United States Patent Application Publication	20250263284
Kind Code	A1
Publication Date	August 21, 2025
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AUTOFILL PITCHER WITH ADDITIVE

Abstract

An autofill pitcher system includes a pitcher and a dispenser. The pitcher includes at least one pitcher wall and an internal volume defined within the at least one pitcher wall. The dispenser defines a cavity. The cavity is configured to receive the pitcher. The dispenser also includes a fill tube and a pod receiver. The fill tube is positioned and configured to direct a flow of water from a water supply into the internal volume of the pitcher when the pitcher is received within the cavity. The pod receiver is configured to hold a pod containing an additive. The pod receiver is in fluid communication with the internal volume of the pitcher whereby the dispenser is configured to provide the additive to the internal volume of the pitcher.

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Family ID: **1000007699644**

Appl. No.: **18/582773**

Filed: **February 21, 2024**

Publication Classification

Int. Cl.: **B67D1/00** (20060101); **B67D1/10** (20060101); **B67D1/12** (20060101); **F25D23/12** (20060101)

U.S. Cl.:

CPC **B67D1/0078** (20130101); **B67D1/0022** (20130101); **B67D1/108** (20130101); **B67D1/1202** (20130101); **F25D23/12** (20130101); F25D2331/81 (20130101); F25D2700/06 (20130101)

Background/Summary

FIELD OF THE INVENTION

[0001] The present subject matter relates generally to refrigerator appliances, and more particularly to autofill water dispensing systems for refrigerator appliances.

BACKGROUND OF THE INVENTION

[0002] Some refrigerator appliances include autofill dispensing systems. Autofill dispensing systems typically include a dispensing housing and a pitcher. When the pitcher is positioned in a designated spot, e.g., beneath the autofill housing, water is automatically dispensed into the pitcher.

[0003] Some users prefer water with an additive, such as flavorant, electrolytes, vitamins, and/or other similar additives. Typically, such additives are manually mixed with a volume of water. Manual mixing may be inconvenient, messy, and may result in uneven mixing of the water and additive, e.g., too much or too little flavor in one batch or another.

[0004] Accordingly, an autofill dispensing system in a refrigerator that includes features for automatically mixing water with an additive would be desirable.

BRIEF DESCRIPTION OF THE INVENTION

[0005] Aspects and advantages of the invention will be set forth in part in the following description, may be apparent from the description, or may be learned through practice of the invention.

[0006] In one exemplary aspect, a refrigerator appliance is provided. The refrigerator appliance includes a cabinet. The cabinet defines a fresh food chamber. The refrigerator appliance also includes an autofill pitcher system. The autofill pitcher system includes a pitcher and a dispenser. The pitcher includes at least one pitcher wall and an internal volume defined within the at least one pitcher wall. The dispenser defines a cavity. The cavity is configured to receive the pitcher. The dispenser also includes a fill tube and a pod receiver. The fill tube is positioned and configured to direct a flow of water from a water supply into the internal volume of the pitcher when the pitcher is received within the cavity. The pod receiver is configured to hold a pod containing an additive. The pod receiver is in fluid communication with the internal volume of the pitcher whereby the dispenser is configured to provide the additive to the internal volume of the pitcher.

[0007] In another example aspect, an autofill pitcher system is provided. The autofill pitcher system includes a pitcher and a dispenser. The pitcher includes at least one pitcher wall and an internal volume defined within the at least one pitcher wall. The dispenser defines a cavity. The cavity is configured to receive the pitcher. The dispenser also includes a fill tube and a pod receiver. The fill tube is positioned and configured to direct a flow of water from a water supply into the internal volume of the pitcher when the pitcher is received within the cavity. The pod receiver is configured to hold a pod containing an additive. The pod receiver is in fluid communication with the internal volume of the pitcher whereby the dispenser is configured to provide the additive to the internal volume of the pitcher.

[0008] These and other features, aspects and advantages of the present invention will become better understood with reference to the following description and appended claims. The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] A full and enabling disclosure of the present invention, including the best mode thereof,

directed to one of ordinary skill in the art, is set forth in the specification, which makes reference to the appended figures.

[0010] FIG. **1** provides a front view of a refrigerator appliance according to one or more exemplary embodiments of the present disclosure.

[0011] FIG. **2** provides a front view of the refrigerator appliance of FIG. **1** with refrigerator doors shown in an open configuration.

[0012] FIG. **3** provides a perspective view of a pitcher in accordance with one or more exemplary embodiments of the present disclosure.

[0013] FIG. **4** provides an enlarged side sectional view of a pitcher and lid in accordance with one or more exemplary embodiments of the present disclosure.

[0014] FIG. **5** provides an illustrative view of a pitcher received in a dispenser cavity in accordance with one or more exemplary embodiments of the present disclosure.

[0015] FIG. **6** provides a schematic illustration of some components of the dispenser of FIG. **5** according to one or more exemplary embodiments.

[0016] FIG. **7** provides an illustrative view of a pitcher received in a dispenser cavity in accordance with one or more additional exemplary embodiments of the present disclosure.

[0017] FIG. **8** provides a front elevation view of an exemplary dosing pump for a dispenser such as the exemplary dispenser of FIG. **7**.

[0018] FIG. **9** provides a rear perspective view of the exemplary dosing pump of FIG. **8**.

[0019] FIG. **10** provides a schematic illustration of some components of the dispenser of FIG. **7** according to one or more exemplary embodiments.

[0020] FIG. **11** provides a schematic illustration of an exemplary dispensing tube and an exemplary fill tube, along with exemplary liquid streams associated with each tube, as may be incorporated into an autofill dispenser in accordance with one or more embodiments of the present disclosure.

DETAILED DESCRIPTION

[0021] Reference now will be made in detail to embodiments of the invention, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used with another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents.

[0022] As used herein, the terms “first,” “second,” and “third” may be used interchangeably to distinguish one component from another and are not intended to signify location or importance of the individual components. The terms “includes” and “including” are intended to be inclusive in a manner similar to the term “comprising.” Similarly, the term “or” is generally intended to be inclusive (i.e., “A or B” is intended to mean “A or B or both”). In addition, here and throughout the specification and claims, range limitations may be combined and/or interchanged. Such ranges are identified and include all the sub-ranges contained therein unless context or language indicates otherwise. For example, all ranges disclosed herein are inclusive of the endpoints, and the endpoints are independently combinable with each other. The singular forms “a,” “an,” and “the” include plural references unless the context clearly dictates otherwise.

[0023] Approximating language, as used herein throughout the specification and claims, may be applied to modify any quantitative representation that could permissibly vary without resulting in a change in the basic function to which it is related. Accordingly, a value modified by a term or terms, such as “generally,” “about,” “approximately,” and “substantially,” are not to be limited to the precise value specified. In at least some instances, the approximating language may correspond to the precision of an instrument for measuring the value, or the precision of the methods or machines for constructing or manufacturing the components and/or systems. For example, the

approximating language may refer to being within a 10 percent margin, i.e., including values within ten percent greater or less than the stated value. In this regard, for example, when used in the context of an angle or direction, such terms include within ten degrees greater or less than the stated angle or direction, e.g., “generally vertical” includes forming an angle of up to ten degrees in any direction, e.g., clockwise or counterclockwise, with the vertical direction V.

[0024] The word “exemplary” is used herein to mean “serving as an example, instance, or illustration.” In addition, references to “an embodiment” or “one embodiment” does not necessarily refer to the same embodiment, although it may. Any implementation described herein as “exemplary” or “an embodiment” is not necessarily to be construed as preferred or advantageous over other implementations. Moreover, each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope of the invention. For instance, features illustrated or described as part of one embodiment can be used with another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents.

[0025] Turning to the figures, FIG. **1** provides a front view of an exemplary refrigerator appliance **100** according to one or more exemplary embodiments of the present disclosure. Refrigerator appliance **100** extends between a top **101** and a bottom **102** along a vertical direction V, between a left side **105** and a right side **106** along a lateral direction L, and extends between a front and a back along a transverse direction T (not shown), which is a direction orthogonal to the vertical direction V and the lateral direction L. Vertical direction V, lateral direction L, and transverse direction T are mutually perpendicular and form an orthogonal direction system.

[0026] Refrigerator appliance **100** includes a housing or cabinet **120** defining a chilled chamber, fresh food chamber **122**, and one or more freezer chambers, such as a first freezer chamber **124** and a second freezer chamber **125**, which may both be arranged below fresh food chamber **122** along the vertical direction V. In additional embodiments, the middle chamber may be a flexible chamber in place of first freezer chamber **124** and may be selectively operable at various temperatures for storing any desired food items, such as produce, wine, etc. As illustrated, fresh food chamber **122** is bounded by vertical walls at the left side **105** and at the right side **106**, such walls spaced apart in the lateral direction, a horizontal wall at the top **101** and at the bottom by a lower wall **132**. In this configuration, refrigerator appliance **100** may generally be referred to as a bottom mount, or bottom freezer, refrigerator. Cabinet **120** also defines a mechanical compartment (not shown) for receipt of a sealed cooling system (not shown).

[0027] Left and right refrigerator doors **126**, **128**, respectively, are rotatably hinged to an edge of cabinet **120** at left **105** and right **106** sides, respectively, for accessing fresh food chamber **122** (FIG. **2**) or sealing fresh food chamber **122** as illustrated in FIG. **1**. For example, upper and lower hinges may couple each door **126**, **128** to cabinet **120**. When left and right doors **126**, **128** are configured as illustrated in FIG. **1**, the door arrangement is sometimes referred to as a “French door” configuration. Freezer doors, such as a first freezer door **130** and a second freezer door **131**, may be arranged below refrigerator doors **126**, **128** for accessing one or more freezer chambers, such as first and second freezer chambers **124**, **125**, respectively. In the exemplary embodiment shown in FIG. **1**, freezer doors **130**, **131** are coupled to freezer drawers (not shown) slidably mounted within first and second freezer chambers **124**, **125**. Such drawers are thus generally “pull-out” drawers in that they can be manually moved into and out of freezer chambers **124**, **125** on suitable slide mechanisms. Each door **126**, **128**, **130**, **131** can include a handle for accessing one of the chambers **122**, **124**, **125** of refrigerator appliance **100**.

[0028] Referring still to FIG. **1**, a schematic diagram of an external communication system **110** will be described according to an exemplary embodiment of the present subject matter. In general, external communication system **110** is configured for permitting interaction, data transfer, and

other communications between appliance **100** and one or more external devices. For example, this communication may be used to provide and receive operating parameters, user instructions or notifications, performance characteristics, user preferences, or any other suitable information for improved performance of appliance **100**. In addition, it should be appreciated that external communication system **110** may be used to transfer data or other information to improve performance of one or more external devices or appliances and/or improve user interaction with such devices.

[0029] For example, external communication system **110** permits controller **200** of appliance **100** to communicate with a separate device external to appliance **100**, referred to generally herein as an external device **112**. As described in more detail below, these communications may be facilitated using a wired or wireless connection, such as via a network **114**. In general, external device **112** may be any suitable device separate from appliance **100** that is configured to receive communications, information, or data from the controller **200** regarding the operation of refrigerator appliance **100**, or provide commands from a user to the controller **200** of the refrigerator appliance **100**. In this regard, external device **112** may be, for example, a personal phone, a smartphone, a tablet, a laptop or personal computer, a wearable device, a smart home system, or another mobile or remote device. Controller **200** is in operative communication with external device **112** through network **114** of external communication system **110**.

[0030] In addition, a remote server **116** may be in communication with appliance **100** and/or external device **112** through network **114**. In this regard, for example, remote server **116** may be a cloud-based server **116**, and is thus located at a distant location, such as in a separate state, country, etc., from the appliance **100**. In additional embodiments, the remote server **116** may be in the fog or the edge instead of the cloud. According to an exemplary embodiment, external device **112** may communicate with a remote server **116** over network **114**, such as the Internet, to transmit/receive data or information, provide user inputs, receive user notifications or instructions, interact with or control appliance **100**, etc. In addition, external device **112** and remote server **116** may communicate with appliance **100** to communicate similar information.

[0031] In general, communication between appliance **100**, external device **112**, remote server **116**, and/or other user devices or appliances may be carried using any type of wired or wireless connection and using any suitable type of communication network, non-limiting examples of which are provided below. For example, external device **112** may be in direct or indirect communication with appliance **100** through any suitable wired or wireless communication connections or interfaces, such as network **114**. For example, network **114** may include one or more of a local area network (LAN), a wide area network (WAN), a personal area network (PAN), the Internet, a cellular network, any other suitable short- or long-range wireless networks, etc. In addition, communications may be transmitted using any suitable communications devices or protocols, such as via Wi-Fi®, Bluetooth®, Zigbee®, wireless radio, laser, infrared, Ethernet type devices and interfaces, etc. In addition, such communication may use a variety of communication protocols (e.g., TCP/IP, HTTP, SMTP, FTP), encodings or formats (e.g., HTML, XML), and/or protection schemes (e.g., VPN, secure HTTP, SSL).

[0032] External communication system **110** is described herein according to an exemplary embodiment of the present subject matter. However, it should be appreciated that the exemplary functions and configurations of external communication system **110** provided herein are used only as examples to facilitate description of aspects of the present subject matter. System configurations may vary, other communication devices may be used to communicate directly or indirectly with one or more associated appliances, other communication protocols and steps may be implemented, etc. These variations and modifications are contemplated as within the scope of the present subject matter.

[0033] FIG. **2** provides a front perspective view of refrigerator appliance **100** showing refrigerator doors **126**, **128** in an open position to reveal the interior of fresh food chamber **122**. Additionally,

freezer doors **130**, **131** are shown in partially open positions to reveal a portion of the interior of freezer chambers **124**, **125**, respectively.
[0034] Left door **126** of refrigerator appliance **100** includes an inner surface **134** and an outer surface **136**. Inner surface **134** generally defines a portion of the interior of fresh food chamber **122** when door **126** is in a closed position as shown in FIG. **1**. Outer surface **136** is generally opposite inner surface **134** and defines a portion of the exterior of refrigerator appliance **100** when door **126** is in the closed position.
[0035] The same construction may result in a similarly formed right door **128** as left door **126**, with inner surface **134** and outer surface **136**. Moreover, it will further be appreciated that freezer doors **130**, **131** can likewise include inner and outer surfaces.
[0036] Doors **126**, **128** may include storage bins or shelves **138** movably or fixedly attached to the inner surface **134** of the doors **126**, **128**. In the embodiment illustrated in FIG. **2**, left door **126** includes an autofill pitcher system **140** in accordance with this disclosure. An access door **242** may be provided proximate to the autofill pitcher system **140**, e.g., on the left door **126** in embodiments where the autofill pitcher system **140** is provided on the left door **126**. Components of the autofill pitcher system **140** may be positioned behind the access door **242**, such as a water filter (not shown) and/or a pod receiver **190** (see, e.g., FIGS. **5-7** and **10**). As will be described in further detail below, the pod receiver **190** may be configured to hold a pod containing an additive, e.g., flavorant. Thus, the pod receiver **190** may be accessible through the access door **242** in order to place, remove, and/or replace one or more additive pods in the pod receiver **190**. The autofill pitcher system **140** is illustrated on the left door **126** for convenience. In other embodiments, the autofill pitcher system **140** may be in a different position on the left door **126**, or on the right door **128**, or elsewhere within the fresh food chamber **122**.
[0037] It will be appreciated that the present subject matter can be used with other types of refrigerator appliances as well, such as top mount, or top freezer, refrigerator appliances or single door refrigerators, among other possible variations.
[0038] Consequently, the description set forth herein is not intended to limit the present subject matter in any aspect.
[0039] The autofill pitcher system **140** comprises a removable pitcher, pitcher **142**, a dispenser **180**, and controller **200**. Further details of exemplary pitcher **142** may be seen with reference to FIGS. **3**, **4**, **5**, and **7**. FIG. **3** is a perspective view of a representative pitcher **142** comprising a pitcher wall **144** connected to, or formed with, pitcher bottom **146**. In the illustrated exemplary embodiment, the pitcher wall **144** is a single continuous side wall which extends completely around the outermost perimeter of the pitcher bottom **146** and extends upward from the pitcher bottom **146** generally along the vertical direction V. It should be understood that references herein throughout to the orthogonal direction system including vertical direction V, lateral direction L, and transverse direction T in the context of the pitcher **142** are with reference to when the pitcher **142** is docked in the dispenser cavity **181** and, in embodiments where the autofill pitcher system **140** is provided on a door of the refrigerator appliance, the door is in the closed position.
[0040] A top edge **150** is formed by the pitcher wall **144** at the pitcher end opposite pitcher bottom **146**. The pitcher wall **144** and pitcher bottom **146** define an internal volume of the pitcher **142**, i.e., a pitcher volume **148**, accessible through opening **151** defined by the top edge **150**. In additional embodiments, the pitcher **142** may include a plurality of side walls which collectively extend completely around the outermost perimeter of the pitcher bottom **146** and thereby define the internal volume of the pitcher **142**, e.g., pitcher volume **148** may be enclosed on four sides (such as front, back, left, and right) by one or more side walls and on a fifth side (e.g., bottom) by the pitcher bottom **146**, and the pitcher volume **148** may be open on the sixth side, e.g., at the top edge **150**.
[0041] For convenience, top edge **150** may also define a spout **152** at a first end of the pitcher **142** to facilitate directing liquid into, or out of, the pitcher **142**. At a second end of the pitcher, opposite

the spout **152**, a handle **153** may be included to provide a gripping area to aid in manipulating the pitcher **142**.

[0042] Exemplary pitcher **142** is illustrated as a generally hollow rectangular cuboid for ease of illustration only. Other embodiments may have other shapes, for example a hollow cylinder, or may be non-prismatic, among other possible examples, and may or may not have features such as a spout or a handle.

[0043] As illustrated in FIG. **4**, embodiments of pitcher **142** may include a lid **154** removably received in, and fitted to, the opening **151** at the top edge **150**. The lid **154** may include a peripheral skirt **156** configured to be removably received in the opening **151** of pitcher **142**. Some embodiments of the skirt **156** may include features (not shown) that engage an inner portion of pitcher wall **144** at the top edge **150** to secure the lid against accidental separation from the pitcher **142**, such as one or more gaskets, tabs, and/or ridges which extend at least partially around the skirt **156** and engage or interact with the inner surface of one or more side walls of the pitcher **142**. Lid **154** may include a top wall **158** joined to, or formed with, the skirt **156**. Thus, the lid **154**, and in particular the top wall **158** thereof, may cooperate with the pitcher **142** to fully enclose the internal volume **148** when the lid **154** is received in the opening **151**.

[0044] In accordance with embodiments of this disclosure, lid **154** may include a channel **166** affixed to, or formed with, lid **154**. Channel **166** is generally cylindrical in shape with the longitudinal axis generally parallel to the vertical direction V (as noted above, such direction is with reference to when the pitcher **142** is received in the cavity of the dispenser). The wall of the cylindrical channel **166** may be perforated or sections removed to allow fluid communication with the pitcher volume **148**. In embodiments, water contained in the pitcher volume **148** can freely enter into, and flow out of, the channel **166**.

[0045] Float body **168** is illustrated as a generally cylindrical body for ease of illustration. Other shapes for the float body may be used as will be apparent. Float body **168** is disposed inside channel **166** and constrained for displacement, i.e., to allow free or generally free movement, in the vertical direction V. Float body **168** may move vertically between a first position in which the first end **170** of float body **168** is proximate to the inner surface **160** of lid **154** (FIG. **4**) and a second position (not shown) where the first end **170** is spaced apart from the inner surface **160**.

[0046] Float body **168** is a generally hollow structure formed or sealed to be at least liquid tight against intrusion of liquid (e.g., water). The float body **168** is configured to rise generally in the vertical direction V in reaction to the fluid level **171** in the internal volume **148** of the pitcher **142**. For example, in FIG. **4**, fluid level **171** is at a maximum desirable or full pitcher level and the float body **168** is at the first position, an upper position due to the buoyancy of the float body **168** in the liquid (e.g., water). A sensor trigger **164**, e.g., a magnet, may be positioned in the first end **170** of float body **168**. For example, the magnet may interact with a reed switch when the pitcher **142** is received in the cavity of the dispenser and the fluid level **171** is at the full pitcher level to indicate the pitcher is full and a fill operation may be stopped. In additional embodiments, any suitable sensor and sensor trigger may be used as well as or instead of the exemplary magnet and/or reed switch.

[0047] As illustrated for example in FIGS. **5** and **7**, dispenser **180** defines a cavity **181** to receive the pitcher **142**. In the illustrative embodiment shown in the figures, the dispenser **180** is positioned on the inner surface **134** of left door **126** of the refrigerator appliance **100**. Other embodiments may have the dispenser on other doors or elsewhere in the fresh food chamber **122**. As illustrated, the cavity **181** comprises a support or shelf **108** to support the pitcher **142** in the vertical direction V and a sensor board **188** adjacent to the lid **154** of the pitcher **142**. As illustrated, the shelf **108** is dedicated to support the pitcher **142** on the left door **126**. In other embodiments, the shelf **108** may not be a dedicated shelf for the pitcher **142**. The shelf **108** may have other or additional uses, for example storage of other food products on the door. In other embodiments, the shelf **108** may be within the cabinet **120**. Other features (not shown) may be provided to secure the pitcher **142** in the

cavity **181** during filling and as the door **126** is open and closed to provide access to the fresh food chamber **122**.

[0048] The dispenser **180** may include a fill tube **184** adapted to direct water from a water supply **178** to the pitcher **142**. The water supply **178** may be, for example, a water utility supply or a private source water supply, such as a private well. A valve **186** may be provided in line with the fill tube **184** between the water supply and the pitcher **142** to selectively allow the flow of water to the pitcher **142**. The valve is operatively coupled to the controller **200**.

[0049] Controller **200** (FIGS. **1** and **2**) controls the operation of the autofill pitcher system in that it interprets signals received from various sensors of the dispenser **180** and determines if the autofill operation should initiate and when it should stop. Controller **200** may include control circuits, a memory, clock(s), an input/output device such as user interface **118** (FIG. **1**), and a microprocessor, such as a general purpose or special purpose microprocessor operable to execute programming instructions or micro-control code associated with the operation of the autofill pitcher system. Alternatively, controller **200** may be constructed without using a microprocessor, e.g., using a combination of discrete analog or digital logic circuitry to perform control functionality instead of relying on software.

[0050] In the exemplary embodiment illustrated in FIGS. **5** and **7**, the fill tube **184** is positioned directly above the spout **152** of the pitcher **142**. In other embodiments, the fill tube **184** may be in other locations suitable to allow the flow of fluid (e.g., water) into the pitcher volume **148**. Fluid flow to the pitcher continues until a stop flow event occurs and the controller **200** receives a signal contraindicating the flow of liquid into the pitcher **142**.

[0051] As may be seen generally throughout FIGS. **5** through **11**, in some embodiments, the dispenser **180** may include a pod receiver **190**. The pod receiver **190** may be configured to hold a pod **192** containing an additive **194** (FIGS. **6** and **10**). In various embodiments, the pod receiver **190** may be in fluid communication with the internal volume **148** of the pitcher **142** whereby the dispenser **180** is configured to provide the additive **194** to the internal volume **148** of the pitcher **142**. For example, in some embodiments, the pod receiver **190** may be coupled to a dispensing tube **210**, and the additive **194** may flow from the pod **192** in the pod receiver **190** through the dispensing tube **210**. The dispensing tube **210** may be coupled to the fill tube **184**, whereby mixing of water and additive occurs at least partially in the fill tube **184** before reaching the pitcher **142**, or the dispensing tube **210** may be in direct fluid communication with the pitcher **142**, e.g., an end of the dispensing tube **210** may supply liquid additive to the internal volume **148** of the pitcher **142** without the liquid additive passing through any other intervening structures of the dispenser **180**.

[0052] Referring now to FIGS. **5** and **6** specifically, in some embodiments, the dispenser **180** may include a venturi injector **220**, and the dispensing tube **210** may be coupled to the fill tube **184** via the venturi injector **220**. For example, as illustrated in FIG. **6**, the dispensing tube **210** may be coupled between the pod receiver **190** and a suction port **226** of the venturi injector **220** and the venturi injector **220** may also be coupled with the fill tube **184**. In such embodiments, the venturi injector **220** may include an inlet **222** and an outlet **224**. The inlet **222** and the outlet **224** of the venturi injector **220** may be coupled in-line with the fill tube **184**, whereby the flow of water **250** flows into the venturi injector **220** at the inlet **222**. As the flow of water **250** moves through the venturi injector **220**, a suction is created (due to the geometry of the venturi injector **220**, as is understood by those of ordinary skill in the art), thereby drawing a flow of additive **240** into the venturi injector at the suction port **226**, thereby injecting additive **194** from the pod receiver **190** into the flow of water **250** through the suction port **226**. Thus, as the additive **240** and the water **250** flow to the outlet **224**, the liquids mix within the venturi injector **220**, thereby providing a flow of mixture **260** comprising water and the additive from the outlet **224** of the venturi injector **220**.

[0053] Referring now to FIGS. **7** through **11**, in some embodiments, the dispenser **180** may include a dosing pump **206**, and the dosing pump **206** may be operable and configured to urge additive **194** from the pod **192** in the pod receiver **190** to the pitcher **142**, either via a portion of the fill tube **184**

(e.g., as illustrated in FIGS. **7** and **10**) or directly into the pitcher (e.g., as illustrated in FIG. **11**).
[0054] As may be seen in FIGS. **7** and **10**, in some embodiments, the dosing pump **206** may be positioned between the pod receiver **190** and the pitcher **142**. The dispensing tube **210** may extend from the dosing pump **206** to the fill tube **184**. For example, in such embodiments, the dispensing tube **210** may be coupled to the fill tube **184** by a tee fitting **198**. Such embodiments may also optionally include a valve **196** between the pod receiver **190** and the tee fitting **198**, such as at a port of the tee fitting **198**, e.g., between the dosing pump **206** and the tee fitting **198**. Thus, the autofill pitcher system **140** may, in such embodiments where the valve **196** is provided, be operable to selectively provide, e.g., dispense, water with or without the additive based on the position (open or closed) of the valve **196**. That is, the valve **196** may be movable between an open position and a closed position, where the valve is configured to permit additive flow when in the open position and to obstruct additive flow when in the closed position. The valve **196** may also serve as a flow restrictor to provide additional control over the rate of additive dispensed to the pitcher **142**, e.g., when the valve is in an intermediate position between open and closed.
[0055] Referring now to FIGS. **8** and **9**, in some embodiments, the dosing pump **206** may be a peristaltic pump. For example, a segment of the dispensing tube **210** may extend through a housing **236** of the peristaltic pump **206**, and the peristaltic pump **206** may include a plurality of rollers **232**, each of which compresses a portion of the dispensing tube **210** between the roller **232** and the housing **236**. The peristaltic pump **206** may further include a motor **234** (FIG. **9**), such as a stepper motor, which is operable to rotate the rollers **232** within the housing **236** such that the rollers **232** progressively and sequentially compress portions of the dispensing tube **210**, thereby urging the additive **194** from the pod **192** in the pod receiver **190** through the dispensing tube **210** and to the pitcher **142**.
[0056] Turning now to FIG. **11**, an end portion of the dispensing tube **210** and a stream of additive **240** emanating from an outlet **211** of the dispensing tube **210** are illustrated, as well as an end portion of the water fill tube **184** with a stream of water **250** emanating from an outlet **223** of the water fill tube **184**. As may be seen in FIG. **11**, the water fill tube **184** is oriented at an oblique angle to the vertical direction V, such that the stream of water **250**, which flows to the water fill tube **184** at a generally constant pressure, defines an arcuate path outward from the end portion of the water fill tube **184** and downward along the vertical direction V under the combined influence of the upstream water pressure as the stream of water **250** exits the water fill tube **184** and the force of gravity on the stream of water **250**.
[0057] The end portion of the dispensing tube **210** may be oriented generally along or parallel to the vertical direction V, such that the stream of additive **240** from the dispensing tube **210** flows generally straight down. In some embodiments, the end portion of the dispensing tube **210** may be centered over the center of the spout **152**. The end portion of the dispensing tube **210** may be positioned directly in front of the end portion of the fill tube **184**, e.g., along the flow direction of the stream of water **250**. The outlet **211** of the dispensing tube **210** may be positioned above the outlet **223** of the fill tube **184**. The outlet **211** of the dispensing tube **210** may be offset from the outlet **223** of the fill tube **184** generally along a horizontal direction, e.g., a direction perpendicular to the vertical direction V. The end portion of the dispensing tube **210** may be aligned along a tangent to the arcuate stream of water **250** from the fill tube **184**. The stream of additive **240** and the stream of water **250** may intersect in the air, e.g., above the pitcher **142**, such as above the spout **152** thereof, forming a mixture **260** of water and additive. The mixture **260** may be generated at least in part due to the intermixing of the streams **240** and **250** outside of (e.g., above) the pitcher **142** and at least in part due to kinetic energy of the falling stream as the liquid lands in the internal volume **148** of the pitcher **142**. Thus, the outlet **211** of the dispensing tube **210** may be aligned with the outlet **223** of the fill tube **184** such that the flow of the liquid additive from the dispensing tube **210** mixes with the flow of liquid water from the fill tube **184** to form a mixed flow of liquid water and liquid additive.

[0058] As may be seen in FIG. **11**, the size, e.g., inner diameter, of the dispensing tube **210** may be less than, such as about half of or less than half of, the size, e.g., inner diameter, of the fill tube **184**. Additionally, the dosing pump **206** may be configured to provide a relatively slow velocity (e.g., low pressure) flow of additive through the dispensing tube **210**. Thus, the rate of flow of the stream of additive **240** may be much lower than the rate of flow of the stream of water **250**, such as the stream of additive **240** may be much smaller and slower than the stream of water **250**. For example, the flows may be synchronized, such that the flow time during a fill is the same for both streams, while the stream of additive **240** may be much smaller and slower such that the additive may account for about two percent of the mixture **260** or less, such as about 1.5% or less, such as about 1% or less, such as about 0.5% or less.

[0059] Accordingly, the pitcher **142**, e.g., the spout **152** and/or internal volume **148** thereof, may be positioned downstream of the dispensing tube **210** and downstream of the fill tube **184** when the pitcher **142** is received in the cavity **181**. The pitcher **142** may be configured for receiving the mixed flow of liquid water and liquid additive such that the mixture **260** of liquid water and liquid additive is formed at least partially in the pitcher **142**, e.g., the mixture **260** may be partially formed outside of the pitcher **142** as the liquid flows to the pitcher **142** (e.g., in the air) and further mixing may occur in the pitcher **142**.

[0060] In some embodiments, the autofill pitcher system **140** may include more than one pod receiver **190**. For example, the pod receiver **190** may be a first pod receiver configured to hold a first pod containing a first additive, and the dispenser **180** may further include a second pod receiver configured to hold a second pod containing a second additive. In such embodiments, multiple dosing pumps may be provided, such as one dosing pump for each pod receiver and a corresponding dispensing tube coupled to the pod receiver, with a one-to-one correspondence among the pumps, pod receivers, and dispensing tubes. In embodiments where multiple pod receivers are provided, each pod receiver may be coupled to the fill tube **184**, such as at a cross fitting instead of a tee fitting, or with multiple fittings, such as two or more tee fittings and/or cross fittings in various combinations. Also in embodiments where multiple pod receivers are provided, each pod receiver may be coupled to a corresponding dispensing tube, and each dispensing tube may direct a flow of the respective additive directly to the pitcher **142**, e.g., to the internal volume **148** thereof, at the spout **152** or any other suitable location on the pitcher **142**.

[0061] This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they include structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

Claims

1. A refrigerator appliance comprising: a cabinet defining a fresh food chamber; an autofill pitcher system comprising: a pitcher comprising at least one pitcher wall and an internal volume defined within the at least one pitcher wall; and a dispenser defining a cavity, the cavity configured to receive the pitcher, the dispenser comprising a fill tube and a pod receiver configured to hold a pod containing an additive, the fill tube positioned and configured to direct a flow of water from a water supply into the internal volume of the pitcher when the pitcher is received within the cavity, the pod receiver in fluid communication with the internal volume of the pitcher whereby the dispenser is configured to provide the additive to the internal volume of the pitcher.

2. The refrigerator appliance of claim 1, further comprising a venturi injector, a dispensing tube coupled between the pod receiver and a suction port of the venturi injector, the venturi injector

comprising an inlet and an outlet, the inlet and the outlet of the venturi injector coupled in-line with the fill tube, whereby the flow of water flows through the venturi injector at the inlet, thereby injecting additive from the pod receiver into the flow of water through the suction port.

3. The refrigerator appliance of claim 1, further comprising a dosing pump coupled to the pod receiver, wherein the dosing pump is configured to urge additive from the pod to the internal volume of the pitcher.

4. The refrigerator appliance of claim 3, further comprising a valve between the dosing pump and the internal volume of the pitcher, wherein the valve is movable between an open position and a closed position, the valve configured to permit additive flow when in the open position and to obstruct additive flow when in the closed position.

5. The refrigerator appliance of claim 3, wherein the dosing pump is a peristaltic pump.

6. The refrigerator appliance of claim 5, wherein the peristaltic pump is actuated by a stepper motor.

7. The refrigerator appliance of claim 1, further comprising a dispensing tube extending from the pod receiver, the dispensing tube coupled to the fill tube, whereby additive from the pod mixes with the flow of water in the fill tube upstream of the internal volume of the pitcher.

8. The refrigerator appliance of claim 1, further comprising a dispensing tube extending from the pod receiver to an outlet of the dispensing tube, the outlet of the dispensing tube positioned and oriented to direct a flow of additive into the internal volume of the pitcher.

9. The refrigerator appliance of claim 1, wherein the pod receiver is a first pod receiver configured to hold a first pod containing a first additive, further comprising a second pod receiver configured to hold a second pod containing a second additive.

10. An autofill pitcher system comprising: a pitcher comprising at least one pitcher wall and an internal volume defined within the at least one pitcher wall; and a dispenser defining a cavity, the cavity configured to receive the pitcher, the dispenser comprising a fill tube and a pod receiver configured to hold a pod containing an additive, the fill tube positioned and configured to direct a flow of water from a water supply into the internal volume of the pitcher when the pitcher is received within the cavity, the pod receiver in fluid communication with the internal volume of the pitcher whereby the dispenser is configured to provide the additive to the internal volume of the pitcher.

11. The autofill pitcher system of claim 10, further comprising a venturi injector, a dispensing tube coupled between the pod receiver and a suction port of the venturi injector, the venturi injector comprising an inlet and an outlet, the inlet and the outlet of the venturi injector coupled in-line with the fill tube, whereby the flow of water flows through the venturi injector from the inlet to the outlet, thereby injecting additive from the pod receiver into the flow of water through the suction port.

12. The autofill pitcher system of claim 10, further comprising a dosing pump coupled to the pod receiver, wherein the dosing pump is configured to urge additive from the pod to the internal volume of the pitcher.

13. The autofill pitcher system of claim 12, further comprising a valve between the dosing pump and the internal volume of the pitcher, wherein the valve is movable between an open position and a closed position, the valve configured to permit additive flow when in the open position and to obstruct additive flow when in the closed position.

14. The autofill pitcher system of claim 12, wherein the dosing pump is a peristaltic pump.

15. The autofill pitcher system of claim 14, wherein the peristaltic pump is actuated by a stepper motor.

16. The autofill pitcher system of claim 10, further comprising a dispensing tube extending from the pod receiver, the dispensing tube coupled to the fill tube, whereby additive from the pod mixes with the flow of water in the fill tube upstream of the internal volume of the pitcher.

17. The autofill pitcher system of claim 10, further comprising a dispensing tube extending from

the pod receiver to an outlet of the fill tube, the outlet of the fill tube positioned and oriented to direct a flow of additive into the internal volume of the pitcher.

18. The autofill pitcher system of claim 10, wherein the pod receiver is a first pod receiver configured to hold a first pod containing a first additive, further comprising a second pod receiver configured to hold a second pod containing a second additive.