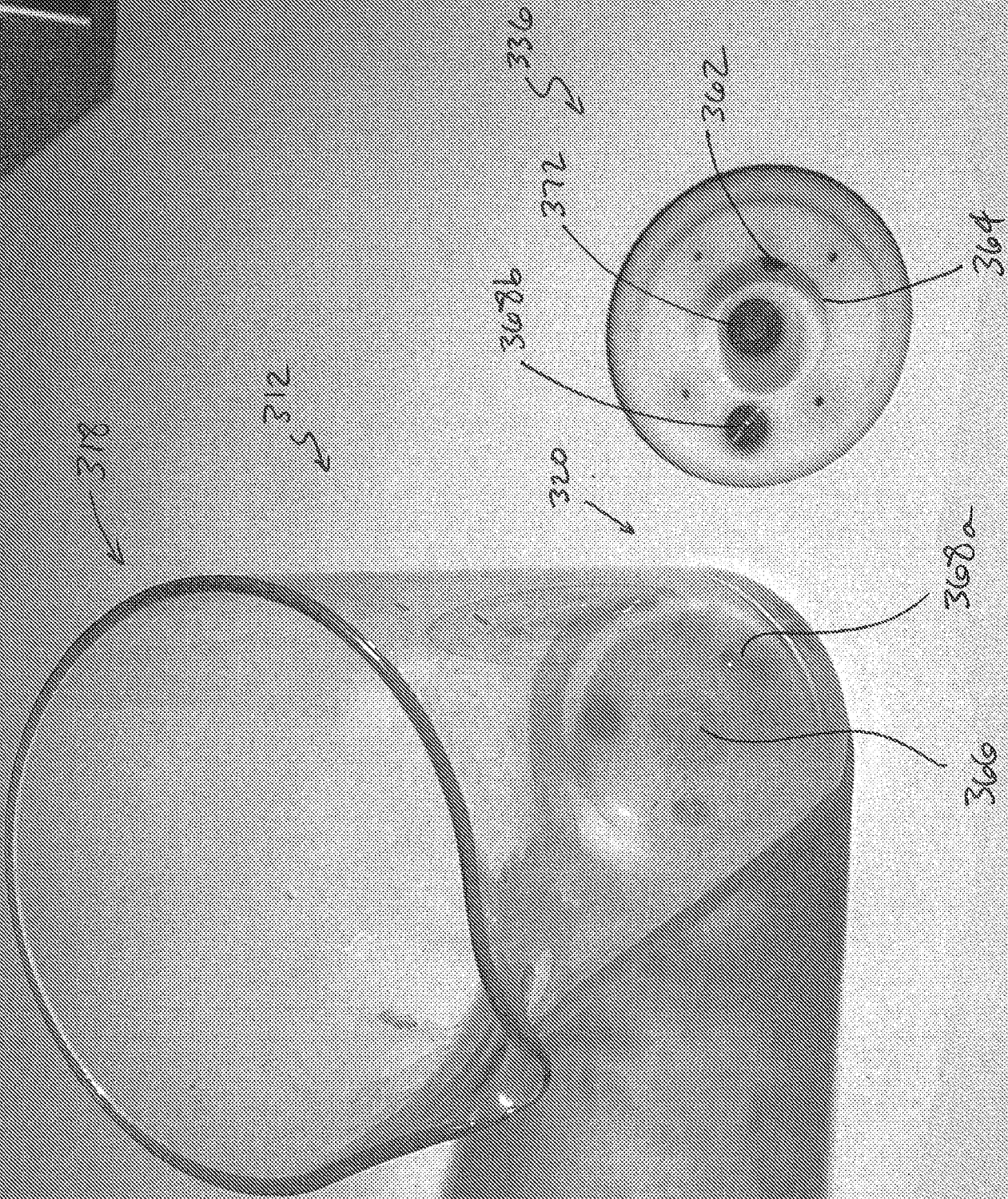
FIG. 4

*FIG. 5*

*FIG. 6*

*FIG. 7*



Fig. 9

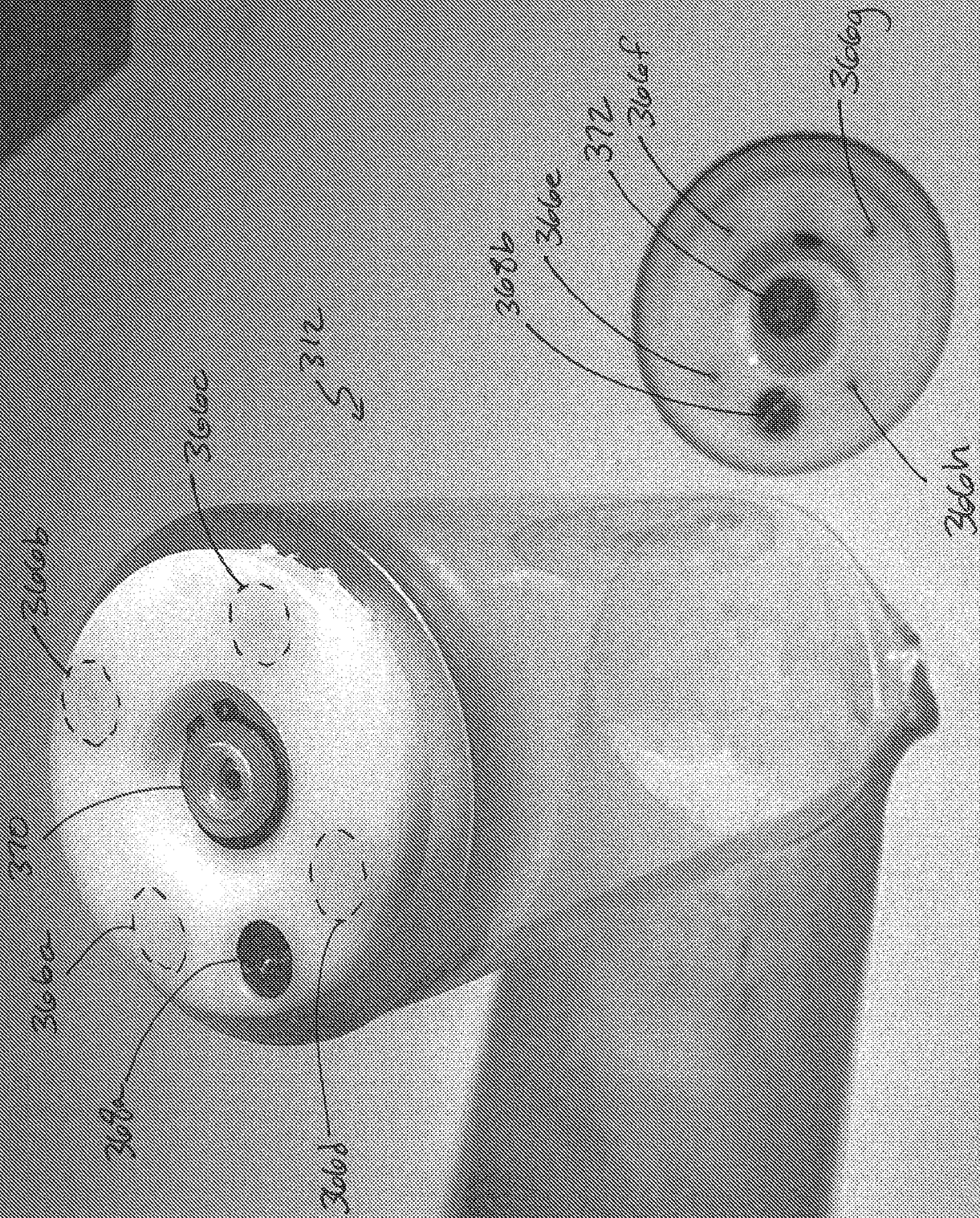


Fig. 10

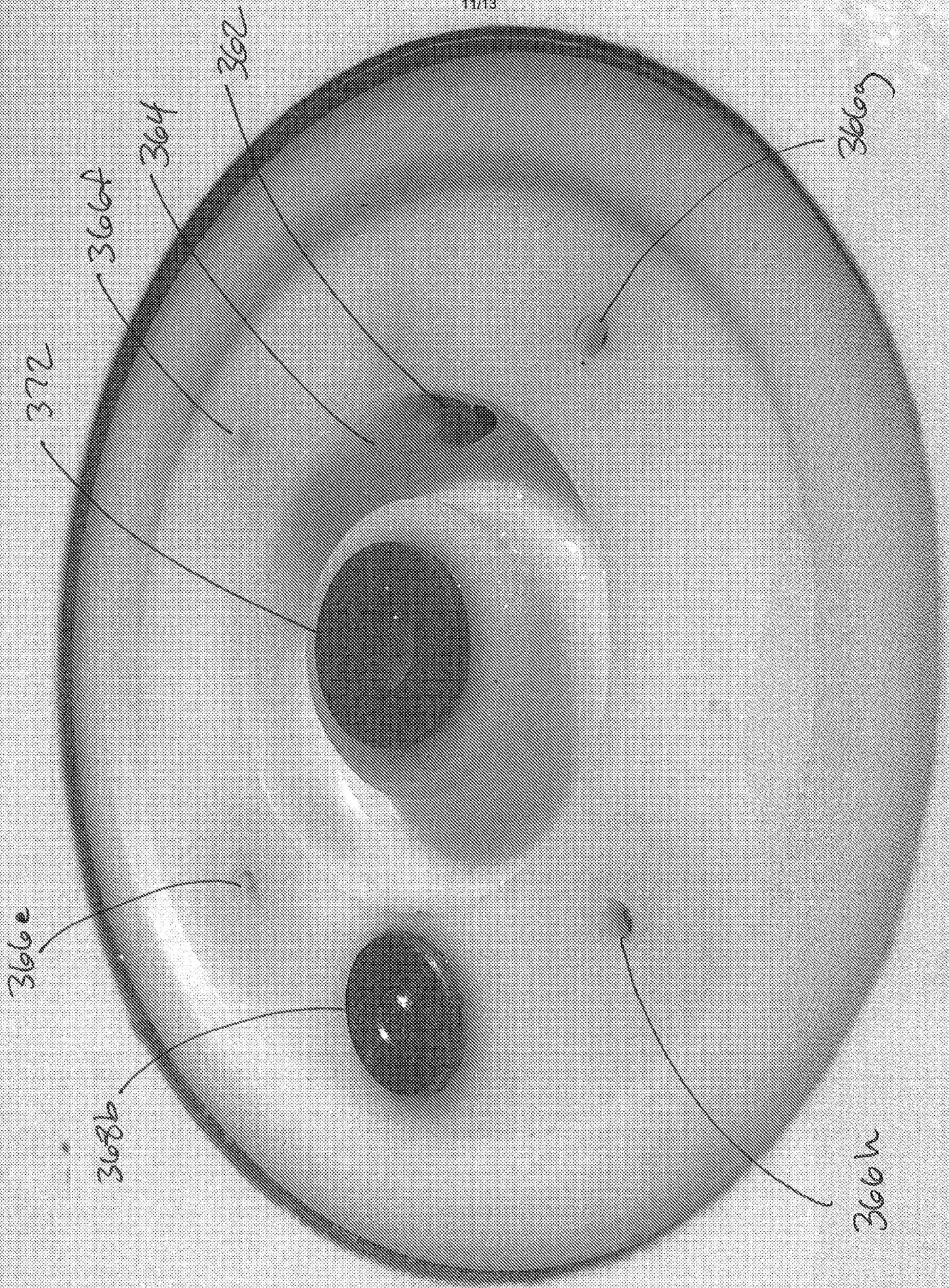
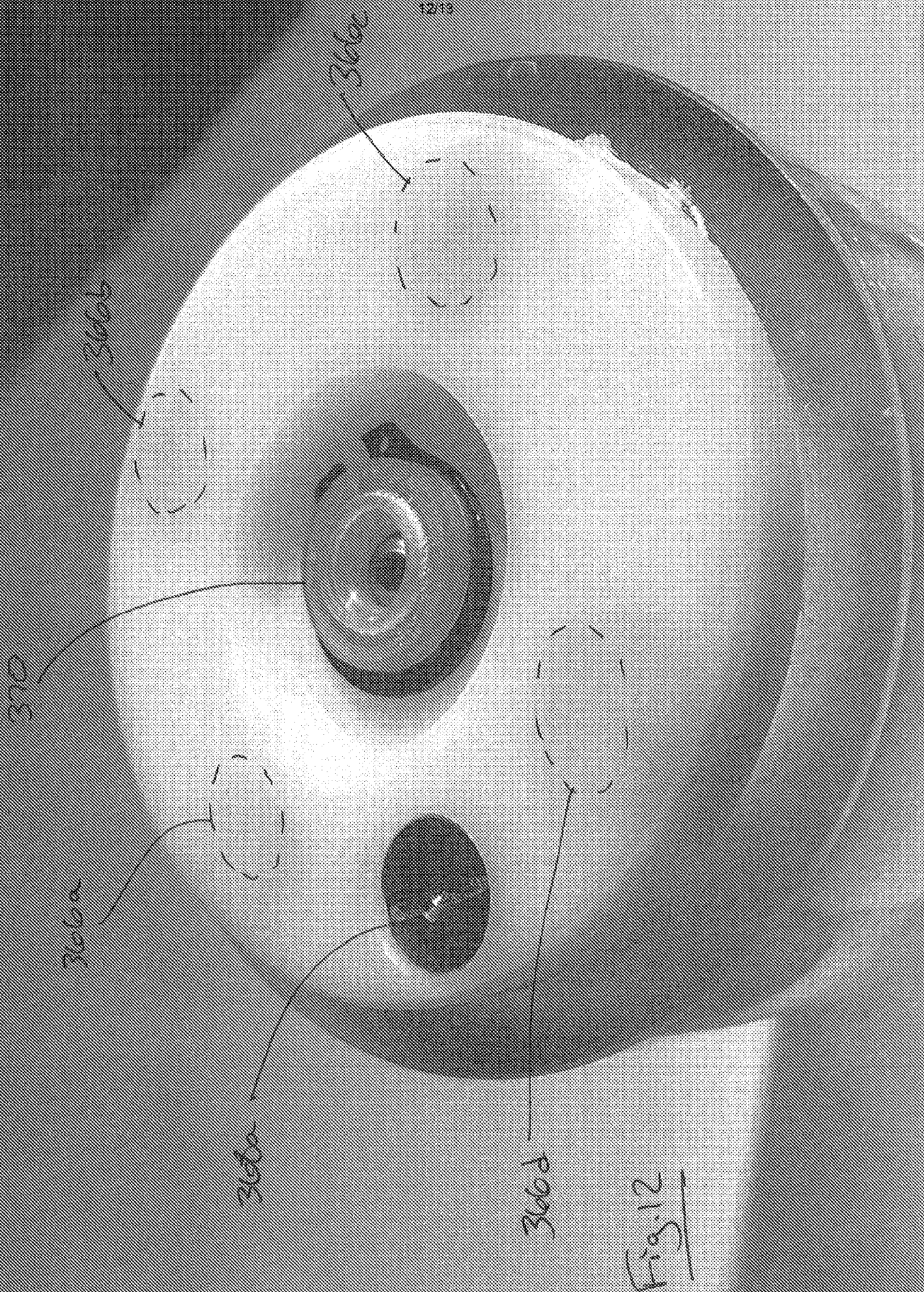


Fig. 11





¹³⁴³
Fig. 13

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368b

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316b

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316c

Electronic Acknowledgement Receipt

EFS ID:	25602429
Application Number:	62327808
International Application Number:	
Confirmation Number:	3629
Title of Invention:	BEVERAGE DISPENSING SYSTEMS AND METHODS
First Named Inventor/Applicant Name:	Dan Apone
Customer Number:	20995
Filer:	Jason R. Swartz/Chelsea Burdeno
Filer Authorized By:	Jason R. Swartz
Attorney Docket Number:	SBUX1.388PR2
Receipt Date:	26-APR-2016
Filing Date:	
Time Stamp:	17:17:59
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 260
RAM confirmation Number	3914
Deposit Account	111410
Authorized User	KNOBBE MARTENS OLSON AND BEAR

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	ADS.pdf	1822992	no	9
			42e64845a951eb0f3a6fe00e2a6ae34c89c3463e		
Warnings:					
Information:					
2	Specification	Application.pdf	681568	no	91
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Warnings:					
Information:					
3	Drawings-only black and white line drawings	Drawings.pdf	10153926	no	13
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