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SYSTEM FOR AUTOMATED BREW CYCLES AND MACHINE CONTROLS AND INTERFACES

Abstract

A system includes: a water reservoir configured to store water; a brew chamber extending below and contiguous with the water reservoir; a piston configured to run in the brew chamber, defining a base of the water reservoir, defining a port extending between the water reservoir and the brew chamber, and including a valve coupled to the fill port and operable in a) a closed position during downward advancement of the piston and b) an open position during upward retraction of the piston; a heating element configured to heat water occupying the brew assembly; and an actuator configured to retract the piston to transfer water from the water reservoir, through piston via the port, and into the brew chamber and to advance the piston by a target piston travel distance—corresponding to a piston swept volume that yields a target brew volume—to displace liquid from the brew chamber.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This Application This Application is a continuation application of U.S. patent application Ser. No. 18/668,046, filed on 17 May 2024, which is a continuation application of U.S. patent application Ser. No. 18/129,592, filed on 31 Mar. 2023, which claims the benefit of U.S. Provisional Application No. 63/326,604, filed on 1 Apr. 2022, and U.S. Provisional Application No. 63/420,241, filed on 28 Oct. 2022, each of which is incorporated in its entirety by this reference.

TECHNICAL FIELD
[0002] This invention relates generally to the field of brewing machines and more specifically to a new and useful system and methods for automated brew cycles, controls, and interfaces in the field of brewing machines.

Description

BRIEF DESCRIPTION OF THE FIGURES
[0003] FIG. **1** is a schematic representation of the system;
[0004] FIG. **2** is a schematic representation of one variation of system;
[0005] FIG. **3** is a schematic representation of one variation of the system;
[0006] FIG. **4** is a schematic representation of one variation of the system; and
[0007] FIG. **5** is a block diagram representation of one variation of the system.
DESCRIPTION OF THE EMBODIMENTS
[0008] The following description of embodiments of the invention is not intended to limit the invention to these embodiments but rather to enable a person skilled in the art to make and use this invention. Variations, configurations, implementations, example implementations, and examples described herein are optional and are not exclusive to the variations, configurations, implementations, example implementations, and examples they describe. The invention described herein can include any and all permutations of these variations, configurations, implementations, example implementations, and examples.
1. System
[0009] As shown in FIGS. **1**, **2**, and **3**, a system **100** includes: a base **102** defining a drip tray **140** and including a scale **142**; a column **104** arranged on the base **102**; a rocker box **106** extending from a front face of the column **104** and arranged over the base **102**; and a brew assembly **110** supported on the column **104** interposed between the base **102** and the rocker box **106**, and including a funnel, a brew chamber **114** extending below the funnel, and a portafilter **118** configured to transiently install across a base **102** of the brew chamber **114** opposite the funnel.

[0010] The system **100** further includes: a piston **120** configured to run in the brew chamber **114** and forming a position-controlled valve **124** operable in a closed position during downward advancement of the piston **120** in the brew chamber **114** to pressurize the brew chamber **114** and prevent flow of water, located between the funnel and the piston **120**, from flowing into the brew chamber **114**, and an open position during upward retraction of the piston **120** in the brew chamber **114** to draw water, located between the funnel and the piston **120**, into the brew chamber **114**. The system **100** further includes: a position sensor **132** configured to output a position signal representing a height of the piston **120** within the brew chamber **114**; an actuator **109** arranged in the column **104**; and a linkage coupling the actuator **109** to the piston **120**, and including a rocker arranged in the rocker box **106**.

[0011] The system **100** further includes: a heating element **116** arranged in the brew assembly **110** between the funnel and the portafilter **118** and configured to heat a volume of water occupying the brew assembly **110** between the funnel and the piston **120**; a temperature sensor **134** coupled to the piston **120** and configured to output a temperature signal representing a temperature of the volume of water inside the brew chamber **114**; and a pressure sensor **136** coupled to the piston **120** and configured to output a pressure signal representing a pressure within the brew chamber **114**.

[0012] The system **100** further includes: a controller **130** configured to trigger the actuator **109** to advance the piston **120** downward within the brew chamber **114** to locate the valve **124** in the closed position; and, during a brew cycle, following insertion of the volume of water into the funnel, the volume of water at an initial temperature and located above the piston **120** opposite the brew chamber **114**, activate the heating element **116** to heat the volume of water to a brew temperature. The controller **130** is further configured to: in response to the volume of water reaching the brew temperature, trigger the actuator **109** to retract the piston **120** upward, to a target displacement based on the position sensor **132** and corresponding to the volume of water, within the brew chamber **114** to locate the valve **124** in the opened position; trigger the actuator **109** to drive the piston **120** downward within the brew chamber **114** at a target pressure to push the volume of water through the portafilter **118** and dispense the volume of coffee into a vessel arranged on the drip tray **140** of the base **102**; measure a weight of the vessel via the scale **142**; and, in response to the weight of the vessel reaching a target vessel weight during the brew cycle, trigger the actuator **109** to discontinue advancement of the piston **120** at the target pressure to terminate the brew cycle.

1.1 Variation

[0013] As shown in FIGS. **1**, **2**, and **3**, one variation of the system **100** includes: a base **102**; a rocker box **106**; a column **104**; a brew assembly **110**; a piston **120**; an actuator **109**; a heating element **116**; a position sensor **132**; a set of temperature sensors **134**; a pressure sensor **136**; and a controller **130**.

[0014] In this variation, the rocker box **106** houses a rocker arm **108** and the column **104** supports the rocker box **106** above the base **102**.

[0015] The brew assembly **110** is supported on the column **104** between the base **102** and the rocker box **106**. The brew assembly **110** includes: a water reservoir **112** configured to store a first volume of water; a brew chamber **114** defining a internal cylindrical wall, extending below water reservoir **112**, and contiguous with the water reservoir **112**; a set of mating features **117** arranged below the brew chamber **114** opposite the water reservoir **112**; and a portafilter **118** configured to transiently couple to the set of mating features **117**.

[0016] The piston **120** is configured to run in the brew chamber **114**, is coupled to the rocker arm **108**, and defines a fill port **122** extending between the water reservoir **112** and the brew chamber **114**. A valve **124** is coupled to the fill port **122** and operable in both a closed position during downward advancement of the piston **120** within the brew chamber **114** and an open position during upward retraction of the piston **120** within the brew chamber **114**.

[0017] The actuator **109** is arranged in the column **104** and coupled to the rocker arm **108**.

[0018] The heating element **116** is arranged in the brew assembly **110** and configured to heat the first volume of water occupying the brew assembly **110**.
[0019] The position sensor **132** is configured to output a position signal representing a position of the piston **120** within the brew assembly **110**.
[0020] The set of temperature sensors **134** is configured to output a set of temperature signals representing a temperature of the first volume of water occupying the brew assembly **110**.
[0021] The pressure sensor **136** is configured to output a pressure signal representing a pressure within the brew chamber **114** between the piston **120** and the portafilter **118**.
[0022] The controller **130** is configured to activate the heating element **116** and, in response to the temperature of the first volume of water reaching a target temperature, trigger the actuator **109** to retract the piston **120** by a target retraction distance to transfer water from the water reservoir **112** through the fill port **122** and into the brew chamber **114**, the target retraction distance corresponding to a swept piston **120** volume approximating a target brew volume. The controller **130** is also configured to trigger the actuator **109** to advance the piston **120** by a target piston advance distance to displace liquid from the brew chamber **114** and through the portafilter **118** toward the base **102**.
1.2 Variation
[0023] Another variation of the system **100** includes: a base; a rocker arm **108**; a column **104** supporting the rocker arm **108** above the base; a brew assembly **110**; a piston **120**; an actuator **109**; a heating element **116**; a temperature sensor **134**; and a controller **130**.
[0024] In this variation, the brew assembly **110** is supported on the column **104** between the base **102** and the rocker arm **108** and includes: a water reservoir **112** configured to store a first volume of water; a brew chamber **114** defining a cylindrical internal wall, extending below water reservoir **112**, and contiguous with the water reservoir **112**; a set of mating features arranged below the brew chamber **114** opposite the water reservoir **112**; and a portafilter **118** configured to transiently couple to the set of mating features.
[0025] In this variation, the piston **120**: is configured to run in the brew chamber **114**; is coupled to the rocker arm **108**; defines a fill port **122**: extending between the water reservoir **112** and the brew chamber **114**; and includes a valve coupled to the fill port and operable in a) a closed position during downward advancement of the piston **120** within the brew chamber **114** and b) an open position during upward retraction of the piston **120** within the brew chamber **114**.
[0026] In this variation, the actuator **109**: is arranged in the column **104**; and is coupled to the rocker arm **108**.
[0027] In this variation, the heating element **116**: is arranged in the brew assembly **110**; and is configured to heat the first volume of water occupying the brew assembly **110**.
[0028] In this variation, the temperature sensor **134** is configured to output a temperature signal representing a temperature of the first volume of water occupying the brew assembly **110**.
[0029] In this variation, the controller **130** is configured to: activate the heating element **116**; in response to the temperature of the first volume of water reaching a target temperature, trigger the actuator **109** to retract the piston **120** to transfer water from the water reservoir **112** through the fill port **122** and into the brew chamber **114**; and trigger the actuator **109** to advance the piston **120** to displace liquid from the brew chamber **114** and through the portafilter **118** toward the base **102**.
1.3 Variation
[0030] In a similar variation, the system **100** includes: a column **104**; a brew assembly **110**; a piston; an actuator; a heating element **116**; a temperature sensor **134**; and a controller **130**.
[0031] In this variation, the brew assembly **110** is supported on the column **104** and includes: a water reservoir **112** configured to store a first volume of water; and a brew chamber **114** defining a cylindrical internal wall, extending below water reservoir **112**, and contiguous with the water reservoir **112**.
[0032] In this variation, the piston **120**: is configured to run in the brew chamber **114**; defines a fill

port **122** extending between the water reservoir **112** and the brew chamber **114**; and includes a valve coupled to the fill port **122** and operable in a) a closed position during downward advancement of the piston **120** within the brew chamber **114** and b) an open position during upward retraction of the piston **120** within the brew chamber **114**.

[0033] In this variation, the actuator **109** is supported on the column **104** and is coupled to the piston **120**.

[0034] In this variation, the heating element **116**: is arranged in the brew assembly **110**; and is configured to heat the first volume of water occupying the brew assembly **110**.

[0035] In this variation, the temperature sensor **134** is configured to output a temperature signal representing a temperature of the first volume of water occupying the brew assembly **110**.

[0036] In this variation, the controller **130** is configured to: activate the heating element **116**; in response to the temperature of the first volume of water approaching a target temperature, trigger the actuator **109** to retract the piston **120** by a target piston travel distance to transfer water from the water reservoir **112**, through the piston **120** via the fill port, and into the brew chamber **114**, the target piston travel distance corresponding to a piston swept volume that yields a target brew volume; and trigger the actuator **109** to advance the piston **120** by the target piston travel distance to displace liquid from the brew chamber **114**.

[0037] Additionally or alternatively, in this variation, the controller **130** is configured to, during a brew cycle: activate the heating element **116**; trigger the actuator **109** to retract the piston **120** to a) transfer water from the water reservoir **112**, through the piston **120** via the port, and into the brew chamber **114** and to b) wet coffee grounds contained in the portafilter **118** below the piston **120** and the brew chamber **114**; and trigger the actuator **109** to advance the piston **120** by a target piston travel distance to displace liquid from the brew chamber **114**, the target piston travel distance corresponding to a piston swept volume that yields a target brew volume.

2. Applications

[0038] Generally, the system **100** is configured to automate brew cycles for batches of coffee. Generally, the system **100** includes: an actuator **109**; a brew chamber **114** configured to accept a volume of water; and a heating element **116** arranged around the brew chamber **114** to heat the volume of water. During a brew cycle, responsive to actuation of the actuator **109** in a first direction (e.g., a downward motion), the system **100** can transfer the heated water into the brew chamber **114**. During the brew cycle, responsive to actuation of the actuator **109** in a second direction opposite the first direction (e.g., an upward motion), the system **100** can dispense a batch of brewed coffee out of the brew chamber **114** into a cup arranged below the brew chamber **114**.

[0039] In one implementation, the system **100** includes: a base **102**; a column **104** arranged on the base **102**; and a rocker box **106** extending from a front face of the column **104** and arranged over the base **102**. The system **100** further includes: a brew assembly **110** supported on the column **104** and interposed between the base **102** and the rocker box **106**; a funnel; a brew chamber **114** extending below the funnel; and a portafilter **118** configured to install across a base **102** of the brew chamber **114**. The brew assembly **110** is configured to receive a volume of water via the funnel and to store and/or heat this volume of water directly above the brew chamber **114** in preparation for subsequent brewing with a volume of coffee grounds or other brew ingredients (e.g., tea leaves) contained in the portafilter **118**.

[0040] The system **100** further includes: a piston **120** configured to run in the brew chamber **114**; and including a valve **124** operable in a) an open position during upward retraction of the piston **120** in the brew chamber **114** to enable heated water located above the piston **120** to draw into the brew chamber **114** and b) a closed position during downward advancement of the piston **120** into the brew chamber **114** to force liquid (e.g., coffee, tea) downward through the portafilter **118** and into a vessel below (rather than release liquid upward above the piston **120**). More specifically, with the valve **124** in the closed position, the piston **120** can: prevent ingress of water into the brew chamber **114** and into the portafilter **118**. With the valve **124** in the closed position, the piston **120** can: push water—occupying the brew chamber **114**—across the volume of coffee grounds and through the portafilter **118**.

[0041] The system **100** also includes: a heating element **116** arranged in the brew assembly **110** between the funnel and the portafilter **118**; and configured to heat a volume of water occupying the brew assembly **110** between the funnel and the piston **120** during a brew cycle. Thus, during a brew cycle, the system **100** can control flow of heated water from above the piston **120** into the brew chamber **114** via the valve **124** based on: upward actuation of the piston **120**; and flow of brewed liquid (e.g., coffee, tea) out of the brew chamber **114** via the portafilter **118** based on downward actuation of the piston **120**. More specifically, retraction (i.e., upward displacement) of the piston **120** from the portafilter **118** creates a vacuum in the brew chamber **114**, which opens the valve **124** and draws a volume of water—equivalent to the swept volume of the piston **120** during this upward actuation—from the heated volume above the piston **120**, through the valve **124**, and into the brew chamber **114**. Alternatively, retraction of the piston **120** from the portafilter **118** can mechanically separate a lower section of the piston sealed against a wall of the brew chamber from an upper section of the piston coupled to the rocker arm **108**, thereby opening the the fill port **122** in the piston and enabling this volume of water to move from the water reservoir **112**, through the fill port **122**, and into the brew chamber **114**.

[0042] Once the piston **120** reaches a retracted position above the portafilter **118**, the actuator **109** retains the piston **120** in this retracted position, which prevents further liquid from entering the brew chamber **114** via the valve **124** (unless the liquid cools and reduces in volume, thereby creating a vacuum in the brew chamber **114** that draws water from above the piston **120** into the brew chamber **114** via the valve **124**). Furthermore, the valve **124** prevents liquid in the brew chamber **114** from moving from the brew chamber **114** back into the funnel zone arranged above the piston **120** (e.g., if the liquid expands due to further heating within the brew chamber **114**).

[0043] Subsequent advancement of the piston **120** downward toward the portafilter **118** increases pressure within the brew chamber **114**, which closes the valve **124** (if not already closed) and forces liquid in the brew chamber **114** through the portafilter **118**, out of the brew chamber **114**, and into a vessel (e.g., a coffee mug) below. The system **100** further includes: an actuator **109** (e.g., a linear motor) arranged in the column **104**; and a linkage coupling the actuator **109** to the piston **120**. Thus, the actuator **109** can retract and advance the piston **120**—via the rocker arm **108**—to draw water into the brew chamber **114**, and then drive (e.g., coffee, tea) out of the brew chamber **114**, respectively. More specifically, the actuator **109** can load water into the brew chamber **114**: to precisely meter a volume of water entering the brew chamber **114** (i.e., as a function of displacement and swept volume of the piston **120** during retraction); and to then dispense a precise volume of coffee (or tea, etc.) from the brew chamber **114** (i.e., as a function of displacement and swept volume of the piston **120** during advancement). In one variation, the actuator **109** can be mounted over the piston **120** via direct coupling of the actuator **109** to the piston **120**. Thus, the actuator **109** can advance and retract the piston **120** to draw water into the brew chamber **114** without the rocker box **106**.

[0044] The system **100** further includes: a position sensor **132** configured to output a signal representing a position (or "height") of the piston **120** within the brew chamber **114**. In this implementation, the system **100** can implement a direct relationship between displacement of the piston **120** indicated by: the position sensor **132**; and both a) a volume of water loaded into the brew chamber **114** at the beginning of a brew cycle and b) a volume of water dispensed from the brew chamber **114** at the end of the brew cycle. Thus, the system **100** can: meter water input and liquid output during a single brew cycle; and meter consistency across many brewing cycles based solely on piston **120** positions detected via the position sensor **132**. Therefore, the system **100** can meter water input and liquid output with an actuator **109** and a single position sensor **132** (e.g., rather than with multiple pumps, actuators, flow meters, and/or other complex and space-filling sensors and actuators).

[0045] The system **100** further includes: a pressure sensor **136** coupled to the piston **120** and configured to output a pressure signal representing a pressure within the brew chamber **114**. In this implementation, the system **100** can monitor a pressure inside the brew chamber **114** based on a pressure signal according to the pressure sensor **136**. More specifically, as the piston **120** advances in the downward direction, the pressure sensor **136** can output the pressure signal indicative of a pressure differential (e.g., an increase) in the brew chamber **114**. Thus, the system **100** can control brew cycle parameters (e.g., a water flow rate, a flavor profile, water pressure) based on the pressure within the brew chamber **114** during a brew cycle. In one variation, the system **100** can measure pressure within the brew chamber **114** during a brew cycle by computing an electromechanical force metric and/or a torque output metric based on the linear actuator **109**.

2.1 Methods

[0046] Generally, the system **100** includes a controller **130** configured to automate a brew cycle. In one implementation, prior to a brew cycle, the controller **130** can trigger the actuator **109** to advance the piston **120** downward to a brew cycle start position within the brew chamber **114**, thereby setting the valve **124** in the piston to a closed position.

[0047] At the start of a subsequent brew cycle, a user may: pour a volume of water (e.g., between 1 and 5 fluid ounces) at an unknown initial temperature into the brew assembly **110** via the funnel; load coffee grounds into the portafilter **118**; and install the portafilter **118** into the base of the brew assembly **110**. The brew assembly **110** thus initially stores this volume of water in the water reservoir **112** above the piston. The controller **130** can then: initiate a brew cycle, such as in response to manual selection of a “start” or “brew” input on a user interface **150** arranged on the system **100**; retrieve brew parameters for the brew cycle; activate the heating element **116** to heat the volume of water in the water reservoir **112** to a target brew temperature (e.g., 90-96° C., or 195-205° F.) specified in the brew parameters; and monitor the temperature of this water—stored above the piston **120**—via the temperature sensor **134**.

[0048] Then, in response to the volume of water reaching the target brew temperature, the controller **130** can: trigger the actuator **109** to retract the piston **120** upwardly by a linear distance that corresponds to a swept volume of the piston equal to (or based on) a target brew volume (e.g., for a single coffee serving). Such retraction of the piston **120** opens the valve **124** and draws a volume of heated water—equal to the swept volume of the piston **120** during this retraction motion—from the water reservoir **112** above the piston **120**, through the valve **124** in the piston, and into the brew chamber **114**. More specifically, the system **100** can retract the piston **120** over the target displacement distance that yields a total swept volume of the piston based on the target volume of coffee output by the system **100** upon completion of the brew cycle, such as: equal to the target volume of coffee; or equal to a sum of the target volume of coffee and a predicted volume of water necessary to saturate coffee grounds occupying the portafilter **118**.

[0049] As coffee grounds and water in the brew chamber **114** bloom, the system **100** can control pressure within the brew chamber **114** by: monitoring pressure in the brew chamber **114** directly via the pressure sensor **136** in the piston or reading force or torque outputs of the actuator **109** necessary to move the piston over short distances; advancing the piston when this pressure drops below a target brew pressure; and retracting or stopping the piston when this pressure increases above the target brew pressure. The system **100** can also selectively activate the heating element **116** based on outputs of the temperature sensor **134** to maintain liquid in the brew chamber **114** at a target brew temperature as coffee grounds steep in the brew chamber **114** during this bloom period (e.g., of 0-60 seconds).

[0050] Upon completion of the bloom period, the controller **130** can: trigger the actuator **109** to advance the piston **120** downwardly by a linear distance that corresponds to a target brew volume (e.g., for a single coffee serving). Such advancement of the piston **120** closes (or ensures closure of) the valve **124** and forces water toward and through the portafilter **118**. More specifically, the system **100** can advance the piston **120** over the target displacement distance that yields a total swept volume of the piston equal to the target volume of coffee for the brew cycle.

[0051] In one implementation, during the brew cycle, the controller **130** can also trigger the actuator **109** to drive the piston **120** downward within the brew chamber **114** at a speed that yields a target pressure within the brew chamber **114**, thereby driving liquid through the portafilter **118**—and thus dispensing a volume of coffee into a vessel arranged below (e.g., on the drip tray **140**, on the scale **142**) at a target dispense pressure that extracts further, select flavors from the coffee grounds.

[0052] In one variation in which the system **100** includes a scale **142** arranged on the base during the brew cycle, the controller **130** further: triggers the actuator **109** to advance the piston downwardly following the bloom period; interfaces with the scale **142** to monitor a weight of contents of a vessel arranged on the scale **142** below the portafilter **118**; and triggers the actuator **109** to cease advancement of the piston in response to the weight of contents of the vessel—as detected via the scale **142**—reaching the target brew volume or a target brew weight (i.e., rather than based on a target displacement distance of the piston).

[0053] The system **100** can therefore control water loading and distribution, brew chamber **114** pressure, brew temperature, bloom duration, and output brew volume during a brew cycle autonomously via a single actuator and a heating element **116** and without manual input (e.g., via a lever), thereby maintaining consistent brew parameters across brew cycles.

2.2 Brew Parameters

[0054] Generally, coffee bean roasting processes impact flavor profiles of coffee beans and brewed coffee. For example, coffee beans labeled as “dark roast” are roasted for a longer period of time during processing and are therefore consistently bitter in flavor. Similarly, coffee beans labeled as “light roast” are roasted for a shorter period of time during processing and therefore provide a diverse flavor profile including sweetness, acidity, and bitterness. Accordingly, the system **100** can autonomously implement target brew parameters based on a type of coffee loaded into the portafilter **118** and/or based on a predefined or user-defined brew recipe in order to extract a target flavor profile from the coffee. For example, the controller **130** can autonomously directly control brew heating element **116** output power, piston and actuator position, and piston and actuator speed to indirectly control: brew pressure; brew temperature; bloom duration; brew steep volume; and dispense volume.

[0055] For example, the system **100** can: receive a set of brew parameters, via a user interface **150** in communication with the controller **130**, such as entered manually by a user; retrieve the brew parameters from a recipe selected manually by the user via the user interface **150**; retrieve the brew parameters linked to a barcode, quick-response code, or other optical identifier read from a coffee packaging scanned by an optical sensor arranged on the system **100**; or download the brew parameters from an active or passive wireless transmitter arranged on a coffee packaging via a wireless receiver in the system **100**. The controller **130** can then autonomously implement these brew parameters to brew a volume (e.g., a cup) of coffee, such as once the user installs the portafilter **118** and loads a volume of water in the water reservoir **112** in the brew assembly **110**.

3. Body/Housing

[0056] Generally, the system **100** includes a column **104** arranged over a base **102** (e.g., platform). In particular, the column **104** and the base cooperate to form a housing configured: to support a vessel (e.g., a coffee mug), a scale **142** supporting a vessel as described below, and/or a drip tray **140**; to house the actuator **109**; to locate the brew assembly **110** over the vessel; to support the rocker arm **108**—located within a rocker box **106**—over the brew assembly **110**; to house the actuator **109**, which is coupled to the piston in the brew assembly **110** via the rocker arm **108** and a connecting rod, as described below; and to house the controller **130** and a user interface **150**.

[0057] In one implementation, the system **100** can include: a base **102** defining a drip tray **140** (e.g., a grated tray) configured to collect liquid (e.g., water, coffee); and a column **104** arranged on the base **102** and configured to support a rocker box **106**. In this example, the system **100** can further include: the rocker box **106** extending from a front face of the column **104**; arranged over the drip tray **140** of the base **102**; and configured to enclose the rocker arm **108**, which couples the actuator **109** to the piston and translates linear or angular motion of the actuator **109** into translation (i.e., advancement and retraction) of the piston within the brew chamber **114**.

[0058] For example, the column **104** and the rocker box **106** can be constructed of cast, extruded, and/or billet aluminum, steel (e.g., stainless steel), and/or polymer and can form an assembled or unitary structure. In this example, the base **102** can be constructed of thick-walled or solid steel plate in order to achieve a low center of gravity and thus increase stability of the system **100**.

4. Brew Assembly

[0059] The brew assembly **110** is supported on the column **104** between the base and the rocker arm **108** and includes: a water reservoir **112** configured to store a first volume of water; a brew chamber **114** defining a cylindrical internal wall, extending below water reservoir **112**, and contiguous with the water reservoir **112**; a set of mating features arranged below the brew chamber **114** opposite the water reservoir **112**; and/or a portafilter **118** configured to transiently couple to the set of mating features.

[0060] In particular, the brew assembly **110** can include: a brew chamber **114**; a funnel (or other structure) that extends upwardly from the brew chamber **114** to form the water reservoir **112** that is contiguous with the brew chamber **114**; and a portafilter **118** configured to load a volume of coffee grounds (or tea leaves, etc.) and to transiently install in the base of the brew chamber **114** opposite the water reservoir **112**.

[0061] In one implementation, the water reservoir **112** and the brew chamber **114** define a unitary structure, such as a cast, extruded, or billet aluminum or steel structure. The water reservoir **112** and the brew chamber **114** can be cast or machined: to form a cylindrical running surface configured to seal against the piston; to form an internal or external thread in the base of the brew chamber **114** configured to receive the portafilter **118**; and to form a set of bores or other receptacles configured to house a set of heating elements **116**, such as a set of cartridge heaters.

[0062] Furthermore, the piston **120**: forms an interface between the water reservoir **112** from the brew chamber **114**; defines a bottom of the water reservoir **112**; defines a top of the brew chamber **114**; and includes a fill port and valve that controls flow of water from the water reservoir **112** into the brew chamber **114**. Accordingly, with the piston in a fully-advanced position at the bottom of the brew chamber **114**, the brew assembly **110** and the piston can cooperate to define a water reservoir **112** with a total volume approximating and greater than a maximum target brew volume (i.e., a total volume of coffee dispensed by the system **100** during a brew cycle), such as 115-130% of the maximum target brew volume in order to enable the system **100** to both draw sufficient water into the brew chamber **114** to saturate coffee grounds in the portafilter **118** and then output the maximum target brew volume while the coffee grounds remain saturated. Because the maximum total volume of the water reservoir **112** is minimally greater than the maximum target brew volume, the system **100** can thus heat minimally more water than needed for a brew chamber **114**, thereby reducing total brew cycle duration, reducing total brew cycle power consumption, and/or enabling integration of smaller, lower-output heating elements **116** and thus a small brew assembly **110** and system size.

[0063] In one variation, the system **100** further includes a lid removably or operably arranged over the water reservoir and configured to retain heat within the water reservoir, thereby enabling the system **100** to heat water in the water reservoir to a target brew chamber in less time and/or with a lower total energy consumption.

4.1 Screen

[0064] In one variation, the system **100** further includes a screen **119** arranged in the brew chamber **114** adjacent and above the portafilter **118** and configured to: prevent water from flowing from the brew chamber **114** into the portafilter **118** when pressure within the brew chamber **114** remains below a threshold pressure (i.e., prior to downward advancement of the piston); and to distribute water—loaded into the brew chamber **114** between the piston and the screen **119**—across coffee grounds occupying the portafilter **118** in response to an increase in pressure within the brew chamber **114** above the threshold pressure during downward advancement of the piston.

[0065] The screen **119** defines an array of perforations (or "pores") permeable to water at a target brew temperature under brew chamber **114** pressures greater than ambient pressure. For example, the screen **119** can include a stainless steel sheet defining hundreds or thousands of perforations less than 0.2 micron and uniformly distributed across its area: such that heated water in the brew chamber **114** remains above the screen **119** when pressure in the brew chamber **114** approximates ambient pressure (i.e., prior to downward advancement of the piston during a brew cycle); and such that heated water in the brew chamber **114** flows through all perforations in the screen **119** to uniformly wet grounds in the portafilter **118** when pressure in the brew chamber **114** increases substantially above ambient pressure (i.e., during downward advancement of the piston during the brew cycle). Thus, the screen **119**: can prevent water from reaching the coffee grounds in the portafilter **118** until the brew chamber **114** is fully charged with a target volume of water at a target brew temperature; and then distribute this heated water uniformly across the coffee grounds in the portafilter **118**—thereby preventing uneven wetting, preventing uneven flavor extraction, and enabling tight control over exposure duration of water to coffee grounds—when the system **100** subsequently advances the piston downwardly toward the portafilter **118** during the brew chamber **114**.

[0066] In one implementation, the screen **119** is permanently integrated into the brew chamber **114**. In another implementation, the screen **119** is removable from (i.e., transiently located in) the brew chamber **114**. For example, the brew assembly **110** can define a shoulder: adjacent and above the portafilter **118**; and defining a seat configured to receive and locate the screen **119** above the portafilter **118**. In this example, the screen **119** can: thread into the brew assembly **110** to seat against the shoulder; or insert into and clamp against the shoulder to form a perimeter seal against the brew chamber **114**.

5. Piston

[0067] The piston: is configured to run in the brew chamber **114**; is coupled to the rocker arm **108**; defines a fill port extending between the water reservoir **112** and the brew chamber **114**; and includes a valve coupled to the fill port and operable in a) a closed position during downward advancement of the piston within the brew chamber **114** and b) an open position during upward retraction of the piston within the brew chamber **114**.

[0068] Generally, the piston **120** is configured to run vertically within and to seal against the cylindrical bore of the brew chamber **114**. The piston further includes: a fill port extending from the top of the piston to the bottom of the piston; and a one-way valve arranged in the fill port. The valve **124** is configured: to permit water to flow from the water reservoir **112** above the piston, through the fill port in the piston, and into the brew chamber **114** below the piston (e.g., when pressure in the brew chamber **114** is less than ambient pressure; when the piston is retracted upwardly in the brew chamber **114**); and to prevent water from flowing from the brew chamber **114** back into the water reservoir **112** (e.g., when pressure in the brew chamber **114** is greater than ambient pressure; when the piston is advanced downwardly in the brew chamber **114**).

[0069] For example, the piston can be molded, cast, machined, or otherwise fabricated in steel, aluminum, polymer, or other food-safe material.

5.1 Valve

[0070] In particular, the piston **120**: is configured to run vertically in the brew chamber **114**; and includes a valve **124** operable between a closed position and an open position. The valve **124** is operable in the open position during upward retraction of the piston **120** within the brew chamber **114**, thereby enabling reduced pressure in the brew chamber **114** to draw water—stored in the water reservoir **112**—through the fill port in the piston **120** and into the brew chamber **114**. Thus, as the piston **120** is retracted in the upward direction within the brew chamber **114**, the valve **124** can open to permit the system **100** to draw water from the water reservoir **112** into the brew chamber **114**. The valve **124** is further operable in the closed position during downward advancement of the piston within the brew chamber **114** in order to enable the system **100** to pressurize the brew chamber **114** and to prevent flow of additional water—stored in the water reservoir **112**—from flowing into the brew chamber **114**. Thus, while the piston **120** is advanced, the valve **124** remains in the closed position.

[0071] In one implementation, the valve **124** includes a check valve **124** (e.g., a ball check valve **124**) to control water flow (e.g., unidirectional flow) down into the brew chamber **114** (rather than release liquid upward). For example, the valve **124** can include a straight-through check-valve: arranged in the piston and fluidly coupled to the fill port; configured to transition into the closed position in response to an increase in pressure in the brew chamber **114** during downward advancement of the piston; and configured to transition into the open position in response to a decrease in pressure in the brew chamber **114** during upward retraction of the piston. Thus, the valve **124** can define a pressure-controlled valve **124** to control flow of water into the brew chamber **114** according to a water pressure in the check valve **124**.

[0072] In another implementation shown in FIG. **3**, the piston and the valve **124** are contiguous. In this implementation, the piston: includes a lower piston section sealed against a wall of the brew chamber **114** and defining the fill port; and an upper piston section coupled to the rocker arm **108** via a connecting rod and mechanically coupled to the lower piston section. When the actuator **109** advances the piston, the upper piston section: drives against the lower piston section and seals against the fill port, thereby preventing liquid from moving between the water reservoir **112** and the brew chamber **114**; and drives the lower piston section downwardly in the brew chamber **114**, thereby increasing pressure in the brew chamber **114**. Conversely, when the actuator **109** retracts the piston, the upper piston section: retracts from the lower piston section and unseals from the fill port, thereby enabling water to move from the water reservoir **112** into the brew chamber **114**; and lifts the lower piston section upwardly in the brew chamber **114**, thereby drawing water from the water reservoir **112** into the brew chamber **114**.

[0073] In a similar example, the piston includes a lower piston section configured to seal against an internal cylindrical internal wall of the brew chamber and defining the fill port. In this example, the valve includes an upper piston section interposed between the actuator and the lower piston section. In this example, in response to downward advancement of the piston, the upper piston section can: seal over the fill port in the lower piston section to set the valve in the closed position; and drive the lower piston section downwardly in the brew chamber. Similarly, in response to upward retraction of the piston, the upper piston section can: retract from the lower piston section to open the the fill port to the water reservoir and to set the valve in the open position; and lift the piston upwardly in the brew chamber.

[0074] In one variation, the valve can further function as an over-pressure valve configured to open in response to a pressure in the brew chamber exceeding a maximum brew pressure. Alternatively, the system **100** can include a separate over-pressure valve integrated into the piston or into the brew chamber.

6. Actuator

[0075] In one implementation, the system **100** includes an actuator **109** configured to drive the piston **120** within the brew assembly **110**. The system **100** can thus control water flow from the water reservoir **112** into the brew chamber **114**, liquid flow from the brew chamber **114** into a vessel below, and pressure within the brew chamber **114** solely based on motion of the piston (e.g., position and velocity) set via the actuator **109**.

[0076] In one implementation shown in FIGS. **2** and **3**, the actuator **109** includes a linear actuator arranged in the column **104** below the rocker box **106** and the rocker arm **108**. The rocker arm **108**: includes a pivot mounted to the column **104** over the brew assembly **110**; defines a first end coupled directly to the actuator **109**; and defines a second end coupled to the piston via a connecting rod. Thus, in the implementation, the controller **130** can: trigger the actuator **109** to retract, thereby rotating the rocker arm **108** and retracting the piston in the brew chamber **114**; and similarly trigger the actuator **109** to extend, thereby rotating the rocker arm **108** and advancing the piston in the brew chamber **114**.

[0077] In a similar implementation shown in FIG. **4**, the actuator **109** includes a linear actuator arranged over the brew assembly **110** and directly coupled to the piston. Thus, in the implementation, the controller **130** can: trigger the actuator **109** to retract, thereby retracting the piston in the brew chamber **114**; and similarly trigger the actuator **109** to extend, thereby advancing the piston in the brew chamber **114**.

[0078] In another implementation, the actuator **109** includes a rotary motor arranged in the column **104** and coupled to the rocker arm **108** via a second connecting rod (and/or a gearbox). Thus, in this implementation, the controller **130** can: trigger the actuator **109** to rotate in a first direction, thereby rotating the rocker arm **108** and retracting the piston in the brew chamber **114**; and similarly trigger the actuator **109** to rotate in a second direction, thereby rotating the rocker arm **108** and advancing the piston in the brew chamber **114**.

[0079] In a similar implementation, the actuator **109** includes a rotary motor: arranged over the brew assembly **110**; and including an eccentric crank arranged on an output shaft of the rotary motor and coupled to the piston via a connecting rod. Thus, in this implementation, the controller **130** can: trigger the actuator **109** to rotate in a first direction, retracting the piston in the brew chamber **114**; and similarly trigger the actuator **109** to rotate in a second direction, thereby advancing the piston in the brew chamber **114**.

[0080] However, the actuator **109** can include any other type of actuator coupled to the piston in any other way.

7. Heating Element

[0081] The system **100** includes a heating element **116** arranged in (or otherwise coupled to) the brew assembly **110** and configured to heat water occupying the water reservoir **112** and/or the brew chamber **114**.

[0082] For example, the heating element **116** can include a cartridge heater arranged in a bore or other receptacle in the brew assembly **110**, such as adjacent and extending parallel to the axis of the brew chamber **114**. In another example, the heating element **116** includes a band heater wrapped around the brew assembly **110**.

[0083] For example, the water reservoir **112** can be configured to accept a volume of cool water, such as between one and five fluid ounces. At the start of a brew cycle, the controller **130** can activate the heating element **116**, which thus heats the brew chamber **114** and water reservoir **112**, which thus heats this volume of water. Then, in response to detecting that the volume of water has reached a target brew temperature, the controller **130** can trigger the actuator **109** to retract the piston **120**, thereby reducing pressure in the brew chamber **114**, opening the valve **124**, and drawing a volume of heated water—equal to the swept volume of the piston during this retraction action-from the water reservoir **112** into the brew chamber **114**.

[0084] Therefore, the system **100** can: reduce brew cycle duration by heating only water contained in the brew assembly **110** (e.g., 1-5 ounces rather than 0.5-1.0 gallon of water); and both preheat water prior to a brew cycle and maintain water and ground temperature during a bloom period within the brew chamber **114** via a single heating element **116** (or a single heating element **116** assembly) integrated into the brew assembly **110**.

8. Sensors

[0085] The system **100** can further include a set of sensors, such as: a temperature sensor **134** configured to output a temperature signal representing a temperature of water in the water reservoir **112** and/or in the brew chamber **114**; a pressure sensor **136** configured to output a pressure signal representing a pressure within the brew chamber **114**; and/or a position sensor **132** configured to output a position signal representing a position (or a change in position) of the piston within the brew chamber **114**. (In one variation, the system **100** includes additional sensors, such as flow rate, weight, pH, humidity, and/or force sensors configured to output signals representing conditions in the brew chamber **114**, ambient conditions, and operational conditions of the system **100** during a brew cycle).

8.1 Temperature Sensor

[0086] The system **100** includes a temperature sensor **134** configured to output a temperature signal representing a temperature of a volume of water occupying the brew assembly **110**. More specifically, the system **100** can include a set of (i.e., one or more) temperature sensors **134** configured to output temperature signals representing the temperature of the volume of water occupying the brew chamber **114** and/or the water reservoir **112**.

[0087] In one implementation, the system **100** includes an upper temperature sensor **134** (e.g., a thermocouple): arranged in the piston proximal an upper surface of the piston; and configured to output a first temperature signal representing a temperature of a volume of water occupying the water reservoir **112**. In this implementation, the controller **130** can: retrieve a target pre-brew temperature (e.g., 185° F.) in preparation for a brew chamber **114**; monitor a temperature of water in the water reservoir **112** based on the temperature signal output by the upper temperature sensor **134**; and implement closed-loop controls (e.g., PID control, a bang-bang control) to selectively activate the heating element **116** to heat and maintain this volume of water at the target pre-brew temperature prior to the brew cycle.

[0088] In this implementation, because the water reservoir **112** and the brew chamber **114** are contiguous, the water reservoir **112** and the brew chamber **114** are both heated by the heating element **116**. Furthermore, because the piston contacts both the water reservoir **112** and the brew chamber **114**, the controller **130** can monitor and control temperatures of water in the water reservoir **112** and the brew chamber **114** via a single temperature sensor **134** and the heating element **116**.

[0089] Additionally or alternatively, in an instance of the system **100** with the screen **119**, the system **100** can include a lower temperature sensor **134** (e.g., a second thermocouple): arranged in the piston proximal a lower surface of the piston; and configured to output a second temperature signal representing a temperature of water occupying the brew chamber **114** (i.e., located between the piston and the portafilter **118**). In this implementation, the controller **130** can: retrieve a target brew temperature (e.g., 192° F.) from a set of brew parameters, such as predefined for a particular coffee roast; load pre-heated water from the water reservoir **112** into the brew chamber **114** between the piston and the screen **119** by triggering the actuator **109** to retract the piston; monitor a temperature of water in the brew chamber **114** based on the temperature signal output by the lower temperature sensor **134**; and activate the heating element **116** to heat this volume of water to the target brew temperature. Upon this water reaching the target brew temperature, the controller **130** can trigger the actuator **109** to advance the piston forward, thereby driving this water through the screen **119**, over the grounds, and through the portafilter **118** to complete the brew cycle.

[0090] Additionally or alternatively, in an instance of the system **100** without the screen **119**, the controller **130** can: retrieve a target bloom temperature (e.g., 192° F.) from the set of brew parameters; load pre-heated water from the water reservoir **112** into the brew chamber **114**—and thus in contact with the coffee grounds in the portafilter **118**—by triggering the actuator **109** to retract the piston; monitor a temperature of water in the brew chamber **114** based on the temperature signal output by the lower temperature sensor **134**; and implement closed-loop controls (e.g., PID control, a bang-bang control) to selectively activate the heating element **116** to heat and maintain this volume of water in the brew chamber **114** at the target bloom temperature during a bloom period, such as defined in the brew parameters. Upon completion of the bloom period (e.g., 30 seconds), the controller **130** can trigger the actuator **109** to advance the piston forward, thereby driving liquid through the portafilter **118** to complete the brew cycle.

[0091] Additionally or alternatively, the system **100** can include a temperature sensor arranged in the brew assembly and configured to output temperature values representing temperatures of water in the water reservoir and/or in the brew chamber. However, the system **100** can include any other type, position, or configuration of temperature sensor **134**(s) and/or heating elements **116**.

8.2 Pressure Sensor

[0092] In one variation, the piston further includes a pressure port **126** facing the brew chamber **114**. In this variation, the system **100** further includes a pressure sensor **136**: arranged in the piston; fluidly coupled to the pressure port **126**; and configured to output a pressure signal representing a pressure within the brew chamber **114** between the piston and the portafilter **118** (or between the piston and the screen **119**). Generally, in this variation, the system includes a pressure sensor **136** integrated directly into the piston. Accordingly, the controller **130** can: directly monitor a pressure within the brew chamber **114** during a brew cycle based on a pressure signal output by the pressure sensor **136**; and implement closed-loop controls to maintain a pressure within the brew chamber **114** by modulating a position of the piston (e.g., during a bloom period), by modulating a velocity of the piston (e.g., while advancing the piston downwardly near a conclusion of a brew cycle), and/or by modulating an output torque or output power of the piston.

[0093] In a similar implementation, the pressure port **126** is arranged in a wall of the brew chamber **114**; and the pressure sensor **136** is arranged in the brew assembly outside of the brew chamber and fluidly coupled to brew chamber via the pressure port **126**.

[0094] In another variation, the system **100** includes a force sensor, torque sensor, or physical or virtual load sensor coupled to, arranged on, or integrated into the actuator **109** and configured to output a signal representing a force output of the actuator **109**. As described above, the rocker arm **108** includes: a pivot mounted to the column **104**; a first end coupled to the actuator **109**; and a second end coupled to the piston via a connecting rod. Accordingly, during a brew cycle, the controller **130** can: access a target brew pressure from a set of brew parameters, such as predefined for a particular coffee roast; and monitor a force output of the actuator **109** via this sensor. The controller **130** can then monitor a pressure in the brew chamber **114** based on: the force output of the actuator **109**; a stored cross-sectional area of the piston; and a ratio of distances between the pivot, the first end, and the second end of the rocker arm **108**. The controller **130** can implement closed-loop controls to maintain the target brew pressure within the brew chamber **114** by modulating the position of the piston (e.g., during a bloom period), by modulating a velocity of the piston (e.g., while advancing the piston downwardly near a conclusion of a brew cycle), and/or by modulating an output torque or output power of the piston.

[0095] In a similar implementation, the controller **130** can monitor back-EMF of the actuator **109**, derive a force or torque output of the actuator **109** based on back-EMF of the actuator **109**, and convert this force or torque output to a pressure in the brew chamber **114**.

[0096] Additionally or alternatively, the system **100** can include a set of home switches that output signals representing presence of the actuator (or the piston) in maximum extension and retraction positions.

[0097] However, the system **100** can include any other type or configuration of physical or virtual pressure sensor **136**, and the controller **130** can implement any other methods or techniques to monitor or detect pressure in the brew chamber **114**.

8.3 Position Sensor

[0098] In another variation, the system **100** includes a position sensor **132** configured to output a position signal representing a position of the piston in the brew chamber **114**.

[0099] In one implementation, the position sensor **132** includes an angular positions sensor (e.g., a potentiometers) coupled to the rocker arm **108** and configured to output an angular position of the rocker arm **108**. Accordingly, in this implementation, the controller **130** can monitor an angular position of the rocker arm **108** via the position sensor **132** and convert this angular position of the rocker arm **108** into a vertical position of the piston in the brew chamber **114** based on a stored geometry of the rocker arm **108** and connecting rod.

[0100] In another implementation, the position sensor **132** includes a linear or rotary encoder arranged on the actuator **109**. Accordingly, in this implementation, the controller **130** can monitor a length of the actuator **109** via the position sensor **132** and convert this length of the actuator **109** into a vertical position of the piston in the brew chamber **114** based on a stored geometry of the actuator **109**, the rocker arm **108**, and the connecting rod.

[0101] In yet another implementation, the position sensor **132** includes a home sensor (or "home switch"): coupled to the actuator **109** or to the rocker arm **108**; and configured to indicate presence of the piston in the home position (e.g., a maximal lower position of the piston in the brew chamber **114**). In this implementation, the actuator **109** includes a stepper motor. Accordingly, the controller **130** can: trigger the actuator **109** to move the piston to the home position, such as at the start of a brew chamber **114**; then count steps of the stepper motor while moving the piston from the home position; and calculate a distance of the piston from the home position—and thus a position of the piston in the brew chamber **114**—based on a known position of the piston at the home position, the step count, and a stored geometry of the actuator **109**, the rocker arm **108**, and the connecting rod.

[0102] However, the system **100** can include any other type or configuration or physical or virtual position sensor, and the controller **130** can implement any other methods or techniques to monitor or detect a position of the piston in the brew chamber **114**.

8.4 Scale

[0103] In one variation, the base further defines a scale receptacle. In this variation, the system **100** further includes a scale **142** configured to transiently seat in the scale receptacle and to output a weight signal. Generally, in this variation, the scale **142** can be permanently or transiently (i.e., removably) arranged in the base and can output a weight signal representing a weight of an object arranged on the scale **142**, such as a coffee mug, prior to a brew cycle or a filled coffee mug upon completion of a brew cycle. Accordingly, in this variation, the controller **130** can: monitor a weight signal output by the scale **142**; detect placement of a vessel (e.g., a coffee mug, an espresso cup) on the scale **142** based on a change in the weight signal; and trigger the actuator **109** to advance the piston in the brew chamber **114** until the weight signal indicates an increase in weight on the scale **142** that corresponds to dispensation of a target controlled volume of coffee (e.g., 100 milliliters) into the vessel. Therefore, in this variation, the controller **130** can modulate motion of the actuator **109** motion based on weight of dispensed coffee rather than based on swept volume of the piston.

[0104] In one implementation, the scale **142** is removable and separately operable from the system **100**, such as for use as a kitchen scale **142**. In this implementation, the scale receptacle can include a charge receptacle; and the scale **142** can be battery operated and can include a charge port configured to engage the charge receptacle in response to insertion of the scale **142** onto the scale receptacle. The scale **142** can thus charge its internal battery via the charge receptacle when the scale **142** is installed in the scale receptacle under the brew assembly **110**.

[0105] In the foregoing implementation, the system **100** can also include a wireless communication module coupled to the controller **130** and configured to wirelessly receive a weight signal from the scale **142**. The system **100** can further include a display **152**: arranged on the column **104**; configured to render a brew parameter during the brew cycle; and configured to render a weight value received from the scale **142** in response to removal of the scale **142** from the scale receptacle. More specifically, in this implementation, the display **152** can render content related to an upcoming, ongoing, or recent brew cycle, options for configuration of brew parameters, or system settings, etc. by default when the scale **142** is loaded into the scale receptacle. However, when the scale **142** is removed from the scale receptacle, the controller **130** can: disable brew cycle operation; and update the display **152** to render weight values received wirelessly from the scale **142**. The system **100** can therefore: function as a remote display for the scale **142** when the scale **142** is removed from the scale receptacle; and function as an integrated coffee brewing machine configured to dispense metered volumes of coffee when the scale **142** is installed in the scale receptacle.

[0106] Additionally or alternatively, the system **100** can include a drip tray **140**: arranged in the base; and configured to catch liquid released from the portafilter **118** or water reservoir **112** and not caught by a vessel arranged below the portafilter **118**. The drip tray **140** can also be contiguous with or otherwise define the scale receptacle and can locate the scale **142** offset above liquid caught from the portafilter **118** or water reservoir **112** above.

9. Controller+Brew Cycle

[0107] As shown in FIG. **5**, the controller **130** is configured to execute a brew cycle, such as according to stored or retrieved brew parameters. In particular, a user may: load coffee grounds into the portafilter **118**; fill the water reservoir **112**—with the piston fully advanced to the bottom of the brew chamber **114**—with water; select a brew recipe, brew profile, or other input (e.g., via the display **152** and user interface **150** or by scanning coffee bean or coffee ground packaging) associated with a set of brew parameters; and then initiate a brew cycle (e.g., via the user interface **150**).

[0108] Based on the brew recipe, brew profile, or other input from the user, the controller **130**: retrieves a target brew volume for the brew cycle (i.e., target liquid dispense volume from the portafilter **118** upon conclusion of the brew chamber **114**); retrieves a target pre-brew temperature, a target brew temperature, and/or a target bloom temperature for the brew cycle; retrieves or calculates a piston retraction distance that corresponds to a swept volume of the piston equal to a target bloom volume for the brew cycle; retrieves or calculates a piston advancement distance that corresponds to a swept volume of the piston equal to the target brew volume for the brew cycle; retrieves a target brew pressure and/or bloom pressure in the brew chamber **114** during the brew cycle; and/or retrieves a target bloom duration.

[0109] The controller **130** then implements these brew parameters to output the target brew volume of coffee by: selectively actuating the heating element **116** to heat water in the water reservoir **112** and/or the brew chamber **114**; triggering the actuator **109** to selectively retract the piston by the piston retraction distance to load water into the brew chamber **114**; modulating a position of the piston in the brew chamber **114** via the actuator **109** to control pressure in the brew chamber **114**; and triggering the actuator **109** to selectively advance the piston by the piston advancement distance to dispense the target brew volume of liquid from the brew chamber **114** to complete the brew cycle.

9.1 Piston Travel Distance(s)

[0110] In one implementation, the controller **130**: retrieves a target brew volume (e.g., from a stored or retrieved brew recipe), from a selection entered by a user via the user interface **150**; and calculates a target piston travel distance—that corresponds to a piston swept volume equal to the target brew volume—by dividing the target brew volume by a stored cross-sectional area of the piston. During a brew cycle, the controller **130** thus: triggers the actuator **109** to retract the piston by this target piston travel distance to transfer a volume of water equal to the target brew volume from the water reservoir **112**, through the fill port, and into the brew chamber **114**; and then (e.g., immediately thereafter or following a dwell period equal to bloom duration specified in the brew parameters) triggers the actuator **109** to advance the piston by the target piston travel distance to dispense the target brew volume of liquid—less a volume of water absorbed by coffee grounds occupying the portafilter **118**—from the portafilter **118**.

[0111] In another implementation, the controller **130**: retrieves a target brew volume; and retrieves a nominal water saturation volume of coffee grounds occupying the portafilter **118** (e.g., one milliliter of water per two grams of coffee grounds; 20 milliliters of water per charge of coffee grounds). The controller **130** then calculates a target piston swept volume based on a sum of the target brew volume and the nominal water saturation volume; and transforms the piston swept volume into a target piston travel based on the stored cross-sectional area of the piston. During a brew cycle, the controller **130** thus: triggers the actuator **109** to retract the piston by this target piston travel distance to transfer a volume of water equal to a sum of the target brew volume and the nominal water saturation volume from the water reservoir **112**, through the fill port, and into the brew chamber **114**; and then triggers the actuator **109** to advance the piston by the target piston travel distance to dispense the target brew volume of liquid from the portafilter **118**.

9.2 Standard Brew Cycle With Bloom Period and Without Screen

[0112] In one implementation, the controller **130** triggers the actuator **109** to drive the piston to the bottom of the brew chamber **114** at the end of each brew cycle. In preparation for a next “standard” brew cycle, a user loads the water reservoir **112** with water. At the start of the brew cycle, the controller **130**: activates the heating element **116** to heat this volume of water to a target pre-brew temperature (e.g., 90-96° C., 195-205° F.); and monitors the temperature of this volume of water via the (upper) temperature sensor **134**. Then, in response to this volume of water reaching the target pre-brew temperature, the controller **130**: triggers the actuator **109** to retract the piston **120** upwardly by the target piston travel (or the target piston retraction distance), thereby inducing vacuum in the brew chamber **114**, opening the valve **124**, and drawing a volume of water—equal to the swept volume of the piston—into the brew chamber **114** and into contact with coffee grounds occupying the brew chamber **114**.

[0113] The controller **130** then: initiates a bloom timer for a bloom duration; monitors a temperature in the brew chamber **114** via the (lower) temperature sensor **134**; and implements closed-loop controls to maintain a temperature in the brew chamber **114** at a target bloom temperature by selectively activating the heating element **116**. For example, the controller **130** can: retrieve a target pre-brew temperature and a target bloom temperature; activate the heating element **116** to heat the volume of water occupying the water reservoir **112**; trigger the actuator **109** to retract the piston upwardly to draw water from the water reservoir **112** into the brew chamber **114** in response to the temperature of the volume of water in the water reservoir **112** approaching the target pre-brew temperature (e.g., as detected in a first temperature signal output by the upper temperature sensor **134** described above); selectively activate the heating element **116** to maintain liquid occupying the brew chamber **114** proximal the bloom temperature during a bloom period (e.g., based on a second temperature signal output by the lower temperature sensor **134** described above); and then trigger the actuator **109** to advance the piston downwardly to displace liquid from the brew chamber **114** in response to completion of the bloom period.

[0114] In this implementation, the controller **130** can also monitor a pressure in the brew chamber **114** directly via the pressure sensor **136** during the bloom period. Alternatively, the controller **130** can: trigger the actuator **109** to oscillate the piston over a very short throw (e.g., 0.5 millimeter, 0.020″); monitor force output of the actuator **109**, and implement methods and techniques described above to transform these force outputs of the actuator **109** into a pressure in the brew chamber **114**. The controller **130** can then implement closed-loop controls to maintain the pressure in the brew chamber **114** at a target brew pressure by selectively triggering the actuator **109** to advance the piston when the pressure drops below the target brew pressure and retracting or stopping the piston when the pressure exceeds the target brew pressure.

[0115] Upon expiration of the bloom timer (e.g., 0-30 seconds), the controller **130** triggers the actuator **109** to advance the piston downwardly toward the portafilter **118** by the target piston travel (or by the target advancement distance) to dispense the target brew volume from the portafilter **118** and into a vessel below. Furthermore, the controller **130** can: implement methods and techniques described above to monitor pressure in the brew chamber **114** while advancing the piston; and implement closed-loop controls to maintain a target brew pressure (or the target bloom pressure) in the brew chamber **114** by modifying a speed of the actuator **109**—and therefore a speed of the piston running in the brew chamber **114**.

[0116] For example, during the brew cycle, the controller **130** can: access the target brew pressure; monitor a pressure signal output by the pressure sensor **136**; trigger the actuator **109** to advance the piston downwardly toward the portafilter **118** at an initial speed; detect a first pressure in the brew chamber **114** at a first time based on the pressure signal received from the pressure sensor **136**;

reduce the initial speed of the actuator **109** to a first speed in response to the first pressure exceeding the target brew pressure; detect a second pressure in the brew chamber **114** at a second time based on the pressure signal received from the pressure sensor **136**; and increase the first speed to a second speed in response to the second pressure falling below the target brew pressure. Therefore, the controller **130** can modulate a speed of the actuator **109** while a) advancing the piston toward the portafilter **118** to maintain the target brew pressure within the brew chamber **114** and b) displacing liquid from the brew chamber **114**.

[0117] Then, in response to the piston reaching the bottom of the brew chamber **114**, the controller **130** can conclude the brew cycle.

9.2 Brew Cycle Without Bloom Period and With Screen

[0118] In another implementation, at the start of a brew cycle (e.g., an "espresso brew chamber **114** with screen"), the controller **130**: activates the heating element **116** to heat the volume of water in the water reservoir **112** to a target brew temperature (e.g., 90° C., 194° F.); and monitors the temperature of this volume of water via the temperature sensor **134** in the piston. Then, in response to this volume of water reaching the target brew temperature, the controller **130**: triggers the actuator **109** to retract the piston **120** upwardly by the target piston travel (or the target piston retraction distance), thereby inducing vacuum in the brew chamber **114**, opening the valve **124**, and drawing a volume of water—equal to the swept volume of the piston—into the brew chamber **114** between the piston and the screen **119**.

[0119] The controller **130** then: triggers the actuator **109** to advance the piston downwardly toward the screen **119** to force water through the screen **119**, across the portafilter **118**, and into contact with coffee grounds in the portafilter **118**. As water enters the volume between the screen **119** and the portafilter **118**, this water displaces air out of the portafilter **118**. A pressure required to displace air through the portafilter **118** (and to compress air remaining in the portafilter **118**) may be significantly less than a pressure required to displace water through the portafilter **118** (and to compress water in the portafilter **118**). Therefore, a force (or torque) output of the actuator **109** needed to move the piston at a nominal speed may increase and a pressure in the brew chamber **114** may similarly increase once water fully displaces air from the portafilter **118**, fills the volume between the screen **119** and portafilter **118**, and thus saturates coffee grounds in the portafilter **118**. Accordingly, the controller **130** can detect an instant that water fills the portafilter **118** (and thus detect saturation of the coffee grounds, or a "saturation event") based on an increase in force or torque output of the actuator **109**, an increase in current draw or back-EMF of the actuator **109**, and/or an increase in pressure in the brew chamber **114**.

[0120] The controller **130** can then: detect or interpret a saturation position of the piston at the instant of this saturation event; and trigger the actuator **109** to advance the piston downwardly from this position by a further target advancement distance corresponding to a piston swept volume equal to the target brew volume, thereby displacing (exactly) the target brew volume from the portafilter **118**.

[0121] In one example, during a brew cycle, the controller **130**: accesses or calculates a target advancement distance (or a target piston travel distance) corresponding to a piston swept volume approximating a target brew volume; and triggers the actuator **109** to advance the piston downwardly toward the portafilter **118**. Then, based on a pressure signal received from the pressure sensor **136** arranged in the piston, the controller **130**: detects a first pressure in the brew chamber **114** when the piston occupies a first piston position at a first time; and detects a second pressure in the brew chamber **114** when the piston occupies a second piston position, below the first piston position, at a second time succeeding the first time. Then, in response to a pressure difference between the first pressure and the second pressure exceeding a threshold pressure difference, the controller **130**: detects saturation of coffee grounds occupying the portafilter **118** at the second time; and triggers the actuator **109** to advance the piston downwardly to a third position, offset below the second position by the target advancement distance, to dispense the target brew volume of liquid from the portafilter **118**.

[0122] Furthermore, while advancing the piston over this target advancement distance, the controller **130** can also: implement methods and techniques described above to monitor pressure in the brew chamber **114** while advancing the piston; and implement closed-loop controls to maintain a target brew pressure in the brew chamber **114** by modifying a speed of the actuator **109**—and therefore a speed of the piston running in the brew chamber **114**. Then, in response to the piston reaching the target advancement distance below the saturation position in the brew chamber **114**, the controller **130** can conclude the brew cycle.

9.3 High-Pressure Brew Cycle

[0123] In one variation, the controller **130** executes a high-pressure brew cycle by creating a high-impulse shock in the brew chamber **114**—between piston retraction and piston advancement periods—in the standard brew cycle without screen, thereby driving coffee grounds into pores in the portafilter **118**, temporarily clogging these pores, increasing a pressure required to displace liquid through the portafilter **118** during the subsequent piston advancement period, and increasing a maximum brew pressure achievable in the brew chamber **114** during the brew cycle.

[0124] In one implementation, during a brew cycle, the controller **130**: triggers the actuator **109** to retract the piston **120** upwardly to draw water from the water reservoir **112**, through the valve **124**, and into the brew chamber **114**; then triggers the actuator **109** to advance the piston **120** downwardly over a first distance (e.g., 1 millimeter) toward the portafilter **118** at a first speed (e.g., 5 centimeters per second) and over a first time duration (e.g., 0.2 second) to drive coffee grounds into pores defined by the portafilter **118**; and then triggers the actuator **109** to advance the piston **120** downwardly toward the portafilter **118** over the target advancement distance (e.g., 5 centimeters) at a second speed (e.g., 0.5 centimeters per second) and over a second time duration (e.g., 10 seconds) to dispense liquid from the brew chamber **114** through the portafilter **118**.

[0125] The controller **130** can therefore create a high-impulse shock in the brew chamber **114** in order to clog pores in the portafilter **118**—and thus increase a maximum achievable pressure in the brew chamber **114** during a brew cycle—by rapidly advancing the piston **120** over a short distance within the brew chamber **114**. The controller **130** can execute this process before a bloom period in order to enable the system **100** to achieve a greater brew chamber **114** pressure during a subsequent bloom period. Alternatively, if brew parameters for the coffee specify a low-pressure bloom period followed by high-pressure dispense, the controller **130** can: implement methods and techniques described above to maintain the brew chamber **114** at a target bloom pressure after loading water into the brew chamber **114**; then create a high-impulse shock in the brew chamber **114** following completion of the bloom period and before advancing the piston **120** to dispense liquid from the brew chamber **114**.

[0126] In a similar variation, the controller **130** similarly executes a high-pressure brew cycle by creating a high-impulse shock in the brew chamber **114**—following a saturation event—in the brew cycle with screen, thereby driving coffee grounds into pores in the portafilter **118**, temporarily clogging these pores, increasing a pressure required to displace liquid through the portafilter **118** during the subsequent piston advancement period, and increasing a maximum brew pressure achievable in the brew chamber **114** during the brew cycle.

[0127] The controller **130** can therefore selectively create a high-impulse shock in the brew chamber **114** in order to increase maximum achievable brew pressure in the brew chamber **114** in response to brew parameters—selected by the user, read from product packaging, or otherwise loaded by the controller **130**—specifying a high-pressure brew chamber **114** or specifying a target brew pressure greater than a nominal maximum brew pressure associated with the portafilter **118**.

9.4 Weight-Based Dispense Control

[0128] In one variation described above in which the system **100** includes a scale

[0129] **142**, the controller **130** can: calculate or retrieve a piston retraction distance corresponding to a piston swept volume that loads a volume of water greater than (e.g., 20% greater than) a target brew volume (i.e., a total volume of coffee dispensed by the system **100** upon completion of a brew chamber **114**); trigger the actuator **109** to retract the piston **120** by this piston retraction distance during a brew chamber **114**; then trigger the actuator **109** to advance the piston **120**; monitor a weight signal output by the scale **142** while the actuator **109** advances the piston **120**; interpret a volume or weight of coffee dispensed into a vessel—loaded onto the scale **142**—based on this weight signal; and trigger the actuator **109** to cease advancement of the piston **120** in response to this volume or weight of coffee dispensed reaching the target brew volume.

[0130] The controller **130** can then: detect removal of the vessel from the scale **142** in response to the weight signal indicating a decrease in weight on the scale **142** (e.g., return to a tare weight); and then purge remaining liquid from the brew chamber **114**.

[0131] In this variation, the system **100** can also detect first dispense of liquid from the portafilter (eg a "first drop") in response to the the weight signal output by the scale **142** indicating an increase in weight on the scale **142**. The system can then: implement methods and techniques described herein displace the piston by a further downward distance to sweep the piston through a volume that corresponds to a target brew volume for the brew cycle; and/or modify a speed of the actuator, such as: to slow the piston and thus slow a dispense rate from the brew chamber for wider flavor extraction; or to accelerate the piston and thus increase a dispense rate from the brew chamber for narrower, more controlled flavor extraction from the coffee grounds.

9.5 Brew Chamber Purge

[0132] In one variation, the controller **130** purges remaining liquid from the brew chamber **114** following completion of the brew cycle.

[0133] In one implementation, the controller **130** can detect placement of a first vessel (e.g., a coffee mug, an espresso cup) under the portafilter **118** in response to a first change in the weight signal received from the scale **142**. Then, following detection of placement of the first vessel under the portafilter **118**, the controller **130** can: trigger the actuator **109** to retract the piston **120** to load water from the water reservoir **112** into the brew chamber **114**; and then trigger the actuator **109** to advance the piston **120**—such as to a dispense position or by a target advancement distance as described above—to displace liquid from the brew chamber **114**, through the portafilter **118**, and into the first vessel. The controller **130** can then: detect removal of the first vessel in response to a second change (i.e., a decrease) in the weight signal received from the scale **142**; and detect placement of a second vessel (e.g., a drip tray **140**, a purge vessel) under the portafilter **118** in response to a third change (i.e., an increase) in the weight signal received from the scale **142**. Following detection of placement of the second vessel under the portafilter **118**, the controller **130** can trigger the actuator **109** to advance the piston **120** from its current position (e.g., the dispense position) to a purge position (i.e., a maximum advancement position of the position) to displace remaining liquid from the brew chamber **114**, through the portafilter **118**, and into the second vessel.

[0134] In the foregoing implementation, the water reservoir **112** can be configured to store a maximum water volume less than twice a maximum swept volume of the piston **120** between the purge position and a maximum retracted position in the brew chamber **114**. Accordingly, following detection of placement of the second vessel under the portafilter **118**, the controller **130** can trigger the actuator **109** to retract the piston **120** to the maximum retracted position to transfer remaining water in the water reservoir **112** into the brew chamber **114**. The controller **130** can then trigger the actuator **109** to advance the piston **120** to the purge position, thereby: displacing remaining liquid from the brew chamber **114**, through the portafilter **118**, and into the second vessel; and compressing and drying coffee grounds occupying the portafilter **118**.

[0135] The user may then remove the portafilter **118** from the brew assembly **110** and discard the spent coffee grounds before returning the portafilter **118** to the brew assembly **110**.

9.5 Dynamic Pressure v. Flow Rate

[0136] As described above, the controller **130** can control pressure in the brew chamber **114** during a brew cycle by controlling velocity (or "advancement rate") and/or position of the piston **120** in the brew chamber **114**. For example, the controller **130** can implement an isobaric brew cycle with variable (e.g., dynamic) piston velocity and liquid dispense rate. In this implementation, the controller **130** can also implement a maximum piston velocity corresponding to a maximum liquid dispense rate that yields laminar (or otherwise smooth) flow of liquid from the portafilter **118**. The controller **130** can similarly implement a minimum piston velocity that corresponding to a maximum contact duration of water and coffee grounds in the brew chamber **114** during a brew cycle.

[0137] Conversely, the controller **130** can implement a constant piston velocity-and therefore a variable brew chamber **114** pressure-during a portion or all of the brew cycle, such as to achieve a consistent or target initial dispense rate from the portafilter **118**.

9.6 Controller: Pressure Adjustment vis. Flavor Profile

[0138] In one implementation, the system **100** can dynamically control and adjust pressure of the piston **120** during a brew cycle for a flavor profile-based brew cycle. More specifically, the system **100** can receive an input specifying a target flavor profile of a brewed volume of coffee, such as: "sweet"; "acidic"; and/or "bitter." The system **100** can then derive target brew parameters, such as brew pressure, and/or a brew cycle duration based on the target flavor profile. For example, in response to receiving input of a target flavor profile (e.g., "acidic"), the controller **130** can: during the brew cycle, trigger the actuator **109** to drive the piston **120** downward within the brew chamber **114** at a first target pressure (e.g., 13 bar) for a first time interval (e.g., 15 seconds); and trigger the actuator **109** to drive the piston **120** downward within the brew chamber **114** at a second target pressure (e.g., 11 bar) different from the first target pressure for a second interval of time (e.g., 5 seconds). In this example, during a second brew cycle, in response to receiving input of a second target flavor profile (e.g., "bitter), the controller **130** can dynamically derive and adjust pressure settings for different time intervals during the second brew cycle to brew a volume of coffee exhibiting the second target flavor profile. Thus, the system **100** can calibrate a set of settings (e.g., pressure inside of the brew chamber **114**, flow rate, temperature) and brew durations based on target flavor profiles characteristic of coffee to extract various flavor profiles from the coffee grounds.

10. Grinder

[0139] In one variation, the system **100** can communicate with a grinder (e.g., a coffee grinder) to identify coffee ground characteristics. More specifically, the system **100** can communicate with a grinder to receive a set of coffee ground characteristics descriptive of the coffee grounds contained in the portafilter **118**, such as: a roast type (e.g., dark roast, light roast); a grind profile based on a numerical scale **142** (e.g., "1"—fine, "5"—coarse"); and/or a mass of coffee grounds (e.g., 6-8 grams or 1.5-2 tsp). The system **100** can then adjust a set of brew parameters, such as: a brew cycle duration; a set of brew pressures; a flow rate of water; and/or a target brew temperature, based on the set of coffee ground characteristics received from the grinder. For example, the controller **130** can: receive a grind profile parameter, descriptive of a grind size, from a grinder; receive a weight parameter, descriptive of a weight of coffee grounds in the portafilter **118**, from the grinder; and, during a brew cycle, derive a set of target brew parameters (e.g., target pressure, target temperature, and target flow rate) based on the grind profile parameter and the weight parameter. Therefore, the system **100** can reduce or eliminate error from manual calibration of brew parameters based on user-derived measurements and estimations of the coffee grounds for the brew cycle.

[0140] In one implementation, the system **100** includes: a water tank configured to store and heat water prior to loading into the brew chamber; and a pump configured to transfer water from the water tank into the water reservoir **112**. For example, the water tank can be arranged in the column, and the controller **130** can trigger the pump to transfer a volume of water from the water tank into the water reservoir **112** in response to activation of a brew cycle.

[0141] In another example, the controller **130** is configured to communicate wirelessly with a grinder and receive, from the grinder: a coffee ground profile; a coffee ground weight; and/or a coffee ground volume. The controller **130** can then derive a set of target brew parameters for a brew cycle based on the coffee ground profile, the coffee ground weight, and/or the coffee ground volume.

11. Water Tank

[0142] In another variation, the system **100** includes: a water tank configured to store and heat water prior to loading into the brew chamber; and a pump configured to transfer water from the water tank into the water reservoir **112**. For example, the water tank can be arranged in the column, and the controller **130** can trigger the pump to transfer a volume of water from the water tank into the water reservoir **112** in response to activation of a brew cycle.

12. User Interface

[0143] In one implementation, the system **100** can include a user interface **150** including a knob **154** and a display **152**. More specifically, the system **100** can include: a display **152** (e.g., an LCD screen) on the front face of the column **104** adjacent the rocker box **106**; and a knob **154** arranged below the display **152** and configured to rotate between a set of positions (e.g., angles of rotation).

[0144] For example, the controller **130** can select: a first setting based on a first depression of the knob **154** at a first angle of rotation; and a second setting based on a second depression of the knob **154** at a second angle of rotation. In this example, for each angle of rotation, the display **152** can depict a new setting or performance metric (e.g., a current pressure metric, a current water temperature, a piston **120** displacement, a flow rate, a brew cycle timer, a weight of the vessel on the drip tray **140**).

[0145] More specifically, the system **100** can interface with a user via the user interface **150** to set target brew parameters for a brew cycle, such as: a target brew pressure or variable brew profile; a target brew temperature; a target pre-brew temperature; a target brew or bloom duration; and/or a brew volume; etc. The system **100** can then automatically execute these brew parameters during a subsequent brew cycle. The system **100** can then store these target brew parameters in local memory and repeat these target brew parameters in subsequent brew cycles when selected by a user via the user interface **150**.

[0146] In a similar implementation, the user interface **150** includes a display **152** arranged on the column **104** and a knob **154** arranged on the column **104** and configured to rotate between a set of positions. The controller **130** can then present a set of brew parameters via the display **152**, load brew parameters based on a selection entered manually via the knob **154**, and render confirmation of these brew parameters via the display **152**.

[0147] In another example, the system can raise or lower the piston, tare the scale, and/or start, end, or pause a brew cycle based on inputs to the user interface **150**.

[0148] In one variation, the system **100** wirelessly communicates with a mobile device, such as a tablet or a cellphone, as the user interface **150** in order to adjust brew parameters and remotely view system **100** performance metrics. In this implementation, the system **100** can communicate with a mobile application via a mobile device (e.g., a tablet, a phone) to select settings of a brew cycle. For example, during a brew cycle, a user can load the portafilter **118** with a volume of coffee grounds. Once the portafilter **118** is installed in the brew assembly **110**, the system **100** can receive, via the mobile application associated with the system **100**, a set of target brew parameters for the brew cycle, such as: a target flavor profile; a brew cycle start time; and/or a brew concentration. Thus, during the brew cycle, the system **100** can remotely calibrate brew parameters according to the set of target brew parameters based on user preferences.

[0149] The systems and methods described herein can be embodied and/or implemented at least in part as a machine configured to receive a computer-readable medium storing computer-readable instructions. The instructions can be executed by computer-executable components integrated with the application, applet, host, server, network, website, communication service, communication interface, hardware/firmware/software elements of a user computer or mobile device, wristband, smartphone, or any suitable combination thereof. Other systems and methods of the embodiment can be embodied and/or implemented at least in part as a machine configured to receive a computer-readable medium storing computer-readable instructions. The instructions can be executed by computer-executable components integrated by computer-executable components integrated with apparatuses and networks of the type described above. The computer-readable medium can be stored on any suitable computer readable media such as RAMs, ROMs, flash memory, EEPROMs, optical devices (CD or DVD), hard drives, floppy drives, or any suitable device. The computer-executable component can include a processor but any suitable dedicated hardware device can (alternatively or additionally) execute the instructions.

[0150] As a person skilled in the art will recognize from the previous detailed description and from the figures and claims, modifications and changes can be made to the embodiments of the invention without departing from the scope of this invention as defined in the following claims.

Claims

1. A system comprising: a brew assembly comprising: a water reservoir configured to store a first volume of water; and a brew chamber extending from and contiguous with the water reservoir; a piston: configured to run in the brew chamber; and defining a fill port extending between the water reservoir and the brew chamber; a valve coupled to the fill port and operable in: a closed position during advancement of the piston within the brew chamber; and an open position during retraction of the piston within the brew chamber; an actuator coupled to the piston; a scale configured to locate below the brew assembly; a heating element: coupled to the brew assembly; and configured to heat the first volume of water occupying the brew assembly; a controller configured to: activate the heating element; trigger the actuator to retract the piston to transfer water from the water reservoir and into the brew chamber via the fill port; trigger the actuator to advance the piston to displace liquid from the brew chamber; access the weight signal from the scale while the actuator advances the piston; calculate a dispense volume of liquid from the portafilter based on a weight signal output by the scale; and trigger the actuator to cease advancement of the piston in response to the dispense volume reaching a target brew volume.

2. The system of claim 1: further comprising: a temperature sensor configured to output a temperature signal representing a temperature of the first volume of water occupying the brew assembly; and a portafilter configured to transiently install on the brew assembly; and wherein the controller is further configured to: access the temperature signal from the temperature sensor; and trigger the actuator to retract the piston to transfer water from the water reservoir and into the brew chamber via the fill port in response to the temperature of the first volume of water reaching a target temperature.

3. A system comprising: a brew assembly comprising: a water reservoir configured to store a first volume of water; and a brew chamber extending from the water reservoir; a piston: configured to run in the brew chamber; and defining a fill port extending between the water reservoir and the brew chamber; a valve coupled to the fill port and operable in: a closed position during advancement of the piston within the brew chamber; and an open position during retraction of the piston within the brew chamber; an actuator: coupled to the piston; a heating element: coupled to the brew assembly; and configured to heat the first volume of water occupying the brew assembly; a first temperature sensor configured to output a first temperature signal representing a first temperature of the first volume of water occupying the water reservoir; a controller configured to: activate the heating element to heat the volume of water occupying the water reservoir; access the first temperature signal from the first temperature sensor; in response to the first temperature of the first volume of water approaching a target bloom temperature, trigger the actuator to retract the piston to draw water from the water reservoir into the brew chamber via the fill port; access the second temperature signal from the second temperature sensor; trigger the actuator to advance the piston to displace liquid from the brew chamber via the portafilter.

4. The system of claim 2: further comprising: a second temperature sensor configured to output a second temperature signal representing a second temperature of liquid occupying the brew chamber; and a portafilter configured to transiently couple to the brew chamber; and wherein the controller is further configured to: during a bloom period, activate the heating element to maintain liquid occupying the brew chamber proximal the target bloom temperature based on the second temperature signal; and trigger the actuator to advance the piston to displace liquid from the brew chamber via the portafilter in response to completion of the bloom period.