BEVERAGE MACHINE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit under 35 U.S.C. § 119(e) of U.S. provisional application serial number 63/563,503, filed March 11, 2024, the disclosure of which is incorporated by reference in its entirety.

FIELD

[0002] The field of the invention relates to beverage forming systems, such as coffee brewers that use a liquid to form a coffee beverage.

BACKGROUND

[0003] Beverage forming systems that use a liquid, such as water, to form a beverage are well known. For example, U.S. Patent 8,361,527 discloses a beverage forming system that uses a beverage cartridge containing a beverage material to make a beverage by introducing liquid into the cartridge. Liquid provided to the cartridge may be heated in a tank prior to delivery to the cartridge.

SUMMARY

[0004] A beverage machine is provided, the beverage machine comprising a brew chamber arranged to selectively hold a beverage ingredient, the brew chamber comprising a brew chamber inlet to provide liquid for combining with the beverage ingredient to form a beverage and a brew chamber outlet disposed below the brew chamber inlet to allow the beverage to exit the brew chamber, and a dispensing outlet disposed above the brew chamber outlet and fluidly connected to the brew chamber outlet to dispense from the beverage machine. The dispensing outlet is configured to be disposed above the brew chamber outlet during formation and dispensing of the beverage.

[0005] A beverage machine is provided, the beverage machine comprising a brew chamber arranged to selectively hold a beverage ingredient, the brew chamber comprising a brew chamber inlet to provide liquid into the brew chamber, and first and second brew chamber outlets to allow the liquid to exit the brew chamber, a first flow path fluidly

connecting the first brew chamber outlet to a dispensing outlet, and a second flow path connecting the second brew chamber outlet to the dispensing outlet, the second flow path having a larger cross-sectional area than the first flow path. The brew chamber is configured to direct liquid only along the first flow path when the beverage ingredient is in the brew chamber and configured to direct the liquid along at least the second flow path when the beverage ingredient is not in the brew chamber.

[0006] It should be appreciated that the foregoing concepts, and additional concepts discussed below, may be arranged in any suitable combination, as the present disclosure is not limited in this respect. Further, other advantages and novel features of the present disclosure will become apparent from the following detailed description of various non-limiting embodiments when considered in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF DRAWINGS

[0007] The accompanying drawings are not intended to be drawn to scale. In the drawings, each identical or nearly identical component that is illustrated in various figures may be represented by a like numeral. For purposes of clarity, not every component may be labeled in every drawing. In the drawings:

[0008] Fig. 1A is a perspective view of a beverage machine in an illustrative embodiment;

[0009] Fig. 1B is a top view of the beverage machine of Fig. 1A;

[0010] Fig. 1C is side view of the beverage machine of Fig 1A;

[0011] Fig. 2 is a schematic diagram of a brew assembly of the beverage machine of Fig. 1A;

[0012] Fig. 3A is a cross sectional side view of the beverage machine of Fig. 1A;

[0013] Fig. 3B is a cross sectional side view of a brew assembly of the beverage machine of Fig. 1A;

[0014] Fig. 4A is a cross sectional side perspective view of a portion of the brew assembly of Fig. 3B;

[0015] Fig. 4B is a cross sectional top perspective view of a portion of the brew assembly of Fig. 3B; and

[0016] Fig. 5 is a schematic diagram of components of a beverage machine in an illustrative embodiment.

DETAILED DESCRIPTION

[0017] A beverage machine may generally be used to form any suitable beverage, such as tea, coffee, other infusion-type beverages, beverages formed from a liquid or powdered concentrate, soups, juices, sodas, or other beverages made from dried materials. Such beverages may be made by mixing a beverage ingredient, such as ground coffee, powdered drink mix, etc. with water in a brew chamber of the beverage machine.

[0018] In some embodiments, it may be desirable to have a beverage machine with a compact housing, as such a beverage machine may be more easily fit into small spaces. Also, beverage machines are commonly positioned on support surfaces with limited vertical clearance, such as on countertops underneath cabinets. It may therefore be desirable to reduce an overall height of the beverage machine, e.g., to provide increased clearance for easier refilling of the beverage machine.

[0019] In some cases, it may be desirable to maximize a clearance between a dispensing outlet of the beverage machine (e.g., where beverage exits the machine) and a support surface for a beverage container, such as a countertop on which the machine is placed or a drip tray of the machine. This increased clearance may allow larger beverage containers such as travel mugs to be placed underneath the dispensing outlet.

[0020] The inventors have therefore recognized an advantage to positioning the dispensing outlet of a beverage machine to dispense beverage at a vertical height above a brew chamber outlet, e.g., beverage may be dispensed from a location vertically above a position where beverage exits a space where a pod holding beverage ingredients is held. Such a configuration may allow for the increased clearance below the dispensing outlet suitable for use with taller beverage containers and/or minimize the overall height of the machine housing. In some cases, such a configuration may increase a backpressure on beverage exiting the brew chamber, which may be useful, e.g., for producing crema or foam in a beverage, improve extraction of materials from beverage ingredients, etc.

[0021] In some cases, beverage may be moved from the brew chamber outlet to the dispensing outlet without the use of any pumps or other fluid moving devices disposed

downstream of the brew chamber, e.g., to avoid additional complexity and costs. Suitable pressure or other force may be provided to move the beverage from the brew chamber outlet to the dispensing outlet, e.g., if the upper level of beverage in the brew chamber is below the dispensing outlet. Such pressure or force may be provided at the brew chamber outlet in any suitable way such as by heating ambient air in the brew chamber, or by pumping air or steam into the brew chamber to move the beverage from the brew chamber outlet to the higher dispensing outlet.

[0022] In some embodiments, a brew chamber may include two brew chamber outlets, e.g., first and second brew chamber outlets. A first brew chamber outlet may be useable with a pod or other container holding beverage ingredient, and a second brew chamber outlet may be employed with no beverage ingredient in the brew chamber and/or where beverage ingredient is provided in the brew chamber without a pod. Thus, the second brew chamber outlet may permit dispensing water from the dispensing outlet without combining the water with a beverage ingredient prior to dispensing and/or may permit loose beverage ingredient to be provided in the brew chamber for forming a beverage. It may be desirable to allow use of the first or second brew chamber outlets without requiring selection of such an option on a user interface in order to avoid additional complexity and user error. For example, the first brew chamber outlet may be automatically employed when a pod is placed in the brew chamber, and the second brew chamber outlet may be automatically employed when no pod is placed in the brew chamber.

[0023] The inventors have recognized various potential advantages to providing two outlets for the brew chamber. For example, the first and second brew chamber outlets may provide different backpressures for dispensing, may help reduce cross contamination of different beverages (e.g., coffee beverages may be dispensed via a first brew chamber outlet and water or other beverages may be dispensed via the second brew chamber outlet), and/or provide other features. In some cases, both brew chamber outlets may be fluidly connected to the dispensing outlet, e.g., so beverage is dispensed via a common dispensing outlet opening. In some cases, the first and second brew chamber outlets may be fluidly coupled to the dispensing outlet via separate flow paths, e.g., a first flow path may couple the first brew chamber outlet to the dispensing outlet and a second flow path may couple the second brew chamber outlet to the dispensing outlet. In some cases, the dispensing outlet may include two

separate openings for individual dispensing of beverage from the first and second flow paths, respectively. In some cases, the second flow path may have a larger (or otherwise different) cross-sectional area than the first flow path, e.g., to reduce an amount of pressure or other force required to move the beverage from the second brew chamber outlet to the dispensing outlet as compared to the first brew chamber outlet. This may permit beverage in the brew chamber to exit the second brew chamber outlet as opposed to the first brew chamber outlet, e.g., when no pod holding beverage ingredient is in the brew chamber. In some cases, the second brew chamber outlet and the second flow path may only be fluidly coupled to the brew chamber inlet when no beverage ingredient, e.g., a pod, is in the brew chamber. For example, if no pod is provided in the brew chamber and water is delivered into the brew chamber, the water will tend to exit the brew chamber via the second brew chamber outlet rather than the first brew chamber outlet, which is employed when a pod is in the brew chamber. In general, the cross-sectional areas, path length or other aspects of the first and second flow paths may be sized or otherwise configured so that beverage is dispensed from the dispensing outlet with desired flow parameters, regardless of whether or not a beverage ingredient is placed into the brew chamber.

[0024] In some embodiments, the second brew chamber outlet may be disposed below the first brew chamber outlet in the brew chamber. This may help evacuate liquid from the brew chamber when no beverage pod is used, and may allow the second brew chamber outlet to act as a drain to lower the likelihood of beverage remaining the brew chamber after a beverage forming cycle. In some embodiments, directing water to flow along the second flow path limits contact of the water with any residual beverage ingredient left in the first flow path, limiting an amount of cross-contamination.

[0025] Specific non-limiting embodiments are described in further detail below with reference to the figures. It should be understood that the various systems, components, features, and methods described relative to these embodiments may be used either individually and/or in any desired combination as the disclosure is not limited to only the specific embodiments described herein.

[0026] FIGS. 1A–1C show various views of a beverage machine 100 in an illustrative embodiment that incorporates one or more inventive aspects. As noted above, the beverage machine 100 may be used to form any suitable beverage, such as tea, coffee, other infusion-

type beverages, beverages formed from a liquid or powdered concentrate, soups, juices, sodas, or other beverages made from dried materials. The beverage machine 100 may include a drip tray 126, e.g., on which a user's cup or other container may be placed to receive beverage that is dispensed from a dispensing outlet 108. To form a beverage, a pod or other container holding beverage ingredient may be provided in a brew chamber by opening the brew chamber, e.g., by lifting a lid 122 by way of a handle 123, placing a pod in the brew chamber and closing the lid 122. A user interface 124 may receive input, e.g., by a user pressing one or more buttons or other input devices, and cause a dispense operation to be performed. For example, water in a liquid supply 202 may be pumped or otherwise delivered to the brew chamber to mix with beverage ingredient to form a beverage with is dispensed at the dispensing outlet 108.

[0027] The beverage machine 100 may have a total height H_T and a dispensing outlet clearance height H_C, which represents the height between a support for a user's cup or other container and the dispensing outlet 108. In some embodiments, the drip tray 126 is removable to allow a user's cup or other container to be placed on a countertop or other support surface for the beverage machine 100, and thus may provide for an increased dispensing outlet clearance height $H_{C\text{-}MAX}$. However, use of a drip tray or providing for removability of a drip tray 126 is not required.

[0028] In some embodiments, a dispensing outlet clearance height H_C may be maximized by providing the beverage machine with a brew chamber that has a brew chamber outlet located below the dispensing outlet 108. Such an arrangement may also help keep the total height H_T of the machine 100 relatively low. FIG 2 shows a schematic representation of brew assembly 101 that may be employed in the beverage machine 100, and FIGs. 3A and 3B shows cross sectional views of an illustrative brew assembly 101 in the beverage machine of FIGs. 1A-1C. The brew assembly 101 may include a brew chamber 102 configured to receive a beverage ingredient for mixing with liquid from the liquid supply 202 and form a beverage. The brew chamber 102 may be configured to hold a beverage ingredient, e.g., held by a pod 105. During a beverage forming cycle, a fluid system 200 may condition (e.g., heat, cool, etc.) and deliver water or other liquid to a brew chamber inlet 104 which may be disposed at an upper portion of the brew chamber 102. In some cases, the brew chamber inlet 104 may be positioned on the lid 122 of the machine 100 which may be opened to open the brew chamber

102 (e.g., to receive a pod or other beverage ingredient into a lower portion of the brew chamber 102) and closed to close the brew chamber 102. The water may mix with the beverage ingredient to form a beverage, which may flow from a lower portion of brew chamber 102 to the dispensing outlet 108. The beverage may exit the brew chamber 102 via a brew chamber outlet 106, 107 and corresponding channel 110, 111 to the dispensing outlet 108. In some cases, the brew chamber 102 may include only one brew chamber outlet, e.g., outlet 106 or 107, or may include two brew chamber outlets, e.g., outlets 106 and 107. Beverage exiting via a first brew chamber outlet 106 may flow through a connecting channel 110 to the dispensing outlet 108. The flow path of beverage from the first brew chamber outlet 106, through the first connecting channel 110, and out of the dispensing outlet 108 may define a first flow path. Beverage exiting via a second brew chamber outlet 107 may flow through a connecting channel 111 to the dispensing outlet 108, which may define a second flow path.

[0029] Brew chamber 102 may be configured to hold a beverage ingredient in any suitable form. For example, the beverage ingredient may be contained in a pod 105, and the brew chamber inlet 104 and first brew chamber outlet 106 may include piercing elements 120 configured to pierce and/or form a seal with the pod 105 to allow the water from the liquid supply 202 to mix with the beverage ingredient contained in the pod 105 and allow beverage to exit the pod 105. Alternately, the beverage ingredient need not be contained in a pod, but rather may be provided to the brew chamber in a loose or uncontained form. In such embodiments, the brew chamber may include a disposable or reusable filter to hold the beverage ingredient so that the water from the liquid supply can be introduced to the brew chamber via the brew chamber inlet and combined with the beverage ingredient to form a beverage that flows through the filter to the first brew chamber outlet 106 or the second brew chamber outlet 107. In some embodiments, loose beverage ingredient may be provided in the brew chamber with no filter or other holder of any kind, e.g., where the beverage ingredient includes a soluble material.

[0030] As discussed above, it may be desirable to maximize a vertical clearance H_C between the dispensing outlet 108 and a user's cup support (such as a drip tray 126) while minimizing a total height H_T of the beverage machine 100. Such a configuration may allow

for a user to dispense the beverage into a larger beverage container while minimizing the total height H_T, which may allow for more convenient refilling of liquid supply 202.

[0031] In some cases, the dispensing outlet 108 may be disposed a vertical distance D_V above a brew chamber outlet, such as the first brew chamber outlet 106 and/or the second brew chamber outlet 107. Typically, a dispensing outlet of a beverage machine is positioned below an outlet of a brew chamber, and thus may be located vertically below the brew chamber. However, in cases where the dispensing outlet is located above an outlet of the brew chamber, the dispensing outlet 108 must be laterally displaced relative to the brew chamber 102. For example, in some cases the dispensing outlet 108 may be positioned in front of the brew chamber 102 such that the dispensing outlet 108 is disposed between the brew chamber 102 and the front surface 128 of the machine 100 (See FIG. 3A). While the dispensing outlet 108 may be disposed in front of the brew chamber 102 in some embodiments, the dispensing outlet may be disposed in any suitable location relative to the brew chamber 102. For instance, dispensing outlet 108 may be positioned behind, or to one side of the brew chamber 102. In this configuration, a top surface of a user's beverage container may still fit underneath the dispensing outlet 108 even if the top surface of the container extends a vertical distance above the brew chamber outlet 106, 107. Dispensing outlet 108 may be disposed at any suitable vertical distance above a brew chamber outlet, such as the first brew chamber outlet 106 and/or the second brew chamber outlet 107. In some embodiments, dispensing outlet 108 is disposed a vertical distance above or equal to a vertical height of the brew chamber inlet 104. In some embodiments, dispensing outlet 108 is disposed a vertical height between the brew chamber inlet 104 and a brew chamber outlet, such as the first brew chamber outlet 106. In some embodiments, a direction of water flow into the brew chamber 102 from the brew chamber inlet 104 is substantially parallel to a direction in which beverage exits the dispensing outlet 108. In some embodiments, liquid is urged from the brew chamber inlet 104 towards the first brew chamber outlet 106 and/or the second brew chamber outlet 107 at least partially by gravity. Because the dispensing outlet 108 is positioned a vertical distance above at least part of the brew chamber 102, such as a brew chamber outlet, force may be required to move the beverage from the brew chamber outlet to the dispensing outlet 108, e.g., along the first flow path from the first brew chamber outlet 106, through the connecting channel 110, and up to the dispensing outlet 108. In some

embodiments, the beverage may flow from the brew chamber outlet to the dispensing outlet without the use of any additional pumps or other fluid moving devices downstream of the brew chamber. In some cases, the fluid system 200 may provide pressure suitable to cause flow from the brew chamber outlet to the dispensing outlet, e.g., from the first brew chamber outlet 106 to the dispensing outlet 108. A sufficient pressure difference will move the beverage from the first brew chamber outlet 106 and/or the second brew chamber outlet 107 up to the dispensing outlet 108.

[0032] In some cases, a flow path between the brew chamber inlet 104 and the first brew chamber outlet 106 may be sealed, and pressure in the flow path may be higher than at the dispensing outlet 108. Higher pressure at the first brew chamber outlet 106 will force the beverage along the first flow path to up to the dispensing outlet 108. In some cases, a flow path between the brew chamber inlet 104 and the first brew chamber outlet 106 may include an interior of a pod or cartridge and the flow path may be sealed by suitable sealing engagement between the brew chamber inlet 104 with the pod and between the brew chamber outlet 106 and the pod. In embodiments where no pod 105 is used, sealing the flow path upstream of the brew chamber outlet may include sealing the entire brew chamber 102, e.g., via a gasket 130 (See FIG. 3B that provides a seal between an upper portion of the brew chamber (e.g., the lid 122) and a lower portion of the brew chamber (e.g., a pod holder). In embodiments where a pod 105 is used, the pod 105 may be sealed separate from the brew chamber 102 via gaskets 131 (See FIG. 3B) around piercing elements 120. In some embodiments, the dispensing outlet 108 is maintained at ambient pressure. Suitable pressure to move beverage from a brew chamber outlet to the dispensing outlet may be provided in different ways. For example, water from the liquid supply 202 may be heated prior to being delivered to the brew chamber inlet 104, which may increase the temperature of ambient air in the brew chamber to drive flow to the dispensing outlet.

[0033] In some embodiments, a water pump and/or air pump may be configured to pump a quantity of water, air and/or steam through the brew chamber inlet 104 to drive flow from the first brew chamber outlet 106 and/or the second brew chamber outlet 107 to the dispensing outlet 108. Pumping air into the brew chamber may also purge the first and/or second flow path of any remaining beverage. Purging the first and/or second flow path may allow for the beverage machine to maintain sanitary conditions in the flow path and required

less frequent cleaning of the flow path. Purging may also limit an amount of dripping from the pod 105 when removed from the brew chamber 102.

[0034] In some embodiments, it may be desirable for the beverage machine to be capable of running a beverage forming cycle without a pod 105 in the brew chamber 102, in order to allow dispensing of heated or unheated water. However, when there is no pod 105 in the brew chamber 102, the flow path upstream of the brew chamber outlet will include the entire volume of the brew chamber 102. In such a case, suitable pressure (liquid and/or air) may be provided to the brew chamber to drive flow from the first brew chamber outlet 106 and/or the second brew chamber outlet 107 to the dispensing outlet 108. As noted above, the brew chamber may be sealed to help provide suitable pressure in the brew chamber to drive flow from the first brew chamber outlet 106 and/or the second brew chamber outlet 107to the dispensing outlet 108. However, this is not required, e.g., suitably high flow rate of air or other fluid may be introduced into the brew chamber to cause flow from the first brew chamber outlet 106 and/or the second brew chamber outlet 107 to the dispensing outlet 108.

[0035] In cases where the first brew chamber outlet 106 is located above a bottom of the brew chamber 104, all liquid in the brew chamber 104 may not be evacuated from the brew chamber, even in the case of an air purge cycle. In some embodiments, a second brew chamber outlet 107 may be provided in addition to, or in place of, the first brew chamber outlet 106. In some cases, the second brew chamber outlet 107 may be fluidly coupled to a bottom or lowermost portion of the brew chamber so that liquid in the brew chamber will tend to enter the second brew chamber outlet 107. In some embodiments, the second brew chamber outlet 107 and/or second connecting channel 111 may have a larger cross-sectional area or other features to provide a lower resistance to flow than the first brew chamber outlet 106 and the first connecting channel 110 so as to provide a lower fluid flow resistance along the second flow path as compared to the first flow path. This configuration may encourage liquid in the brew chamber 102 to exit via the second brew chamber outlet 107 as opposed to the first brew chamber outlet 106, and may help remove liquid from the brew chamber. In some cases, a lower pressure in the brew chamber may be required to move beverage through the second flow path than is required to move the beverage through the first flow path. While first and second flow paths are shown using a shared dispensing outlet 108, it is contemplated

that first flow path may use a first dispensing outlet, and second flow path may use a second dispensing outlet separate from the first dispensing outlet.

[0036] In some embodiments, when a pod 105 is inserted into the brew chamber 102, brew chamber inlet 104 is fluidly connected to first brew chamber outlet 106, but not second brew chamber outlet 107. Piercing elements 120 on the brew chamber inlet 104 and first brew chamber outlet 106 may puncture the pod 105. In some embodiments, pod 105 may be a reusable pod, and may include holes which align with piercing elements 120 rather than being punctured. Brew chamber inlet 104 and first brew chamber outlet 106 may also include gaskets 131 or some other sealing means to prevent the liquid/ beverage and air from flowing out of the pod 105 and into the brew chamber 102. Thus, the beverage and additional air or steam may only flow to the dispensing outlet 108 via the first flow path.

[0037] When no pod 105 is inserted into the brew chamber 102, both first and second brew chamber outlets 106 and 107 may be fluidly coupled to the brew chamber inlet 104. In this configuration, the beverage in the brew chamber 102 may be directed towards the second flow path. The beverage in the brew chamber 102 may flow along both flow paths, but may tend to flow through the second flow path due to the lower flow resistance of the second flow path. In some embodiments, the air may flow through both the first and second flow paths in order to purge any beverage from either flow path. In some embodiments, if a beverage ingredient is placed into the brew chamber 102 in loose or uncontained form, the beverage may flow along both the first and second flow paths. Flow resistance in the first flow path may be suitably high to encourage flow through the second flow path so that liquid in the second flow path can be purged, e.g., by air introduced into the brew chamber.

[0038] The cross-sectional areas of brew chamber outlets 106 and 107 and connecting channels 110 and 111 may be sized relative to each other such that the beverage may be dispensed from the dispensing outlet 108 with desired flow parameters (i.e. flow rate and amount of turbulence) and properly evacuated from the brew chamber 102, e.g., by suitable air delivered by a pump, regardless of whether or not a pod 105 is placed in the brew chamber 102. In some embodiments, the cross-sectional areas of connecting channels 110 and 111 may remain consistent along an entire length of the channels. In some embodiments, the cross-sectional area of the first brew chamber outlet 106 and first connecting channel 110 is approximately 7 mm^2, while the cross-sectional area of the second brew chamber outlet

107 and first connecting channel 111 is approximately 50 mm^2. In some embodiments the cross-sectional areas of connecting channels 110 and 111 may change along the length of the connecting channels.

[0039] In some embodiments, first brew chamber outlet 106 is disposed at a vertical distance D_O above the second brew chamber outlet 107. Without wishing to be bound by theory, such a configuration may help in limiting the flow of the beverage along the first flow path when no pod 105 is placed in the brew chamber 102. Brew chamber 102 may have a support ledge 132 configured to support the pod 105 when it is placed in the brew chamber 102. First brew chamber outlet 106 may be disposed in the support ledge 132. In some embodiments, a bottom surface of the brew chamber 102 may be sloped towards the second brew chamber outlet 107. Such a configuration may reduce the likelihood of leftover beverage remaining in the brew chamber after purging.

[0040] In some embodiments, the second flow path may function as a pressure relief flow path. For instance, if the first flow path becomes clogged by beverage ingredient when a pod 105 is being used, the pressure in the pod 105 may increase enough to cause the pod 105 to fail, and for liquid and/or beverage to breach the pod 105. In this scenario, this liquid and/or beverage may flow around the pod 105 and into the second flow path, where it will be evacuated from the brew chamber 102. This may prevent excessive buildup of pressure in the beverage machine 100, which may prevent damage to the machine.

[0041] In some embodiments, the brew assembly may include an additional pressure relief flow path in the event that both the first and second flow paths become clogged. In this event, the liquid/beverage may overflow from the brew chamber 102, and be directed towards drain 134, which may drain the water/beverage into the drip tray 126 (See FIG. 3B).

[0042] FIGS. 4A and 4B show upper perspective cross-sectional views of a brew assembly 101 according to an embodiment. In some embodiments, it may be desirable to reduce the fluid velocity or turbulence of the beverage before it reaches the dispensing outlet 108. This may help avoid splatter as a beverage is being dispensed. The brew assembly 101 may therefore include a flow conditioning chamber 112 between the brew chamber 102 and the dispensing outlet 108. In embodiments where only first brew chamber outlet 106 is provided, the flow conditioning chamber 112 may be disposed between the dispensing outlet 108 and connecting channel 110. In embodiments where only second brew chamber outlet

107 is provided, the flow conditioning chamber 112 may be disposed between the dispensing outlet 108 and connecting channel 111. In embodiments where both first brew chamber outlet 106 and second brew chamber outlet 107 are provided, flow conditioning chamber 112 may be disposed between both connecting channels 110 and 111 and the dispensing outlet 108. The flow conditioning chamber 112 may include a bottom surface 136, which the dispensing outlet 108 is disposed in, and outer walls 138 extending vertically along a perimeter of the bottom surface 136. Bottom surface 136 may be configured to slope towards the dispensing outlet 108. One or both of connecting channels 110 and 111 may be fluidly connected to the flow conditioning chamber 112 over or above a back wall 140 of the flow conditioning chamber 112. Back wall 140 extends a vertical distance D_W above the bottom surface 136. In use, the beverage will flow over the back wall 140 from the channels 110, 111 and flow along the bottom surface 136 of the flow conditioning chamber 112. In some embodiments, the fluid connection between the channels 110, 111 and the chamber 112 at the back wall 140 acts as a siphon break. This siphon break may limit backflow of the beverage back into one or both of connecting channels 110 and 111 and back into the brew chamber 102.

[0043] In some embodiments, the flow conditioning chamber may have a central wall 142 which divides the flow conditioning chamber 112 into a first section 144 and a second section 146. The first section 144 may be fluidly connected to the first connecting channel 110, and the second section 146 may be fluidly connected to the second connecting channel 111. Such a central wall 142 may keep the first flow path downstream of the brew chamber 102 separate from the second flow path downstream of brew chamber 102. This may be desirable to ensure that proper flow parameters are reached in the flow conditioning chamber 112 before the beverage is dispensed. In some embodiments, central wall 142 curves as it approaches the dispensing outlet 108. Without wishing to be bound by theory, such a curve may further improve flow parameters. Additionally, such a curve may be necessary to maintain the proper flow areas of the first and second flow paths.

[0044] In some embodiments, connecting channels 110 and 111 run substantially adjacent to each other, as may best be seen in Fig. 4B. However, it is contemplated that connecting channels 110 and 111 may be run in any configuration relative to each other (i.e., a stacked configuration), or may not run relative to each other at all.

[0045] In some embodiments, it may be desirable for the brew chamber 102, one or both of connecting channels 110 and 111 and flow conditioning chamber 112 to be removable from the beverage machine 100. As these components are in contact with the beverage, it may be necessary to clean them to maintain sanitary conditions, and allowing these components to be removable may allow for a user to more easily clean these components. In some embodiments, the conditioning chamber 112 may have a removable lid 148 and the connecting channels may have a removable base 150. This may allow a user to more easily clean the connecting channels and the conditioning chamber, and to visually assess their cleanliness.

[0046] In some embodiments, the brew chamber 102, one or both connecting channels 110 and 111, and conditioning chamber 112 may be formed as a single component. This may allow for easier removal from and reattachment to the beverage machine 100, and may limit the possibility of improper reattachment of these components. In some embodiments, this single component may be integrally formed (i.e., by injection molding). Alternatively, this single component may be formed by fastening various components together using any suitable fastener (i.e., adhesives, screws, welding, etc.).

[0047] FIG. 5 is a schematic diagram of an upstream fluid system of a beverage machine in an illustrative embodiment. As mentioned above, beverage machine 100 may include an upstream fluid system 200 located upstream of brew assembly 101 and configured to condition and deliver liquid from the liquid supply 202 to the brew assembly 101. The upstream fluid system 200 may include, for example, a liquid supply, a liquid heater, pumps, and valves, to name a few components. The beverage machine 100 may include a controller 201 configured to receive a user's input from a user interface 124 and control the upstream fluid system 200 to deliver liquid to the brew assembly 101 with the desired brew parameters (i.e., temperature, volume, flow rate, etc.).

[0048] The upstream fluid system 200 may include a liquid supply 202, such as a cold-water tank. In general, the liquid supply may include a reservoir configured to hold liquid. The water level of the cold-water tank may be monitored by a sensor 204. If the sensor 204 detects that there is insufficient water in the cold-water tank, the sensor may send a signal to a user interface 124 to alert a user. Water from the cold-water tank may pass through a filter 208 and a check valve 210 before being pumped by a pump 212 into a hot water tank

214. The water may be heated within the hot water tank 214 (e.g., via a heating element inside the hot water tank 214), and/or may be heated while traveling along the pathway to the hot water tank 214 (e.g., via an in-line heater). An air pump 222 may be connected to the hot water tank 214 to introduce air into the hot water tank 214 for delivery of hot water to the brew assembly, and for purging the hot water tank and brew assembly of water and/or beverage from the brew assembly. The beverage machine may include a pressure release valve 216 that may be connected to a pressure transducer 218 that monitors pressure levels. In the case that the pressure transducer determines that pressure levels are too high, the pressure release valve may reduce the pressure levels through a vent 220. In some embodiments, the vent 220 is passive, and not controllable. In embodiments in which the vent is controllable, the vent may be directly connected to the hot water tank.

[0049] While the above embodiments of upstream fluid system 200 disclose pump 212 as delivering water to hot water tank 214, and separate air pump 222 moving water from the hot water tank 214 and though brew assembly 101, it is contemplated that a single pump may move water through the entire upstream fluid system 200 and through the brew assembly 101. It should be understood that the upstream fluid system 200 disclosed in embodiments above is only exemplary, and that any upstream fluid system configured to condition and/or deliver liquid and/or air to a brew assembly may be used.

[0050] The beverage machine 100 may include a user interface 124 to allow a user to control the beverage machine. In some embodiments, user interface c 124 may be oriented so as to be viewed by a user positioned adjacent to a front surface 128 of the beverage machine. A user interface may include one or more of the following: a display, one or more buttons, and one or more indicator lights. The user may provide commands to the beverage machine through the user interface 124 by, for example, pressing a button or touching a touch screen. The beverage machine may activate a beverage forming cycle, or may perform various other functions in response to the commands from the user. For example, a beverage having a first set of brew parameters (i.e. temperature, volume, strength, etc.) may be formed by the beverage machine 100 in response to a user inputting a first set of commands via the user interface, while a beverage having a second set of brew parameters may be formed by the beverage machine 100 in response to a user inputting a second set of commands via the user

interface. Information may be communicated to the user through a display or indicator lights of the user interface.

[0051] It should be understood that a user interface may include any number or combination of the above-mentioned components, or any other appropriate components. In some embodiments, a user interface may include only a single touch screen that both receives commands from a user and communicates information to the user. In other embodiments, a user interface may include multiple buttons and multiple indicator lights. A user interface may include knobs, scroll wheels, mechanical switches, microphones, touch sensors, light sensors, or any other suitable components configured to receive input from a user. Additionally, a user interface may include displays, lights, speakers, haptic devices, or any other suitable components configured to provide information to a user.

[0052] According to one aspect, a user interface may be disposed above the brew assembly 101. In some embodiments, the user interface may be disposed on a portion of the housing that is located directly above the brew assembly. In some embodiments, positioning the user interface directly above the brew assembly may help to provide ease of access to a user. In embodiments in which the brew chamber includes a lid 122, the user interface may be disposed on a top surface of the lid 122 and configured to move with lid 122. In some embodiments, lid 122 may include handle 123. In use, a user may manipulate handle 123 in order to move lid 122. In some embodiments, the user interface 106 may be in-line with the brew assembly 101. That is, when a beverage machine 100 is viewed from above, as in FIG. 1B, a single line may pass through the user interface and the brew chamber. Stated differently, a single vertical plane may pass through the user interface and the brew chamber.

[0053] While the present teachings have been described in conjunction with various embodiments and examples, it is not intended that the present teachings be limited to such embodiments or examples. On the contrary, the present teachings encompass various alternatives, modifications, and equivalents, as will be appreciated by those of skill in the art. Accordingly, the foregoing description and drawings are by way of example only.

What is claimed is:

CLAIMS

1. A beverage machine comprising:

a brew chamber arranged to selectively hold a beverage ingredient, the brew chamber comprising a brew chamber inlet to provide liquid for combining with the beverage ingredient to form a beverage and a brew chamber outlet disposed below the brew chamber inlet to allow the beverage to exit the brew chamber; and

a dispensing outlet disposed above the brew chamber outlet and fluidly connected to the brew chamber outlet to dispense from the beverage machine;

wherein the dispensing outlet is configured to be disposed above the brew chamber outlet during formation and dispensing of the beverage.

2. The beverage machine of claim 1, wherein the dispensing outlet is disposed below the brew chamber inlet.

3. The beverage machine of claim 1, wherein the brew chamber outlet is a first brew chamber outlet, the brew chamber further comprising a second brew chamber outlet fluidly connected to the dispensing outlet.

4. The beverage machine of claim 3, wherein a cross-sectional area of the first brew chamber outlet is smaller than a cross-sectional area of the second brew chamber outlet.

5. The beverage machine of claim 3, wherein the brew chamber is configured to direct the liquid only to the first brew chamber outlet when the beverage ingredient is in the brew chamber, and configured to direct the liquid to the second brew chamber outlet when the beverage ingredient is not in the brew chamber.

6. The beverage machine of claim 1, further comprising a flow conditioning chamber between the brew chamber outlet and the dispensing outlet, and a channel configured to fluidly connect the brew chamber outlet to the flow conditioning chamber.

7. The beverage machine of claim 6, wherein the flow conditioning chamber comprises a bottom surface, and wherein the channel is fluidly connected to the flow conditioning chamber at a vertical height above the bottom surface of the flow conditioning chamber.

8. The beverage machine of claim 7, wherein the flow conditioning chamber further comprises a divider at least partially extending between the dispensing outlet and the channel, such that liquid travels from the channel to the dispensing outlet by flowing around the divider.

9. The beverage machine of claim 1, wherein the brew chamber inlet is disposed on an upper portion of the brew chamber, and the brew chamber outlet is disposed on a lower portion of the brew chamber.

10. The beverage machine of claim 9, wherein the upper portion of the brew chamber is movable relative to the lower portion to allow for insertion of the beverage ingredient.

11. The beverage machine of claim 10, further comprising a sealing ring disposed between the upper and lower portions of the brew chamber and configured to seal the brew chamber from an external environment.

12. The beverage machine of claim 1, wherein the brew chamber outlet further comprises a piercing element configured to pierce a cartridge containing the beverage ingredient.

13. The beverage machine of claim 1, wherein a flow path of the liquid and/or beverage between the brew chamber inlet and the brew chamber outlet is approximately parallel to a flow path of the beverage exiting the dispensing outlet.

14. The beverage machine of claim 1, wherein the beverage machine is free of any pump or other fluid moving device downstream of the brew chamber.

15. The beverage machine of claim 1, wherein the beverage is moved from the brew chamber to the dispensing outlet via force provided only at the brew chamber inlet.

16. The beverage machine of claim 15, further comprising a siphon break between the brew chamber and the dispensing outlet.

17. The beverage machine of claim 16, further comprising an air pump configured to deliver air to the brew chamber to move the beverage from the brew chamber to the dispensing outlet.

18. A beverage machine comprising:

a brew chamber arranged to selectively hold a beverage ingredient, the brew chamber comprising a brew chamber inlet to provide liquid into the brew chamber, and first and second brew chamber outlets to allow the liquid to exit the brew chamber;

a first flow path fluidly connecting the first brew chamber outlet to a dispensing outlet; and

a second flow path connecting the second brew chamber outlet to the dispensing outlet, the second flow path having a larger cross-sectional area than the first flow path;

wherein the brew chamber is configured to direct liquid only along the first flow path when the beverage ingredient is in the brew chamber and configured to direct the liquid along at least the second flow path when the beverage ingredient is not in the brew chamber.

19. The beverage machine of claim 18, wherein the dispensing outlet is disposed at a vertical height above the first and second brew chamber outlets.

20. The beverage machine of claim 19, wherein the dispensing outlet is disposed at a vertical height below the brew chamber inlet.

21. The beverage machine of claim 20, further comprising a flow conditioning chamber disposed between and fluidly connected to the first and second brew chamber outlets and the dispensing outlet.

22. The beverage machine of claim 21, wherein the first brew chamber outlet is fluidly connected to the flow conditioning chamber by a first channel, and the second brew chamber outlet is fluidly connected to the flow conditioning chamber by a second channel.

23. The beverage machine of claim 22, wherein the flow conditioning chamber comprises a bottom surface, and wherein the first and second channels are connected to the flow conditioning chamber at a vertical height above the bottom surface of the flow conditioning chamber.

24. The beverage machine of claim 18, wherein the brew chamber inlet is disposed on an upper portion of the brew chamber, and the brew chamber outlet is disposed on a lower portion of the brew chamber.

25. The beverage machine of claim 24, wherein the upper portion of the brew chamber is removable to allow for insertion of the beverage ingredient.

26. The beverage machine of claim 25, further comprising a sealing ring disposed between the upper and lower portions of the brew chamber and configured to seal the brew chamber from an external environment.