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Farris

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(54) **DISHWASHING APPLIANCES AND FLUID-LOSS MITIGATION**

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A47L 15/16 (2006.01)
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(52) **U.S. Cl.**
CPC ***A47L 15/4212*** (2013.01); ***A47L 15/16*** (2013.01); *A47L 2401/06* (2013.01); *A47L 2401/14* (2013.01); *A47L 2501/01* (2013.01); *A47L 2501/26* (2013.01)

(58) **Field of Classification Search**
CPC A47L 15/16
See application file for complete search history.

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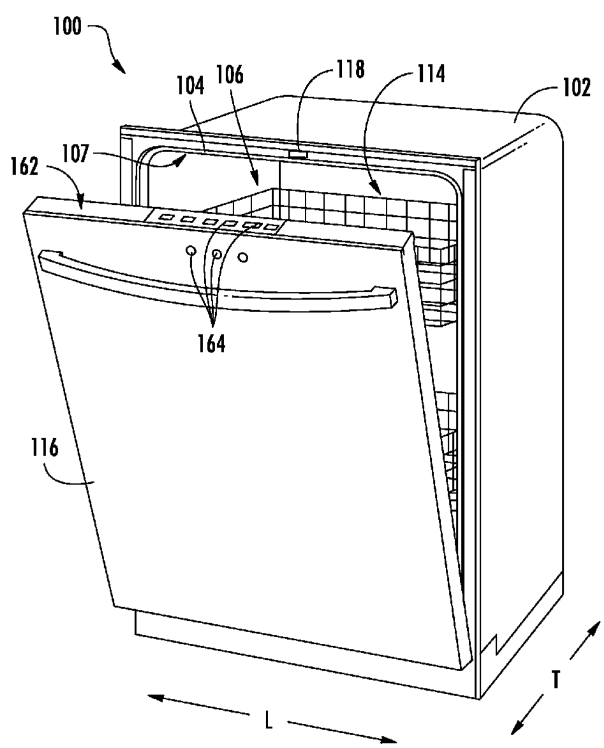
(57) **ABSTRACT**

A wash or dishwashing appliance may include a cabinet, a tub, a door, a fluid pump, a controller, a low-power input sensor, and a conditioning circuit. The controller may be configured to alternate between an active operational mode and a standby mode. The low-power input sensor may be configured to detect a fluid-loss event at the dishwashing appliance at the standby mode of the controller and transmit a fluid-loss signal in response to detecting the fluid-loss event. The conditioning circuit may be attached to the cabinet in electrical communication with the low-power input sensor and separate from the controller. The conditioning circuit may be configured to receive the fluid-loss signal apart from the controller at the standby mode and initiate a mitigation action in response to receiving the fluid-loss signal.

20 Claims, 7 Drawing Sheets



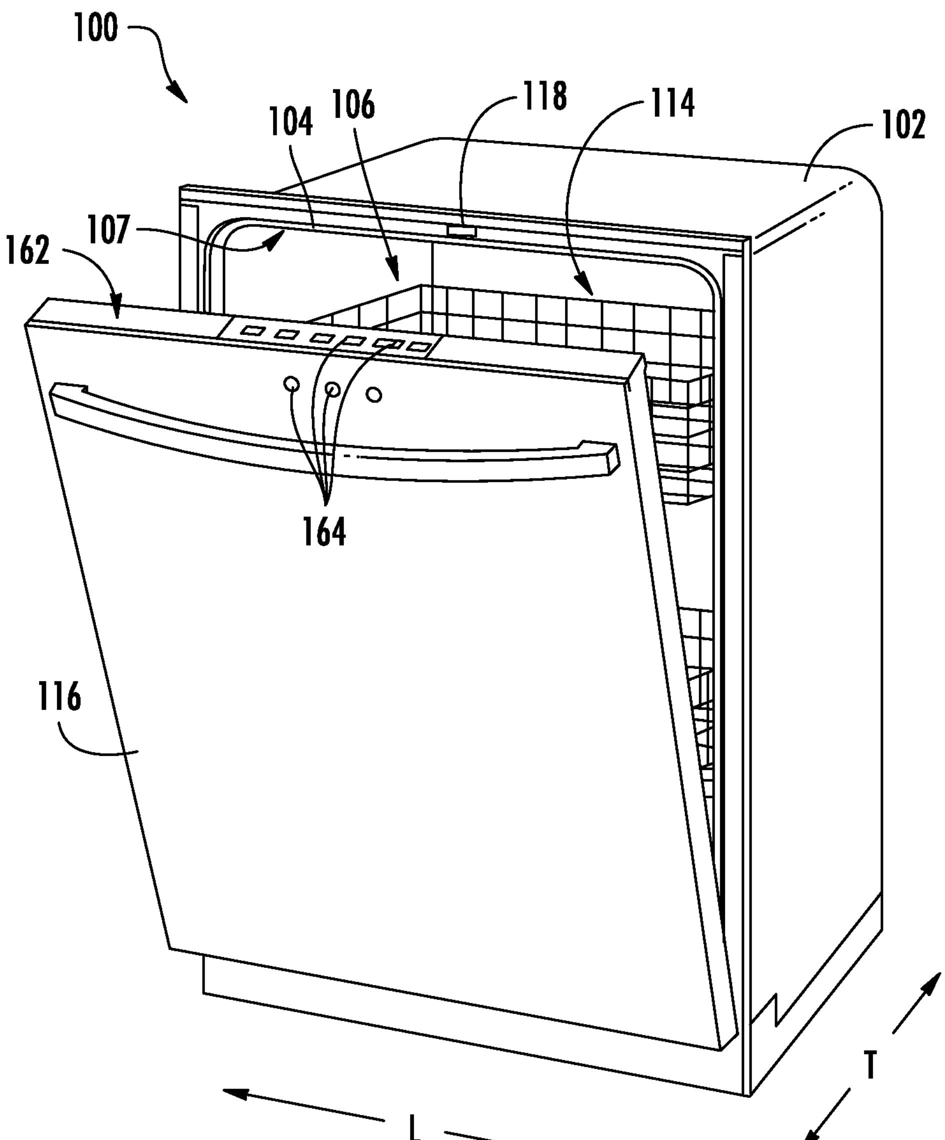
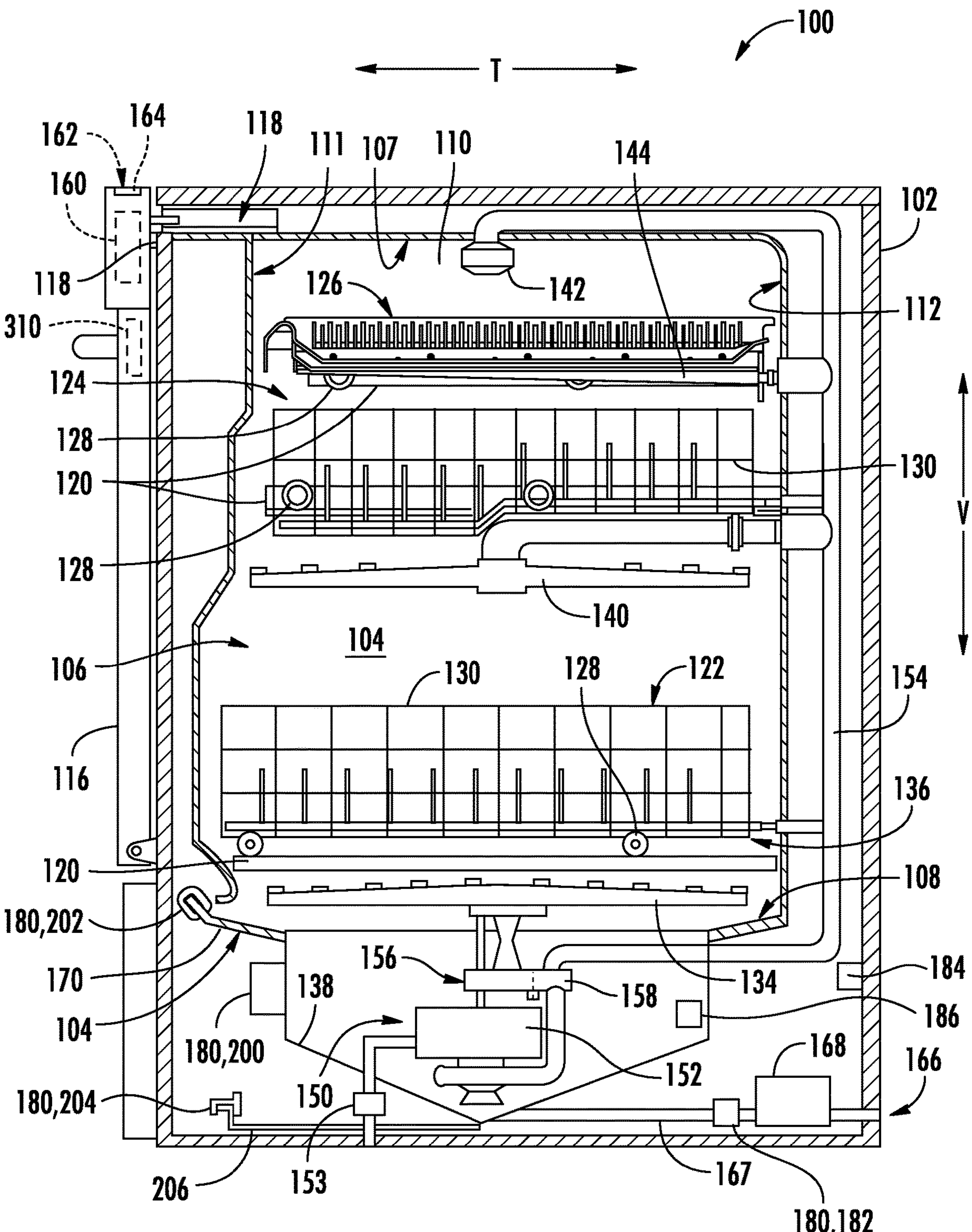


FIG. 1


100
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162
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118
111
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136
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180,202
170
156
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168
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206
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180,182

FIG. 2

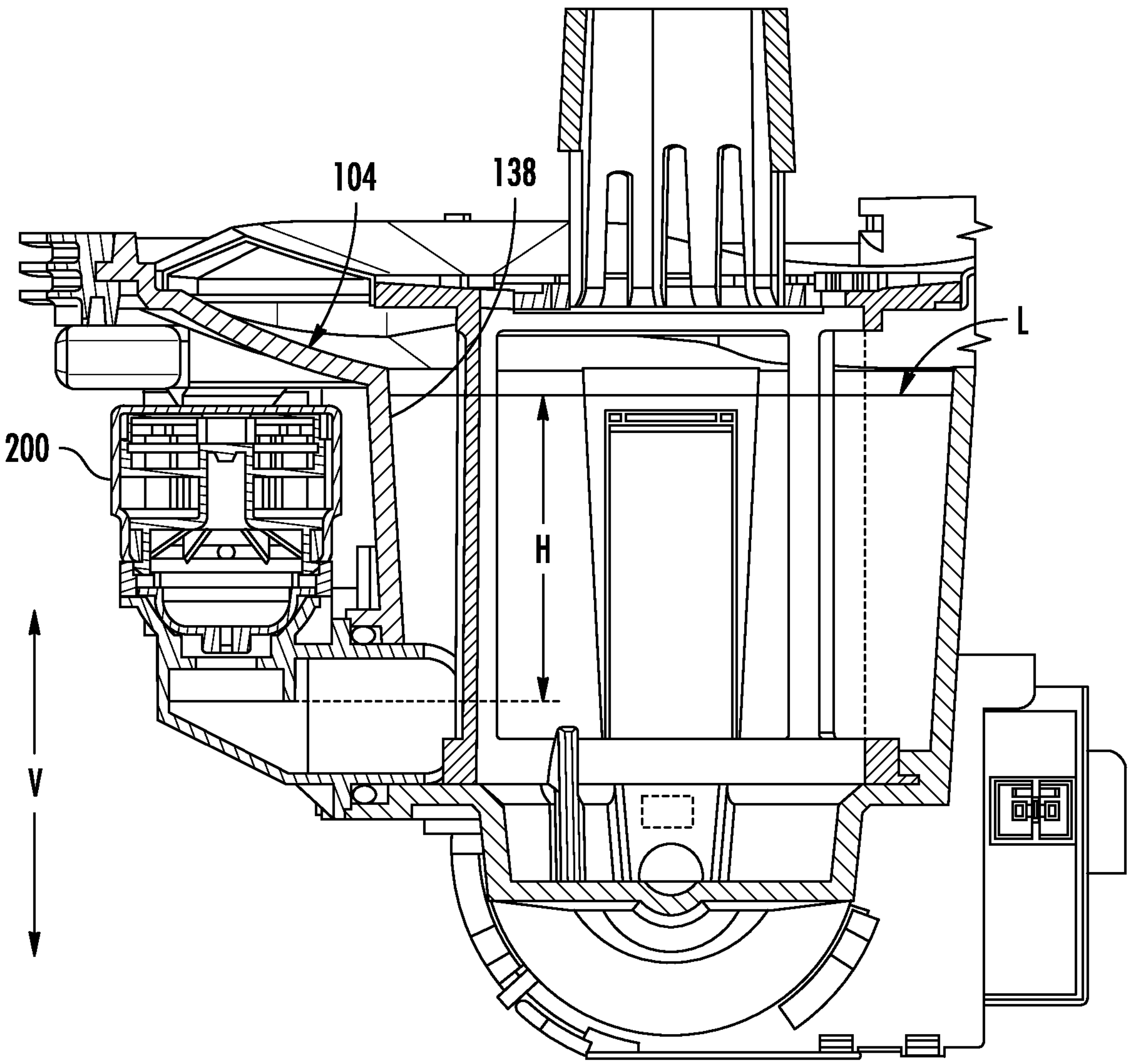


FIG. 3

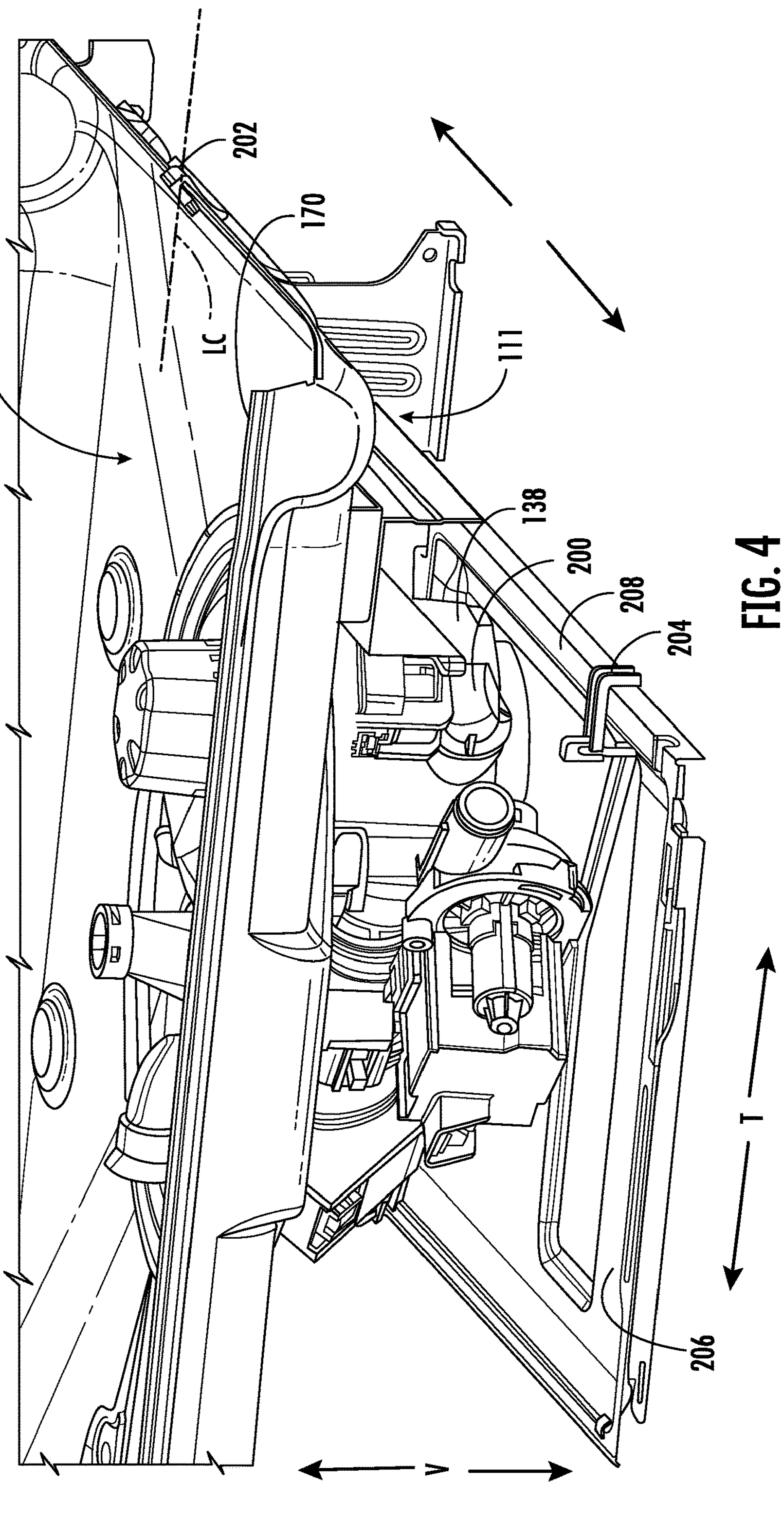


FIG. 4

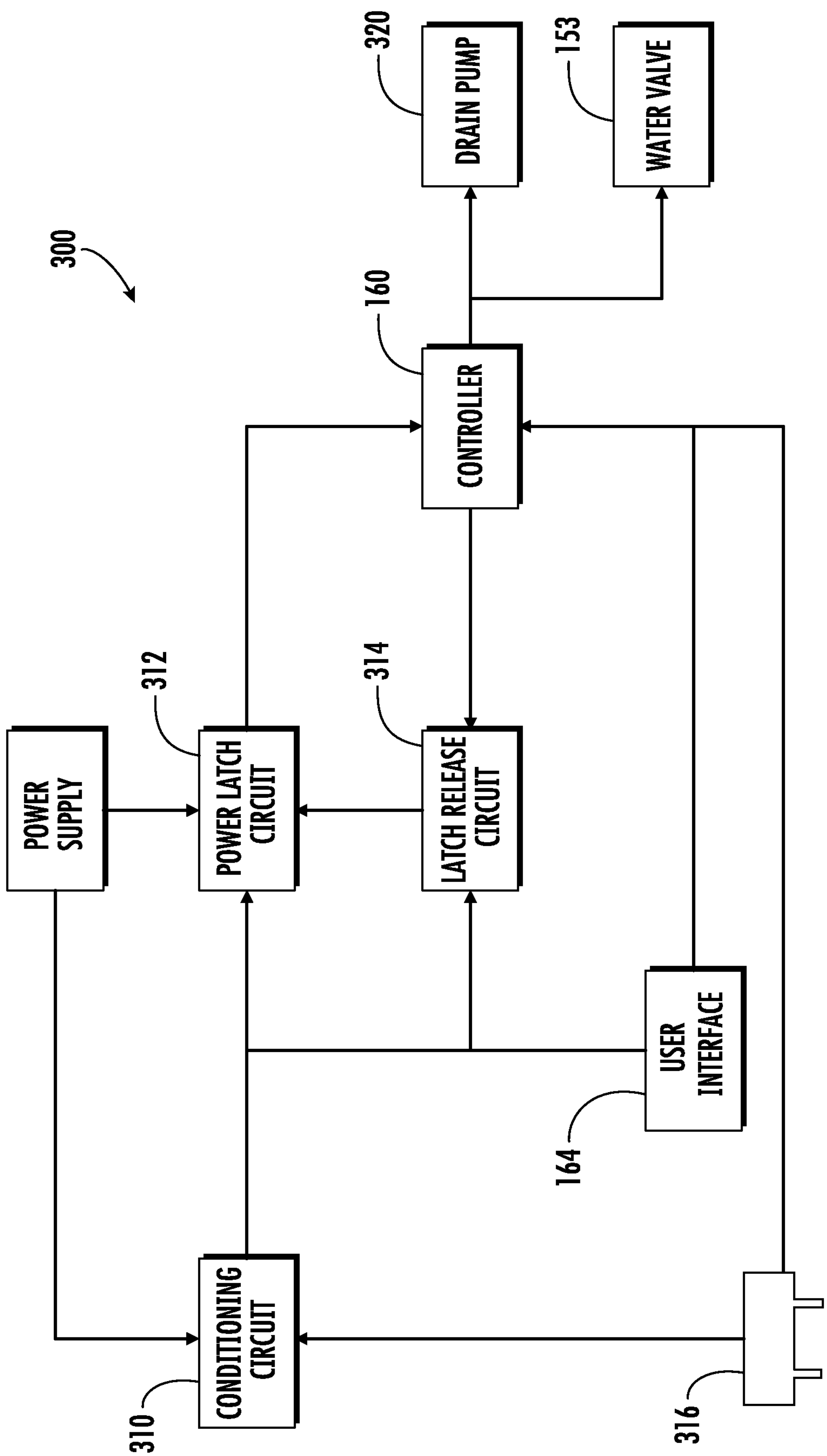
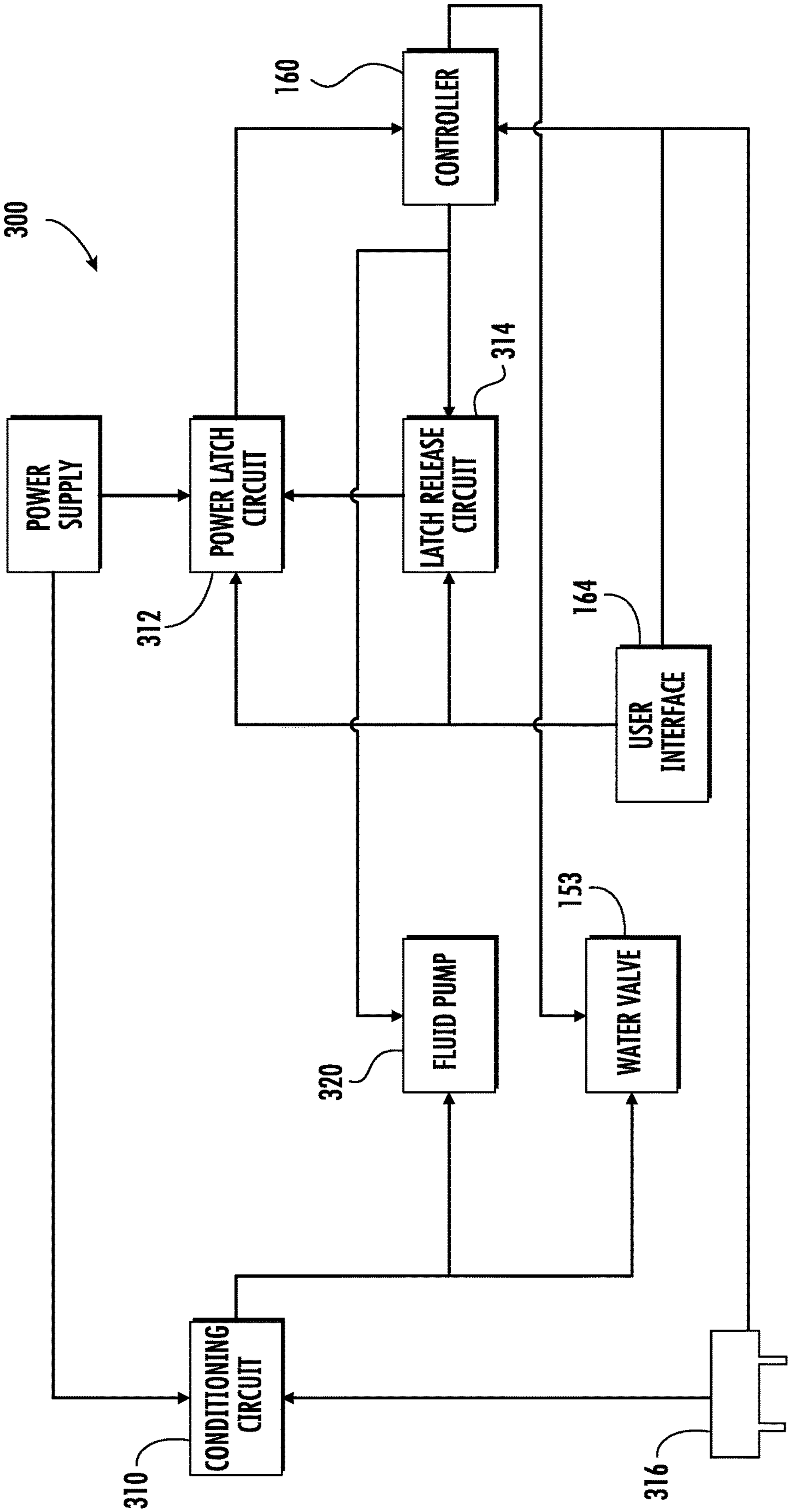

300
POWER SUPPLY
POWER LATCH CIRCUIT
312
LATCH RELEASE CIRCUIT
314
CONDITIONING CIRCUIT
310
CONTROLLER
160
DRAIN PUMP
320
WATER VALVE
153
USER INTERFACE
164
316

FIG. 5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164
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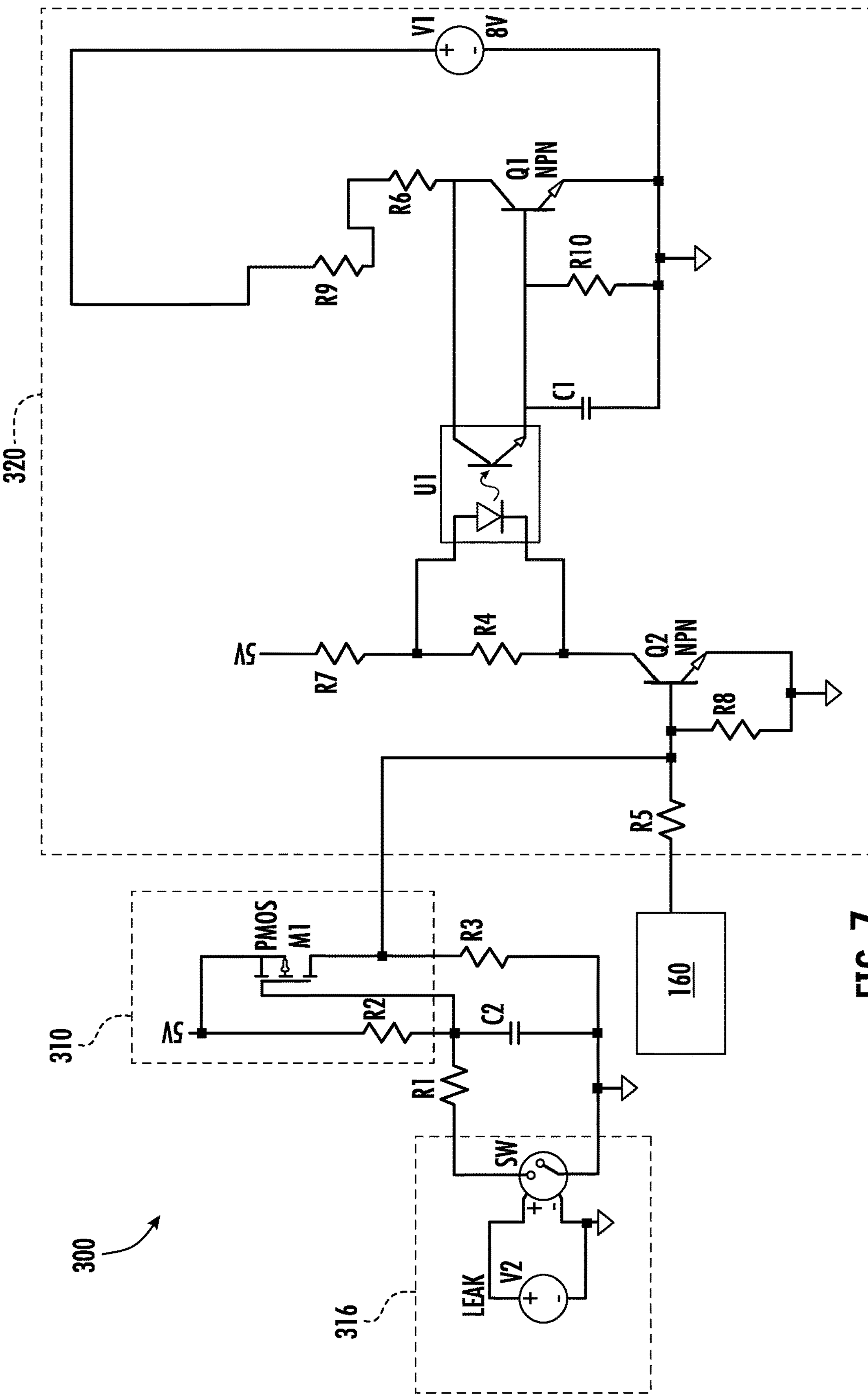
WATER VALVE
153
CONDITIONING CIRCUIT
310
316

FIG. 6



300
310
316
320
V1
8V
Q1
NPN
R6
R9
R10
C1
U1
5V
R7
R4
Q2
NPN
R8
R5
160
PMOS
M1
R3
R2
C2
5V
R1
SW
LEAK
V2

FIG. 7

DISHWASHING APPLIANCES AND FLUID-LOSS MITIGATION

FIELD OF THE DISCLOSURE

The present subject matter relates generally to dishwashing appliances, and more particularly to features for addressing potential fluid-loss of a dishwashing appliance.

BACKGROUND OF THE DISCLOSURE

Dishwashing appliances generally include a tub that defines a wash chamber. Rack assemblies can be mounted within the wash chamber of the tub for receipt of articles for washing. Multiple spray assemblies can be positioned within the wash chamber for applying or directing wash fluid (e.g., water, detergent, etc.) towards articles disposed within the rack assemblies in order to clean such articles. Dishwashing appliances are also typically equipped with one or more pumps, such as a circulation pump or a drain pump, for directing or motivating wash fluid from the wash chamber (e.g., to the spray assemblies or an area outside of the dishwashing appliance).

Conventional dishwashing appliances often include one or more pressure sensors to detect water pressure within the dishwashing appliance (e.g., during a wash cycle). In particular, such pressure sensors may be provided to detected elevated pressure states, which may indicate a clog or some other issue within the wash chamber is causing the dishwashing appliance to be at risk of flooding. As a way of addressing such concerns, typical dishwashing appliances are configured to stop a washing operation or wash cycle as soon as an excessive pressure is detected.

It is notable that fluid-loss events, such as flooding or leaks, may occur outside of an active cycle or operation. Although existing systems may be useful to detect or mitigate flooding during the course of a wash cycle or operation, they may not be suitable for detecting or mitigating flooding or leaks outside of an active cycle or operation. In particular, existing systems typically require a main controller; which controls the user interface, pumps, and general wash cycle execution; to be fully powered. Attempts to use such systems continuously (e.g., even when a cycle is not being performed) can significantly impact the power use of the appliance, and thus increase the cost of owning and operating the appliance.

As a result, it may be useful to provide a system or assembly capable of addressing potential fluid-loss events outside of an active cycle or operation. In particular, it would be advantageous to provide a low-power system or assembly for continuously addressing potential fluid-loss events.

BRIEF DESCRIPTION OF THE DISCLOSURE

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

In one exemplary aspect of the present disclosure, a dishwashing appliance is provided. The dishwashing appliance may include a cabinet, a tub, a door, a spray assembly, a fluid pump, a controller, a low-power input sensor, and a conditioning circuit. The tub may be positioned within the cabinet and define a wash chamber for receipt of articles for washing. The door may be mounted to the cabinet to selectively restrict access to the tub. The spray assembly may be positioned within the wash chamber. The fluid pump may be in fluid communication with the wash chamber. The controller may be configured to alternate between an active operational mode and a standby mode in which a power draw at the controller is less than a power draw of the active operational mode. The low-power input sensor may be configured to detect a fluid-loss event at the dishwashing appliance at the standby mode of the controller and transmit a fluid-loss signal in response to detecting the fluid-loss event. The conditioning circuit may be attached to the cabinet in electrical communication with the low-power input sensor and separate from the controller. The conditioning circuit may be configured to receive the fluid-loss signal apart from the controller at the standby mode and initiate a mitigation action in response to receiving the fluid-loss signal.

In another exemplary aspect of the present disclosure, a wash appliance is provided. The wash appliance may include a cabinet, a tub, a door, a fluid pump, a controller, a low-power input sensor, and a conditioning circuit. The tub may be positioned within the cabinet and define a wash chamber for receipt of articles for washing. The door may be mounted to the cabinet to selectively restrict access to the tub. The fluid pump may be in fluid communication with the wash chamber. The fluid pump may be a drain pump mounted within the cabinet downstream from the wash chamber. The controller may be configured to alternate between an active operational mode and a standby mode in which a power draw at the controller is less than a power draw of the active operational mode. The low-power input sensor may be configured to detect a fluid-loss event at the wash appliance at the standby mode of the controller and transmit a fluid-loss signal in response to detecting the fluid-loss event. The conditioning circuit may be attached to the cabinet in electrical communication with the low-power input sensor and the controller. The conditioning circuit may be configured to receive the fluid-loss signal apart from the controller at the standby mode and initiate a mitigation action in response to receiving the fluid-loss signal. The mitigation action may include directing activation of a water-flow component within the cabinet apart from the controller.

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.

BRIEF DESCRIPTION OF THE DRAWINGS

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.

FIG. **1** provides a perspective view of an exemplary embodiment of a dishwashing appliance of the present disclosure with a door in a partially open position.

FIG. **2** provides a side, cross sectional view of the exemplary dishwashing appliance of FIG. **1**.

FIG. **3** provides a close up, cross sectional view of a sump and a pressure sensor of the dishwashing appliance of FIGS. **1** and **2**.

FIG. **4** provides a perspective view of an exemplary tub lip sensor coupled with a tub lip of a tub of the dishwasher appliance of FIGS. **1** and **2** and a leak pan sensor coupled with a leak pan of the dishwasher appliance.

FIG. **5** provides a schematic view of various operational elements of a dishwashing appliance according to certain exemplary embodiments of the present disclosure.

FIG. **6** provides a schematic view of various operational elements of a dishwashing appliance according to other exemplary embodiments of the present disclosure.

FIG. **7** provides another schematic view, including a circuit, of various operational elements of a dishwashing appliance according to other exemplary embodiments of the present disclosure.

Repeat use of reference characters in the present specification and drawings is intended to represent the same or analogous features or elements of the present invention.

DETAILED DESCRIPTION

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 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.

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 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.

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 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, such as, clockwise or counterclockwise, with the vertical direction V).

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.

The terms "upstream" and "downstream" refer to the relative flow direction with respect to fluid flow in a fluid pathway. For instance, "upstream" refers to the flow direction from which the fluid flows, and "downstream" refers to the flow direction to which the fluid flows. The term "article" may refer to, but need not be limited to dishes, pots, pans, silverware, and other cooking utensils and items that can be cleaned in a dishwashing appliance. The term "wash cycle" is intended to refer to one or more periods of time during which a dishwashing appliance operates while containing the articles to be washed and uses a wash fluid (e.g., water, detergent, or wash additive). The term "rinse cycle" is intended to refer to one or more periods of time during which the dishwashing appliance operates to remove residual soil, detergents, and other undesirable elements that were retained by the articles after completion of the wash cycle. The term "drain cycle" is intended to refer to one or more periods of time during which the dishwashing appliance operates to discharge soiled water from the dishwashing appliance. The term "wash fluid" refers to a liquid used for washing or rinsing the articles that is typically made up of water and may include additives, such as detergent or other treatments (e.g., rinse aid).

Except as explicitly indicated otherwise, recitation of a singular processing element (e.g., "a controller," "a processor," "a microprocessor," etc.) is understood to include more than one processing element. In other words, "a processing element" is generally understood as "one or more processing element." Furthermore, barring a specific statement to the contrary, any steps or functions recited as being performed by "the processing element" or "said processing element" are generally understood to be capable of being performed by "any one of the one or more processing elements." Thus, a first step or function performed by "the processing element" may be performed by "any one of the one or more processing elements," and a second step or function performed by "the processing element" may be performed by "any one of the one or more processing elements and not necessarily by the same one of the one or more processing elements by which the first step or function is performed." Moreover, it is understood that recitation of "the processing element" or "said processing element" performing a plurality of steps or functions does not require that at least one discrete processing element be capable of performing each one of the plurality of steps or functions.

Turning now to the figures, FIGS. **1** and **2** depict an exemplary dishwasher or dishwashing appliance (e.g., dishwashing appliance **100**) that may be configured in accordance with aspects of the present disclosure. Generally, dishwasher **100** defines a vertical direction V, a lateral direction L, and a transverse direction T. Each of the vertical direction V, lateral direction L, and transverse direction T are mutually perpendicular to one another and form an orthogonal direction system.

Dishwasher **100** includes a cabinet **102** having a tub **104** therein that defines a wash chamber **106**. As shown in FIG. **2**, tub **104** extends between a top **107** and a bottom **108** along the vertical direction V, between a pair of side walls **110** along the lateral direction L, and between a front side **111** and a rear side **112** along the transverse direction T.

Tub **104** includes a front opening **114** (FIG. **1**) and a door **116** hinged at its bottom for movement between a normally closed vertical position (shown in FIG. **2**), wherein the wash chamber **106** is sealed shut for washing operation, and a horizontal open position for loading and unloading of articles from the dishwasher **100**. Dishwasher **100** includes a door closure mechanism or assembly **118** that is used to lock and unlock door **116** for accessing and sealing wash chamber **106**.

As further shown in FIG. **2**, tub side walls **110** accommodate a plurality of rack assemblies. More specifically, guide rails **120** are mounted to side walls **110** for supporting a lower rack assembly **122**, a middle rack assembly **124**, and an upper rack assembly **126**. Upper rack assembly **126** is positioned at a top portion of wash chamber **106** above middle rack assembly **124**, which is positioned above lower rack assembly **122** along the vertical direction V. Each rack assembly **122**, **124**, **126** is adapted for movement between an extended loading position (not shown) in which the rack is substantially positioned outside the wash chamber **106**, and a retracted position (shown in FIGS. **1** and **2**) in which the rack is located inside the wash chamber **106**. This is facilitated, for example, by rollers **128** mounted onto rack assemblies **122**, **124**, **126**, respectively. Although guide rails **120** and rollers **128** are illustrated herein as facilitating movement of the respective rack assemblies **122**, **124**, **126**, it should be appreciated that any suitable sliding mechanism or member may be used according to alternative embodiments.

Some or all of the rack assemblies **122**, **124**, **126** are fabricated into lattice structures including a plurality of wires or elongated members **130** (for clarity of illustration, not all elongated members making up rack assemblies **122**, **124**, **126** are shown in FIG. **2**). In this regard, rack assemblies **122**, **124**, **126** are generally configured for supporting articles within wash chamber **106** while allowing a flow of wash fluid to reach and impinge on those articles (e.g., during a cleaning or rinsing cycle). According to other exemplary embodiments, a silverware basket (not shown) may be removably attached to a rack assembly (e.g., lower rack assembly **122**) for placement of silverware, utensils, and the like, that are otherwise too small to be accommodated by rack **122**.

Dishwasher **100** further includes a plurality of spray assemblies for urging a flow of water or wash fluid onto the articles placed within wash chamber **106**. More specifically, as illustrated in FIG. **2**, dishwasher **100** includes a lower spray arm assembly **134** disposed in a lower region **136** of wash chamber **106** and above a sump **138** so as to rotate in relatively close proximity to lower rack assembly **122**. Similarly, a mid-level spray arm assembly **140** is located in an upper region of wash chamber **106** and may be located below and in close proximity to middle rack assembly **124**. In this regard, mid-level spray arm assembly **140** is generally configured for urging a flow of wash fluid up through middle rack assembly **124** and upper rack assembly **126**. Additionally, an upper spray assembly **142** may be located above upper rack assembly **126** along the vertical direction V. In this manner, upper spray assembly **142** may be configured for urging or cascading a flow of wash fluid downward over rack assemblies **122**, **124**, and **126**. As further illustrated in FIG. **2**, upper rack assembly **126** may further define an integral spray manifold **144**, which is generally configured for urging a flow of wash fluid substantially upward along the vertical direction V through upper rack assembly **126**.

The various spray assemblies and manifolds described herein may be part of a fluid distribution system or fluid circulation assembly **150** for circulating water and wash fluid in tub **104**. More specifically, fluid circulation assembly **150** includes one or more fluid pumps (e.g., a circulation pump **152**) for circulating water and wash fluid (e.g., detergent, water, or rinse aid) in tub **104**. Circulation pump **152** is located within sump **138** or within a machinery compartment located below sump **138** of tub **104**. Circulation pump **152** may be in fluid communication with an external water supply line (not shown) and sump **138**. A water inlet valve **153** can be positioned between the external water supply line and circulation pump **152** to selectively allow water to flow from the external water supply line to circulation pump **152**. Additionally or alternatively, water inlet valve **153** can be positioned between the external water supply line and sump **138** to selectively allow water to flow from the external water supply line to sump **138**. Water inlet valve **153** can be selectively controlled to open to allow the flow of water into dishwasher **100** and can be selectively controlled to cease the flow of water into dishwasher **100**. Further, fluid circulation assembly **150** may include one or more fluid conduits or circulation piping for directing water or wash fluid from circulation pump **152** to the various spray assemblies and manifolds. For example, for the embodiment depicted in FIG. **2**, a primary supply conduit **154** extends from circulation pump **152**, along rear **112** of tub **104** along the vertical direction V to supply wash fluid throughout wash chamber **106**.

As further illustrated in FIG. **2**, primary supply conduit **154** is used to supply wash fluid to one or more spray assemblies, such as to mid-level spray arm assembly **140** and upper spray assembly **142**. However, it should be appreciated that according to alternative embodiments, any other suitable plumbing configuration may be used to supply wash fluid throughout the various spray manifolds and assemblies described herein. For example, according to another exemplary embodiment, primary supply conduit **154** could be used to provide wash fluid to mid-level spray arm assembly **140** and a dedicated secondary supply conduit (not shown) could be utilized to provide wash fluid to upper spray assembly **142**. Other plumbing configurations may be used for providing wash fluid to the various spray devices and manifolds at any location within dishwasher appliance **100**.

Each spray arm assembly **134**, **140**, **142**, integral spray manifold **144**, or other spray device may include an arrangement of discharge ports or orifices for directing wash fluid received from circulation pump **152** onto dishes or other articles located in wash chamber **106**. The arrangement of the discharge ports, also referred to as jets, apertures, or orifices, may provide a rotational force by virtue of wash fluid flowing through the discharge ports. Alternatively, spray arm assemblies **134**, **140**, **142** may be motor-driven, or may operate using any other suitable drive mechanism. Spray manifolds and assemblies may also be stationary. The resultant movement of the spray arm assemblies **134**, **140**, **142** and the spray from fixed manifolds provides coverage of dishes and other dishwasher contents with a washing spray. Other configurations of spray assemblies may be used as well. For example, dishwasher **100** may have additional spray assemblies for cleaning silverware, for scouring casserole dishes, for spraying pots and pans, for cleaning bottles, etc.

In operation, circulation pump **152** may draw wash fluid in from sump **138** and pump it to a diverter **156** (e.g., positioned within sump **138** of dishwasher appliance). Diverter **156** may include a diverter disk (not shown) disposed within a diverter chamber **158** for selectively distributing the wash fluid to the spray arm assemblies **134**, **140**, **142** or other spray manifolds or devices. For example, the diverter disk may have a plurality of apertures that are configured to align with one or more outlet ports (not shown) at the top of diverter chamber **158**. In this manner, the diverter disk may be selectively rotated to provide wash fluid to the desired spray device.

According to an exemplary embodiment, diverter **156** is configured for selectively distributing the flow of wash fluid from circulation pump **152** to various fluid supply conduits, only some of which are illustrated in FIG. **2** for clarity. More specifically, diverter **156** may include four outlet ports (not shown) for supplying wash fluid to a first conduit for rotating lower spray arm assembly **134** in the clockwise direction, a second conduit for rotating lower spray arm assembly **134** in the counter-clockwise direction, a third conduit for spraying an auxiliary rack such as the silverware rack, and a fourth conduit for supply mid-level or upper spray assemblies **140**, **142** (e.g., primary supply conduit **154**).

Drainage of soiled water within sump **138** may occur, for example, through drain assembly **166**, which may include one or more fluid pumps (e.g., including or in addition to circulation pump **152**). In particular, water may exit sump through a drain and may flow through a drain conduit **167**. In some embodiments, a fluid pump (e.g., drain pump **168**) may facilitate drainage of the soiled water by pumping the water to a drain line external to the dishwasher **100**.

Dishwasher **100** is further equipped with a controller (e.g., main controller) **160** to regulate general operation of dishwasher **100**. Controller **160** may include one or more memory devices and one or more microprocessors, such as general or special purpose microprocessors operable to execute programming instructions or micro-control code associated with a cleaning cycle. The memory may represent random access memory such as DRAM, or read only memory such as ROM or FLASH. In some embodiments, the processor executes programming instructions stored in memory. The memory may be a separate component from the processor or may be included onboard within the processor. Alternatively, controller **160** may be constructed without using a microprocessor (e.g., using a combination of discrete analog or digital logic circuitry; such as switches, amplifiers, integrators, comparators, flip-flops, AND gates, and the like) to perform control functionality instead of relying upon software.

Controller **160** may be positioned in a variety of locations throughout dishwasher **100**. In the illustrated embodiment, controller **160** may be located within a control panel area **162** of door **116** as shown in FIGS. **1** and **2**. In such an embodiment, input/output ("I/O") signals may be routed between the control system and various operational components of dishwasher **100** along wiring harnesses that may be routed through the bottom of door **116**.

a controller configured to alternate between an active operational mode and a standby mode in which a power draw at the controller is less than a power draw of the active operational mode;

Typically, the controller **160** includes a user interface panel/controls **164** through which a user may select various operational features and modes and monitor progress of dishwasher **100**. In one embodiment, the user interface panel **164** may represent a general purpose I/O ("GPIO") device or functional block. In one embodiment, the user interface panel **164** may include input components, such as one or more of a variety of electrical, mechanical or electro-mechanical input devices including rotary dials, push buttons, and touch pads. The user interface panel **164** may include a display component, such as a digital or analog display device designed to provide operational feedback to a user. The user interface panel **164** may be in communication with the controller **160** via one or more signal lines or shared communication busses. Optionally, a user interface or display of a remote device (e.g., separate computer, tablet, smartphone, wearable electronic device, etc.) may be in wireless operative communication with the controller **160**, such that data or signals (e.g., relating to the status or operation of dishwasher **100**) may be exchanged therebetween (e.g., using a dedicated program or application running on the remote device), as would be understood in light of the present disclosure.

It may be notable that the controller **160** is configured to alternate or switch between two or more discrete operational modes (e.g., influencing the power draw, functional capabilities, or communication to various portions of the controller **160** or the appliance **100** in general). For instance, controller **160** may include an active operational mode and a standby mode that is separate or distinct from the active operational mode. Each of the active and standby operational modes may be configured to have a discrete power draw (e.g., limit or maximum). Thus, the active operational mode may have a first power draw and the standby operational mode may have a second power draw that is less than first power draw. The active operational mode may, moreover, correspond to standard or active operation of the dishwasher **100** (e.g., during a wash cycle or while receiving input signals from the user interface **164**). By contrast, the standby operational mode may correspond to an inactive or relatively low-power state of the dishwasher **100** (e.g., in comparison to the active operational mode). In turn, various components or portions of the controller **160** (e.g., the processor) may be set to power down in the standby operational mode (e.g., as controlled by a power latch circuit **312** configured or mounted along a circuit to open or otherwise restrict flow of an electrical circuit to the controller **160**). Optionally, in the standby operational mode, various components that are connected to or controlled by the controller **160** (e.g., one or more fluid pumps **320**, user interface panel **164**, water valve **153**, etc.) may be inactive or powered down in the standby operational mode (e.g., by the nature of the connection to the controller **160**, which may be configured to supply or control power to such components).

Separate from controller **160**, a conditioning circuit **310** may be attached to cabinet **102** (e.g., directly or, alternatively, indirectly, such as via the door **116**) in electrical communication with the controller **160**. For instance, the conditioning circuit **310** may be mounted on or within the door **116**. Generally, and as will be described in greater detail below, conditioning circuit **310** may be provided as part of a larger operational assembly **300** for selectively powering or directing operations at various components of dishwasher **100** (e.g., independently of or in tandem with controller **160**).

In some embodiments, one or more low-power input sensors **316** are provided on or within dishwasher **100**. Such low-power sensor(s) **316** may be configured to detect a fluid-loss event at the dishwasher **100** (e.g., directly or indirectly, such as inferentially). Generally, such a low-power input sensor **316** may be provided as an suitable electronic sensor configured to detect at least one condition at the dishwasher **100** that is predetermined to correspond to a fluid-loss (i.e., conditions likely to indicate a fluid-loss event or failure, generally) and transmit a fluid-loss signal (e.g., voltage or halting of a voltage) in response to such a detection.

As an example, the low-power input sensor **316** may include or be provided as a positional sensor **184**, such as an accelerometer or gyroscope fixed to cabinet **102** or another suitable portion of dishwasher **100** to detect movement at a portion of the dishwasher **100** and a fluid-loss signal corresponding to such detection or movement.

As an additional or alternative example, the low-power input sensor **316** may include or be provided as a temperature sensor **186**, such as a thermistor, thermocouple, or bimetallic switch attached to cabinet **102** and configured to detect a temperature below or above one more set temperature thresholds and transmit a fluid-loss signal or voltage corresponding to such detection or temperature(s).

As another additional or alternative example, the low-power input sensor **316** may include or be provided as a water sensor **180** configured to detect water or wash fluid (e.g., the general presence or attribute thereof) within the cabinet **102** and transmit a fluid-loss signal corresponding to such a detection or water. For instance, the water sensor **180** may include a continuity sensor (e.g., tub lip sensor **202** or leak pan sensor **204**), pressure sensor (e.g., pressure sensor **200**), or flowmeter **182** (e.g., orifice flowmeter, differential pressure meter, magnetic flowmeter, venturi flowmeter, pitot tube flowmeter, positive displacement flowmeter, volumetric flowmeter, turbine flowmeter, etc., any of which may be mounted along drain conduit **167** or a conduit connecting water valve **153**). At or beyond a predetermined threshold condition of the water sensor, the continuity sensor, pressure sensor, or flowmeter may be configured to transmit a corresponding fluid-loss signal to the conditioning circuit **310**.

It should be appreciated that the present disclosure is not limited to any particular style, model, or configuration of dishwasher. The exemplary embodiment depicted in FIGS. **1** and **2** is for illustrative purposes only. For example, different locations may be provided for user interface **164**, different configurations may be provided for rack assemblies **122**, **124**, **126**, different spray arm assemblies **134**, **140**, **142** and spray manifold configurations may be used, and other differences may be applied while remaining within the scope of the present disclosure. Moreover, it should further be appreciated that, except as otherwise indicated, the present disclosure is not limited to any particular wash appliance. For instance, it would be understood that the present disclosure may be applicable to any suitable wash or dishwashing appliance. As an example, certain aspect of the above disclosure may be appliance to a washing machine appliance for cleaning clothing articles, as is generally understood.

With reference still to FIG. **2**, dishwasher **100** may experience a fluid-loss event that includes or is provided as a tub overfill (e.g., flood) event, such as when wash fluid floods over a tub lip **170** of tub **104**. Such an overfill or flood event can occur as a result of any number of conditions or failures, such as, for example, a clog at one or points of the circulation or drain assemblies, an out-of-level condition, a valve failure, or a fluid pump failure. As noted above, one or more low-power input sensor **316** may provide feedback (e.g., to controller **160** or a conditioning circuit **310**) such that corrective action may be taken. In some embodiments, dishwasher **100** includes a pressure sensor **200** positioned on or mounted to sump **138**. Pressure sensor **200** may be configured to detect a liquid level within sump **138** or tub **104**. In additional or alternative embodiments, dishwasher **100** includes a tub lip sensor **202** positioned on or mounted to tub lip **170**. Tub lip sensor **202** may be configured to detect wash fluid at or proximate tub lip **170**.

Further, in some instances, dishwasher **100** may experience a fluid-loss event that includes or is provided as a direct leak. In such instances, wash fluid may leak from tub **104**, sump **138**, or another component of dishwasher **100**. To prevent leaking wash fluid from spilling onto or pooling on a consumer's floor, for this embodiment, dishwasher **100** includes a leak pan **206** positioned below sump **138** and tub **104** along the vertical direction V. Leak pan **206** may be configured to collect leaking wash fluid. In addition, as shown in FIG. **2**, dishwasher **100** includes a leak pan sensor **204** positioned on or mounted to leak pan **206**. Leak pan sensor **204** may be configured to detect wash fluid in leak pan **206**.

FIG. **3** provides a close up, cross sectional view of sump **138** and pressure sensor **200** mounted thereto of the dishwasher **100** of FIGS. **1** and **2**. As noted above, pressure sensor **200** is operatively configured to detect a liquid level L within sump **138** or tub **104** and then communicate the liquid level L to controller **160** or conditioning circuit **310** via one or more signals. Thus, pressure sensor **200** and controller **160** or conditioning circuit **310** may be communicatively coupled (i.e., in operative communication). Pressure sensor **200** can send signals to controller **160** as a frequency, as an analog signal, or in another suitable manner. Pressure sensor **200** can be any suitable type of sensor capable of sensing the liquid level L within dishwasher **100**.

For the depicted embodiment of FIG. **3**, pressure sensor **200** is configured to sense the height H of the water above pressure sensor **200** along the vertical direction V (e.g., by measuring the pressure on pressure sensor **200**). In particular, for this embodiment, pressure sensor **200** includes a pressure plate that is acted on by the pressure of the wash fluid within sump **138**. As the liquid level L rises, the pressure plate is pushed upward along the vertical direction V and thus compresses air trapped within the housing and a diaphragm of pressure sensor **200**, which causes the diaphragm to flex or alter its position. As a result of the pressure and consequent movement of the diaphragm, a permanent magnet attached to the diaphragm may change its position in relation to a Hall-effect transducer. The transducer delivers one or more electrical signals proportional to the magnetic field of the magnet. The signals may be linearized, digitized, or amplified before being sent to controller **160** for processing. The pressure sensor **200** may include a printed circuit board (PCB) board to electrically connect the various electrical components. As noted above, other types of pressure sensors are contemplated.

FIG. **4** provides a perspective view of tub lip sensor **202** coupled with or attached to tub lip **170** of tub **104** and leak pan sensor **204** coupled with or attached to leak pan **206** of the dishwasher appliance **100** of FIGS. **1** and **2**. As noted above, tub lip sensor **202** is operatively configured to detect high water or wash fluid levels within tub **104**, and more particularly, tub lip sensor **202** is configured to sense wash fluid that is at or proximate tub lip **170**. Tub lip sensor **202** is communicatively coupled with controller **160** or conditioning circuit **310** and may communicate therewith via one or more signals.

For the depicted embodiment of FIG. **4**, a tub lip sensor **202** is positioned on or mounted to tub lip **170** of tub **104**, and more particularly, tub lip sensor **202** is positioned on or mounted to tub lip **170** at front side **111** of tub **104** for this embodiment. By positioning tub lip sensor **202** at or on tub lip **170**, tub lip sensor **202** does not interfere with the water flow through sump **138** during wash or drain cycles and takes up a minimal amount of space (e.g., compared to float sensors). In addition, by placing tub lip sensor **202** at front side **111** of tub **104**, tub lip sensor **202** is advantageously positioned to detect water spillage or floods over the front portion of tub **104**, which is a location where water is likely to spill or flood onto the floor of a consumer's home in the event of a water breach over this portion of tub **104**. Further, for this embodiment, tub lip sensor **202** is positioned approximately along a lateral centerline LC that extends along the transverse direction T midway along the lateral length of tub **104**. In this way, tub lip sensor **170** may still detect high wash fluid levels during out-of-level conditions (e.g., tilting of the dishwasher **100** about the transverse direction T).

In the depicted embodiment of FIG. **4**, tub lip sensor **202** is a conductivity sensor. That is, when water or wash fluid fills up to tub lip **170**, the wash fluid bridges leads or electrical contacts of tub lip sensor **202**, thus allowing an electrical current to travel from one lead to the other. This completes a circuit that includes the electrical leads of tub lip sensor **202** and controller **160** or conditioning circuit **310**, among other possible electrical components. The change or increase in electrical current through the circuit is indicative that wash fluid is present or sensed at tub lip **170**. Optionally, the change in electrical current through the circuit can be measured by any suitable parameter (e.g., a change in current, voltage, or resistance) and by any suitable device (e.g., a multimeter positioned within controller **160**).

As further provided in FIG. **4**, as noted above, leak pan senor **204** is operatively configured to detect wash fluid in leak pan **206**. Moreover, for this embodiment, leak pan sensor **204** is configured to sense wash fluid that is a predetermined distance from a pan lip **208** of leak pan **206**. Leak pan sensor **204** is communicatively coupled with controller **160** or conditioning circuit **310** and may communicate therewith via one or more signals.

In the depicted embodiment of FIG. **4**, leak pan sensor **204** is a conductivity sensor. That is, when water or wash fluid fills to the predetermined distance from the pan lip **208** of leak pan **206**, the wash fluid bridges leads or electrical contacts of leak pan sensor **204**, thus allowing an electrical current to travel from one lead to the other. This completes a circuit that includes the electrical leads of leak pan sensor **204** and controller **160**, among other possible electrical components. The change or increase in electrical current through the circuit is indicative that wash fluid is present or sensed within leak pan **206**, and more particularly, the increase in electrical current between the leads of leak pan sensor **204** is indicative of wash fluid being present at a predetermined distance from pan lip **208**.

In optional embodiments, the leak pan sensor **204** is electrically connected in parallel with tub lip sensor **202**. By electrically connecting leak pan sensor **204** in parallel with tub lip sensor **202**, wiring costs of dishwasher **100** may be reduced, among other benefits.

Turning generally to FIGS. **5** through **7**, and as noted above, a conditioning circuit **310** that is separate from the controller **160** may be provided as part of a larger operational assembly **300**. For instance, the conditioning circuit **310** may be provided in electrical communication with a low-power input sensor **316** and configured to receive one or more fluid0loss signals from the same (e.g., apart from the controller **160**). Generally, the conditioning circuit **310** is also in electrical communication with a power source and may be configured to receive continuous power therefrom (e.g., even when controller **160** is in a standby operational mode or irrespective of the operational mode of the controller **160**).

As would be understood in light of the present disclosure, multiple electrical components may be included with or as part of conditioning circuit **310** (e.g., resistors, switches, transistors, relays, etc.) and may configured to conditionally or selectively close an electrical path through the circuit based on one or more received signals (e.g., from the low-power input sensor **316**). In turn, a mitigation action may be prompted or initiated to address a detected or potential fluid-loss event. Thus, conditioning circuit **310** may be configured to receive the fluid-loss signal and initiate a mitigation action in response to receiving the fluid-loss signal (e.g., apart from the controller **160** at the standby mode).

As also noted above, the controller **160** may be configured to alternate between an active operational mode and a standby operational mode. In some embodiments, a power latch circuit **312** or a latch release circuit **314** may be provided (e.g., in electrical communication with controller **160**) to effectuate alternation between such active and standby operational modes. For instance, in the active operational mode, power (e.g., an electrical current from the power source) may be permitted to the controller **160** through a closed power latch circuit **312**. As shown, the power latch circuit **312** may be in electrical communication with the conditioning circuit **310** or latch release circuit **314**. In some embodiments, the conditioning circuit **310** is configured to close the power latch circuit **312** (e.g., in response to a received fluid-loss signal from the low-power input sensor **316** or as part of a mitigation action) and may, thus, direct the controller **160** to the active operational state from the standby state. In additional or alternative embodiments, the latch release circuit **314** is configured to open the power latch circuit **312** (e.g., in response to a received signal from the controller **160**, such as might be prompted by a determined standby condition) and may, thus, direct the controller **160** to the standby operational state from the active operational state.

Turning especially to FIG. **5**, in some embodiments, the conditioning circuit **310** is directly connected to the low-power input sensor **316** and indirectly connected to one or more operational components (e.g., fluid pump **320** or water valve **153**) of the dishwasher **100**. For instance, the conditioning circuit **310** may be in electrical communication with the controller **160** (e.g., via the power latch circuit **312**) and configured to send one or more signals thereto. The controller **160** may be in (e.g., direct) electrical communication with one or more water-flow components (e.g., the fluid pump **320** or water valve **153**).

In response to receiving a fluid-loss signal from the low-power input sensor **316** (e.g., as described above) at or while the controller **160** is in the standby mode, the conditioning circuit **310** may be configured to initiate a mitigation action. Specifically, a responsive signal or voltage may be transmitted from the conditioning circuit **310** to the power latch circuit **312** in response to the received fluid-loss signal. The responsive signal or voltage may close the power latch circuit **312**, which may subsequently direct power to the controller **160** (e.g., thereby alternating the controller **160** to the active operational mode). Placing the controller **160** in the active operational mode may allow the controller **160** to determine the fluid-loss event (e.g., based on one or more signal received directly from the low-power input sensor **316** at the controller **160**).

In certain embodiments, the mitigation action further includes directing activation of the fluid pump **320** (e.g., circulation pump **152** or drain pump **168**—FIG. **2**) from the controller **160** (e.g., in response to the determined fluid-loss event). Thus, the fluid pump **320** may be activated to pump water or wash fluid from the dishwasher **100** (e.g., to the drain conduit **167**—FIG. **2**). In additional or alternative embodiments, the mitigation action further includes directing the water valve **153** to a closed or restricted position from the controller **160** (e.g., in response to the determined fluid-loss event). Thus, the water valve **153** may limit or prevent the further flow of water to the dishwasher **100**. In still further additional or alternative embodiments, the mitigation action further includes activating the user interface panel **164** (e.g., a display or visible element thereof) from the controller **160** (e.g., in response to the determined fluid-loss event). Thus, a user may be given a visual alert or indication of the fluid-loss event at the user interface panel **164**. As would be understood, an optional signal may be transmitted to a remote device (e.g., as a push alert prompted by the controller **160**) to notify the user of the detected or potential fluid-loss event.

Turning especially to FIGS. **6** and **7**, in some embodiments, the conditioning circuit **310** is directly connected to the low-power input sensor **316** and to one or more operational components (e.g., fluid pump **320** or water valve **153**) of the dishwasher **100**. For instance, the conditioning circuit **310** may be in electrical communication with the controller **160** (e.g., via the power latch circuit **312**) and separately in direct electrical communication with one or more water-flow components (e.g., the fluid pump **320** or water valve **153**).

In response to receiving a fluid-loss signal from the low-power input sensor **316** (e.g., as described above) at or while the controller **160** is in the standby mode, the conditioning circuit **310** may be configured to initiate a mitigation action, which may be irrespective of the operational mode of the controller **160**. Specifically, a responsive signal or voltage may be transmitted from the conditioning circuit **310** to a water-flow component, thereby directing activation of the water-flow component in response to the received fluid-loss signal. Optionally, a responsive signal or voltage may be transmitted from the conditioning circuit **310** to power latch circuit **312** in response to the received fluid-loss signal.

The responsive signal or voltage may prompt activation of the fluid pump **320** (e.g., circulation pump **152** or drain pump **168**—FIG. **2**), closing of the water valve **153**, or close the power latch circuit **312**, which may subsequently direct power to the controller **160** (e.g., thereby alternating the controller **160** to the active operational mode). Placing the controller **160** in the active operational mode may allow the controller **160** to determine the fluid-loss event (e.g., based on one or more signal received directly from the low-power input sensor **316** at the controller **160**), separately from the fluid pump **320** or water valve **153**.

In certain embodiments, the mitigation action further includes selectively directing power to the fluid pump **320** from the conditioning circuit **310** (e.g., in response to the determined fluid-loss event). Thus, the fluid pump **320** may be activated to pump water or wash fluid from the dishwasher **100** (e.g., to the drain conduit **167**—FIG. **2**). In additional or alternative embodiments, the mitigation action further includes directing the water valve **153** to a closed or restricted position from the conditioning circuit **310** (e.g., in response to the determined fluid-loss event). Thus, the water valve **153** may limit or prevent the further flow of water to the dishwasher **100**.

In optional embodiments, the mitigation action further includes activating the user interface panel **164** (e.g., a display or visible element thereof) from the controller **160** (e.g., in response to the determined fluid-loss event). Thus, a user may be given a visual alert or indication of the fluid-loss event at the user interface panel **164**. As would be understood, an optional signal may be transmitted to a remote device (e.g., as a push alert prompted by the controller **160**) to notify the user of the detected or potential fluid-loss event.

Notably, the above-described embodiments may be capable of addressing potential leaks or flooding events of an appliance (e.g., outside of an active cycle or operation or even while a main controller is in an inactive or standby mode). Additionally or alternatively, the above described embodiments may advantageously mitigate address potential leaks or flooding events at a relatively low power draw or without significantly increasing energy use of the appliance (e.g., in comparison with existing appliances or systems).

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 languages of the claims.

What is claimed is:

1. A dishwashing appliance, comprising:

a cabinet;

a tub positioned within the cabinet and defining a wash chamber for receipt of articles for washing;

a door mounted to the cabinet to selectively restrict access to the tub;

a spray assembly positioned within the wash chamber;

a fluid pump in fluid communication with the wash chamber;

a controller configured to alternate between an active operational mode and a standby mode in which a power draw at the controller is less than a power draw of the active operational mode;

a low-power input sensor configured to detect a fluid-loss event at the dishwashing appliance at the standby mode of the controller and transmit a fluid-loss signal in response to detecting the fluid-loss event; and

a conditioning circuit attached to the cabinet in electrical communication with the low-power input sensor and separate from the controller, the conditioning circuit being configured to receive the fluid-loss signal apart from the controller at the standby mode and initiate a mitigation action in response to receiving the fluid-loss signal.

2. The dishwashing appliance of claim **1**, wherein the low-power input sensor comprises a water sensor configured to detect water within the cabinet.

3. The dishwashing appliance of claim **2**, wherein the water sensor comprises a continuity sensor, pressure sensor, or flowmeter.

4. The dishwashing appliance of claim 1, wherein the mitigation action comprises directing the controller to the active operational mode from the standby mode.

5. The dishwashing appliance of claim 4, wherein the controller is in operative communication with the fluid pump, and wherein the mitigation action further comprises directing activation of the fluid pump from the controller.

6. The dishwashing appliance of claim 4, further comprising a water valve in upstream fluid communication with the wash chamber and in operative communication with the controller,

wherein the mitigation action further comprises directing the water valve to a closed position from the controller.

7. The dishwashing appliance of claim 4, further comprising a user interface panel mounted to the cabinet in operative communication with the controller,

wherein the mitigation action further comprises activating the user interface panel from the controller.

8. The dishwashing appliance of claim 1, wherein the mitigation action comprises selectively directing power to the fluid pump from the conditioning circuit.

9. The dishwashing appliance of claim 1, further comprising a water valve in upstream fluid communication with the wash chamber and in electrical communication with the conditioning circuit,

wherein the mitigation action further comprises directing the water valve to a closed position from the conditioning circuit.

10. A wash appliance, comprising:

a cabinet;

a tub positioned within the cabinet and defining a wash chamber for receipt of articles for washing;

a door mounted to the cabinet to selectively restrict access to the tub;

a fluid pump in fluid communication with the wash chamber, the fluid pump being a drain pump mounted within the cabinet downstream from the wash chamber;

a controller in operative communication with the fluid pump and configured to alternate between an active operational mode and a standby mode in which a power draw at the controller is less than a power draw of the active operational mode;

a low-power input sensor configured to detect a fluid-loss event at the wash appliance at the standby mode of the controller and transmit a fluid-loss signal in response to detecting the fluid-loss event; and

a conditioning circuit attached to the cabinet in electrical communication with the low-power input sensor and the controller, the conditioning circuit being configured to receive the fluid-loss signal apart from the controller at the standby mode and initiate a mitigation action in response to receiving the fluid-loss signal, the mitigation action comprising directing the controller to the active operational mode from the standby mode.

11. The wash appliance of claim 10, wherein the low-power input sensor comprises a water sensor configured to detect water within the cabinet.

12. The wash appliance of claim 11, wherein the water sensor comprises a continuity sensor, pressure sensor, or flowmeter.

13. The wash appliance of claim 10, wherein the controller is in operative communication with the fluid pump, and wherein the mitigation action further comprises directing activation of the fluid pump from the controller.

14. The wash appliance of claim 10, further comprising a water valve in upstream fluid communication with the wash chamber and in operative communication with the controller,

wherein the mitigation action further comprises directing the water valve to a closed position from the controller.

15. The wash appliance of claim 10, further comprising a user interface panel mounted to the cabinet in operative communication with the controller,

wherein the mitigation action further comprises activating the user interface panel from the controller.

16. A wash appliance, comprising:

a cabinet;

a tub positioned within the cabinet and defining a wash chamber for receipt of articles for washing;

a door mounted to the cabinet to selectively restrict access to the tub;

a fluid pump in fluid communication with the wash chamber, the fluid pump being a drain pump mounted within the cabinet downstream from the wash chamber;

a controller configured to alternate between an active operational mode and a standby mode in which a power draw at the controller is less than a power draw of the active operational mode;

a low-power input sensor configured to detect a fluid-loss event at the wash appliance at the standby mode of the controller and transmit a fluid-loss signal in response to detecting the fluid-loss event; and

a conditioning circuit attached to the cabinet in electrical communication with the low-power input sensor and the controller, the conditioning circuit being configured to receive the fluid-loss signal apart from the controller at the standby mode and initiate a mitigation action in response to receiving the fluid-loss signal, the mitigation action comprising directing activation of a water-flow component within the cabinet apart from the controller.

17. The wash appliance of claim 16, wherein the low-power input sensor comprises a water sensor configured to detect water within the cabinet.

18. The wash appliance of claim 17, wherein the water sensor comprises a continuity sensor, pressure sensor, or flowmeter.

19. The wash appliance of claim 16, wherein the water-flow component comprises the fluid pump, and wherein the mitigation action comprises selectively directing power to the fluid pump from the conditioning circuit.

20. The wash appliance of claim 16, further comprising a water valve in upstream fluid communication with the wash chamber and in electrical communication with the conditioning circuit,

wherein the water-flow component comprises the water valve, and

wherein the mitigation action further comprises directing the water valve to a closed position from the conditioning circuit.

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