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(54) METHODS FOR OPERATING HEAT PUMP WATER HEATER APPLIANCES

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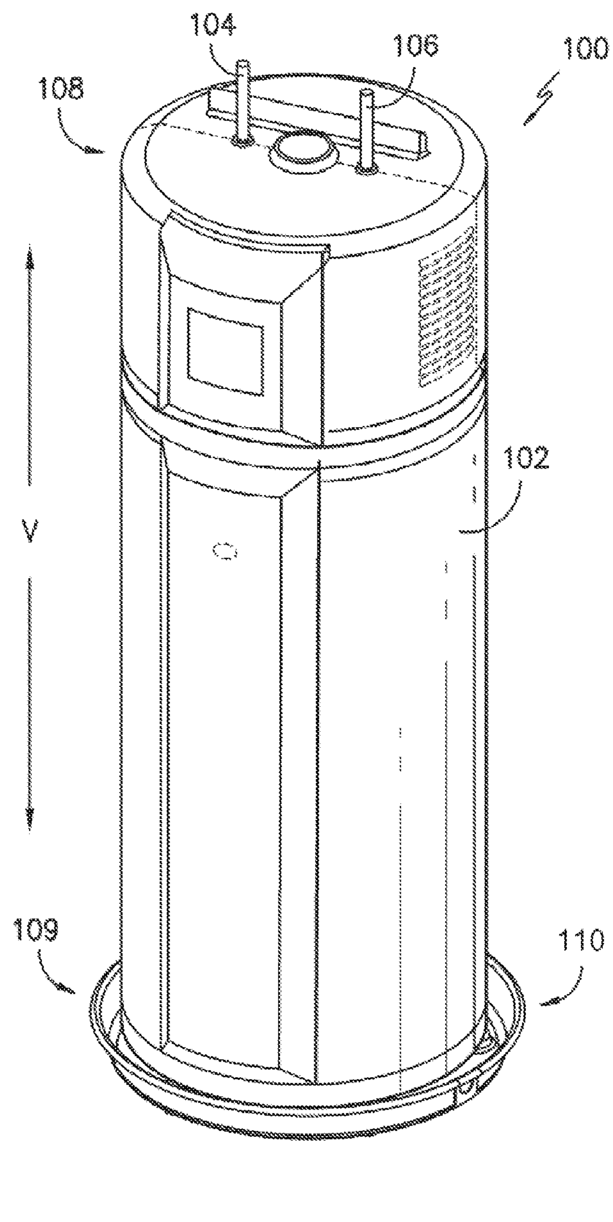
(57) **ABSTRACT**

Heat pump water heater appliances and operational methods therefor are provided. A method includes receiving a peak generation signal, and activating a secondary heating element of the heat pump water heater appliance when the peak generation signal is received. The method further includes activating a sealed system of the heat pump water heater appliance when the peak generation signal is received, and deactivating the secondary heating element when the sealed system is operational after activation or when a non-peak generation signal is received subsequent to receipt of the peak generation signal.



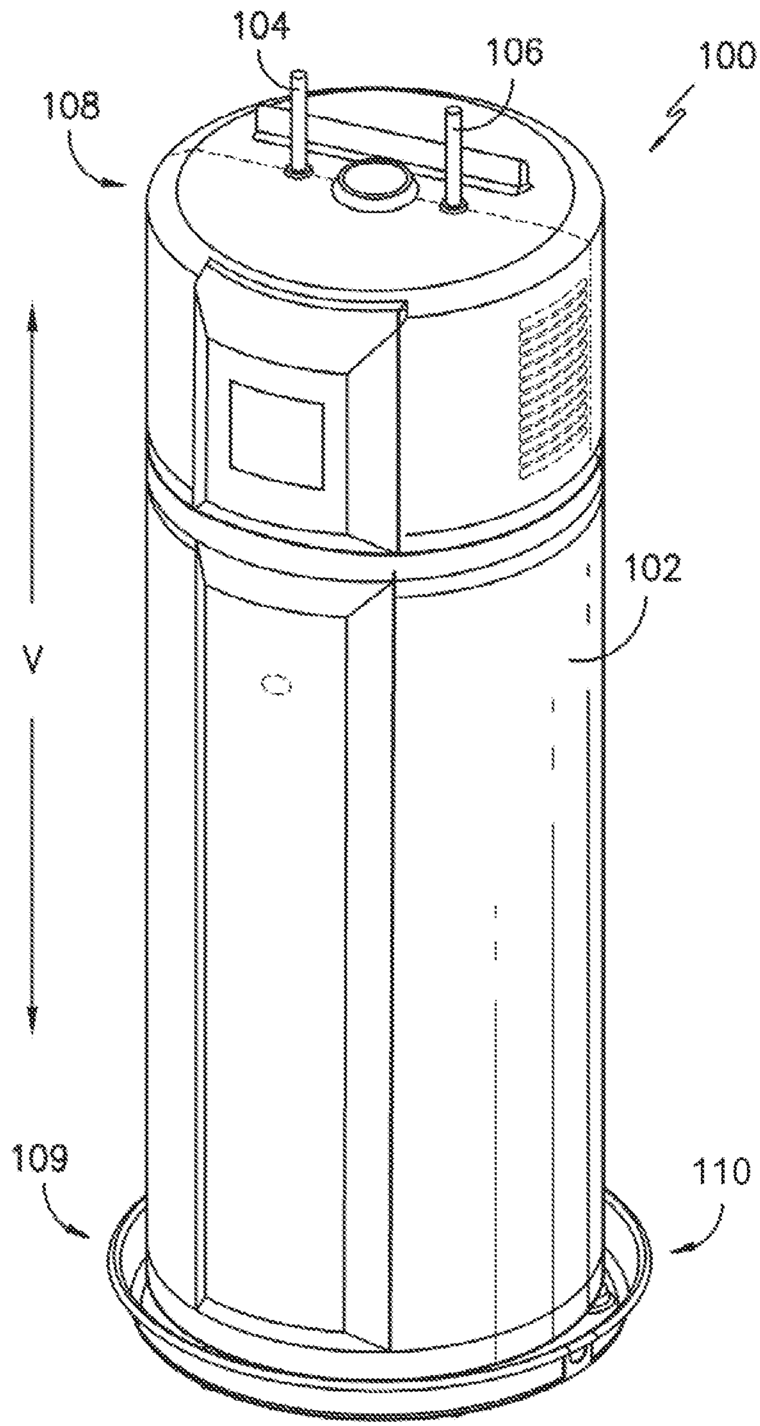


FIG. 1

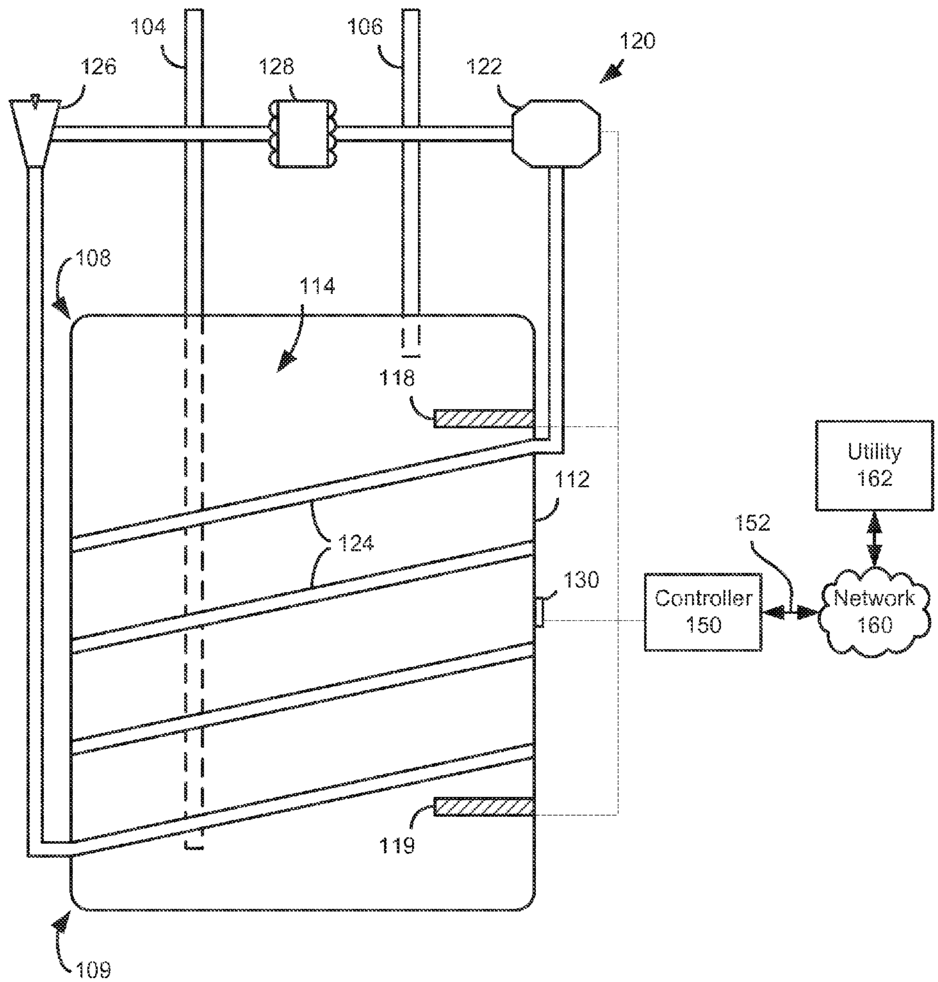

104
106
120
126
128
122
108
114
118
112
124
152
130
Utility
162
Controller
150
Network
160
119
109

FIG. 2

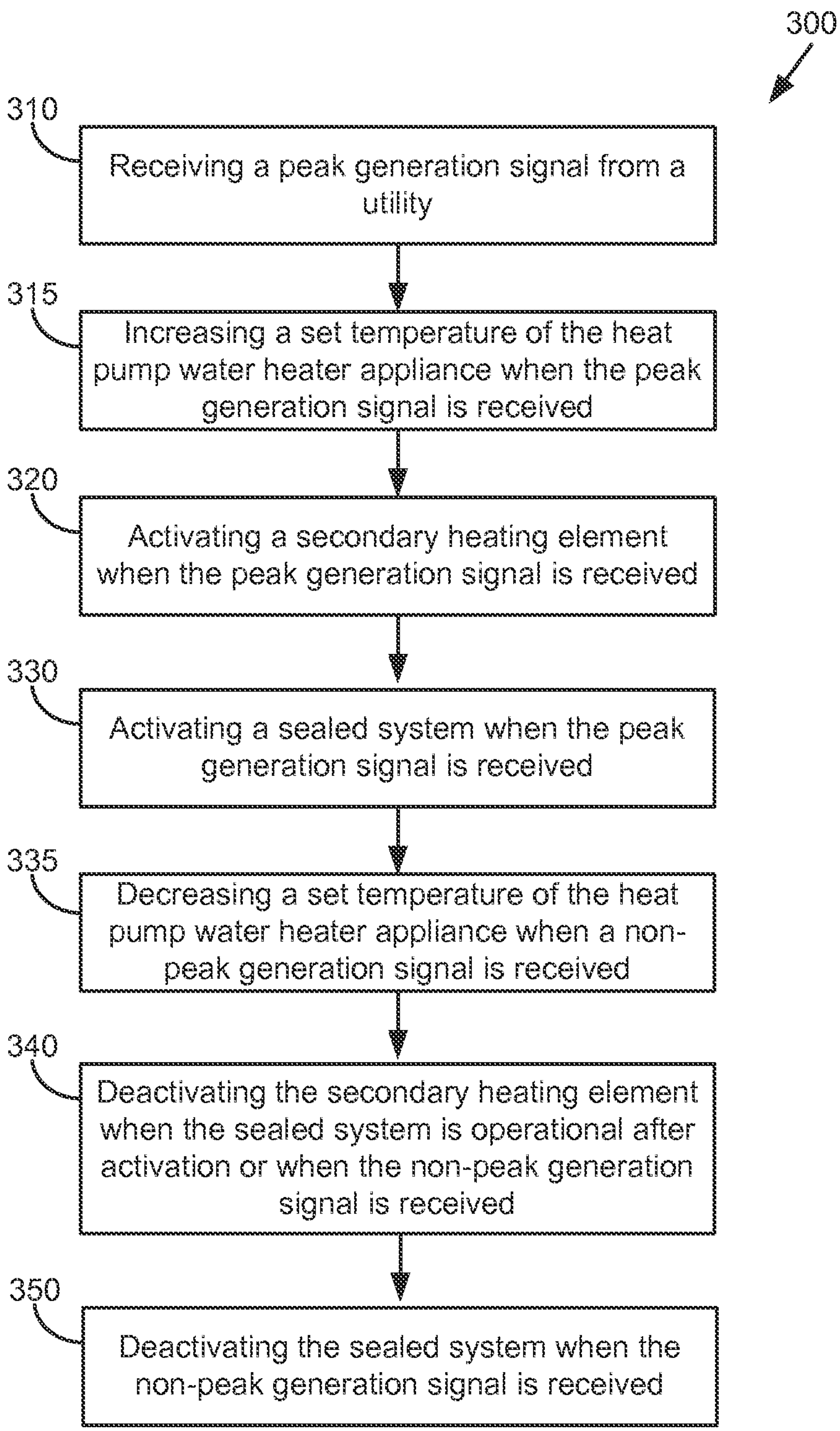

300
310
Receiving a peak generation signal from a utility
315
Increasing a set temperature of the heat pump water heater appliance when the peak generation signal is received
320
Activating a secondary heating element when the peak generation signal is received
330
Activating a sealed system when the peak generation signal is received
335
Decreasing a set temperature of the heat pump water heater appliance when a non-peak generation signal is received
340
Deactivating the secondary heating element when the sealed system is operational after activation or when the non-peak generation signal is received
350
Deactivating the sealed system when the non-peak generation signal is received

FIG. 3

METHODS FOR OPERATING HEAT PUMP WATER HEATER APPLIANCES

FIELD OF THE INVENTION

[0001] The present subject matter relates generally to heat pump water heater appliances and methods for operating the same, and more particularly to cost and energy efficient heating of water within heat pump water heater appliances.

BACKGROUND OF THE INVENTION

[0002] Water heater appliances generally operate to heat water within the water heater appliance's tank to a set temperature. The set temperature is generally selected such that heated water within the tank is at least hot enough for showering, washing hands, etc. Heat pump water heaters are gaining broader acceptance as a more economic and ecologically-friendly alternative to electric and gas water heaters. Heat pump water heaters include a sealed system for heating water to the set temperature.

[0003] One issue with use of a sealed system is that, when the system is activated, a warm-up period is typically required before normal operation of the system commences. For example, an expansion valve of the system may cycle for a period of time (in some cases 2-3 minutes) to balance the various pressures within the system before compressor operation commences. Accordingly, slight delays in heating are incurred when typical sealed systems are utilized.

[0004] Heat pump water heater appliances generally receive power from a utility, and in exemplary embodiments an electrical utility. Power, such as electricity, is supplied by the utility to a structure, such as a residential or commercial building. Additionally, utilities have recently begun charging different prices for power at different times depending on the amount of power that is being required from the utility. At peak load times, when demand by consumers is in excess of the amount of power being generated, a higher price can be required of consumers by the utility. At peak generation times, when the amount of power being generated by the utility is in excess of the demand by consumers, a lower price can be required of consumers by the utility.

[0005] It would be generally desirable to take advantage of lower costs during peak generation periods by operating the heat pump water heater at these times. However, in some cases, periods of peak generation and peak load can occur in relatively short lengths of time, such as between 4 seconds and 10 minutes. Further, in some cases, it can take between 1 minute and 5 minutes for the sealed system to warm-up. Accordingly, a peak generation period may have expired by the time that the sealed system is operational to heat the water within the appliance.

[0006] Accordingly, improved heat pump water heater appliances and methods for operating the same are desired. In particular, cost and energy efficient heat pump water heater appliance operations which take advantage of peak generation periods would be advantageous.

BRIEF DESCRIPTION OF THE INVENTION

[0007] In accordance with one embodiment, a method for operating a heat pump water heater appliance is provided. The method includes receiving a peak generation signal, and activating a secondary heating element of the heat pump water heater appliance when the peak generation signal is received. The method further includes activating a sealed system of the heat pump water heater appliance when the peak generation signal is received, and deactivating the secondary heating element when the sealed system is operational after activation or when a non-peak generation signal is received subsequent to receipt of the peak generation signal.

[0008] In accordance with another embodiment, a heat pump water heater appliance is provided. The heat pump water heater appliance includes a tank defining a chamber, the tank further defining an inlet aperture and an outlet aperture. The heat pump water heater appliance further includes a hot water conduit extending through the outlet aperture and in fluid communication with the chamber of the tank, the hot water conduit configured for directing a flow of water out of the chamber of the tank, and a cold water conduit extending through the inlet aperture and in fluid communication with the chamber of the tank, the cold water conduit configured for directing a flow of water into the chamber of the tank. The heat pump water heater appliance further includes a sealed system configured to heat water within the chamber of the tank, and a secondary heating element configured to heat water within the chamber of the tank. The heat pump water heater appliance further includes a controller in communication with the sealed system and the secondary heating element. The controller is configured for receiving a peak generation signal, and activating the secondary heating element when the peak generation signal is received. The controller is further configured for activating the sealed system when the peak generation signal is received, and deactivating the secondary heating element when the sealed system is operational after activation or when a non-peak generation signal is received subsequent to receipt of the peak generation signal.

[0009] 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

[0010] 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.

[0011] FIG. **1** provides a perspective view of a water heater appliance according to an exemplary embodiment of the present subject matter.

[0012] FIG. **2** provides a schematic view of certain components of the exemplary water heater appliance of FIG. **1**.

[0013] FIG. **3** illustrates a method for operating a water heater appliance according to an exemplary embodiment of the present subject matter.

DETAILED DESCRIPTION

[0014] 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.

[0015] FIG. **1** provides a perspective view of a water heater appliance **100** according to an exemplary embodiment of the present subject matter. FIG. **2** provides a schematic view of certain components of water heater appliance **100**. As may be seen in FIGS. **1** and **2**, water heater appliance **100** includes a casing **102** and a tank **112** mounted within casing **102**. Tank **112** defines an interior volume **114** for heating water therein. Water heater appliance **100** may include similar components, be constructed in a similar manner to and/or operate in the manner described in U.S. Pat. No. 8,422,870 of Nelson et al., which is hereby incorporated by reference in its entirety.

[0016] Water heater appliance **100** also includes a cold water conduit **104** and a hot water conduit **106** that are both in fluid communication with tank **112** within casing **102**. As an example, cold water from a water source, e.g., a municipal water supply or a well, enters water heater appliance **100** through cold water conduit **104**. From cold water conduit **104**, such cold water enters interior volume **114** of tank **112** wherein the water is heated to generate heated water. Such heated water exits water heater appliance **100** at hot water conduit **106** and, e.g., is supplied to a bath, shower, sink, or any other suitable feature.

[0017] As may be seen in FIG. **1**, water heater appliance **100** extends between a top portion **108** and a bottom portion **109** along a vertical direction V. Thus, water heater appliance **100** is generally vertically oriented. Water heater appliance **100** can be leveled, e.g., such that casing **102** is plumb in the vertical direction V, in order to facilitate proper operation of water heater appliance **100**.

[0018] A drain pan **110** is positioned at bottom portion **109** of water heater appliance **100** such that water heater appliance **100** sits on drain pan **110**. Drain pan **110** sits beneath water heater appliance **100** along the vertical direction V, e.g., to collect water that leaks from water heater appliance **100** or water that condenses on an evaporator **128** of water heater appliance **100**. It should be understood that water heater appliance **100** is provided by way of example only and that the present subject matter may be used with any suitable water heater appliance.

[0019] Turning now to FIG. **2**, water heater appliance **100** includes an upper heating element **118**, a lower heating element **119** and a sealed system **120** for heating water within interior volume **114** of tank **112**. Thus, water heater appliance **100** is commonly referred to as a "heat pump water heater appliance." Upper and lower heating elements **118** and **119** can be any suitable heating elements. For example, upper heating element **118** and/or lower heating element **119** may be an electric resistance element, a microwave element, an induction element, or any other suitable heating element or combination thereof. Lower heating element **119** may also be a gas burner, and water heater appliance **100** need not include upper heating element **118** when lower heating element **119** is a gas burner.

[0020] Sealed system **120** includes a compressor **122**, a condenser **124**, a throttling device **126** and an evaporator **128**. Condenser **124** is thermally coupled or assembled in a heat exchange relationship with tank **112** in order to heat water within interior volume **114** of tank **112** during operation of sealed system **120**. In particular, condenser **124** may be a conduit coiled around and mounted to tank **112**. During operation of sealed system **120**, refrigerant exits evaporator **128** as a fluid in the form of a superheated vapor and/or high quality vapor mixture. Upon exiting evaporator **128**, the refrigerant enters compressor **122** wherein the pressure and temperature of the refrigerant are increased such that the refrigerant becomes a superheated vapor. The superheated vapor from compressor **122** enters condenser **124** wherein it transfers energy to the water within tank **112** and condenses into a saturated liquid and/or high quality liquid vapor mixture. This high quality/saturated liquid vapor mixture exits condenser **124** and travels through throttling device **126** that is configured for regulating a flow rate of refrigerant therethrough. Upon exiting throttling device **126**, the pressure and temperature of the refrigerant drop at which time the refrigerant enters evaporator **128** and the cycle repeats itself. In certain exemplary embodiments, throttling device **126** may be an electronic expansion valve (EEV).

[0021] Water heater appliance **100** also includes a tank temperature sensor **130**. Tank temperature sensor **130** is configured for measuring a temperature of water within interior volume **114** of tank **112**. Tank temperature sensor **130** can be positioned at any suitable location within or on water heater appliance **100**. For example, tank temperature sensor **130** may be positioned within interior volume **114** of tank **112** or may be mounted to tank **112** outside of interior volume **114** of tank **112**. When mounted to tank **112** outside of interior volume **114** of tank **112**, tank temperature sensor **130** can be configured for indirectly measuring the temperature of water within interior volume **114** of tank **112**. For example, tank temperature sensor **130** can measure the temperature of tank **112** and correlate the temperature of tank **112** to the temperature of water within interior volume **114** of tank **112**. Tank temperature sensor **130** may also be positioned at or adjacent top portion **108** of water heater appliance **100**, e.g., at or adjacent an inlet of hot water conduit **106**.

[0022] Tank temperature sensor **130** can be any suitable temperature sensor. For example, tank temperature sensor **130** may be a thermocouple or a thermistor. As may be seen in FIG. **2**, tank temperature sensor **130** may be the only temperature sensor positioned at or on tank **112** that is configured for measuring the temperature of water within interior volume **114** of tank **112** in certain exemplary embodiments. In alternative exemplary embodiments, additional temperature sensors may be positioned at or on tank **112** to assist tank temperature sensor **130** with measuring the temperature of water within interior volume **114** of tank **112**, e.g., at other locations within interior volume **114** of tank **112**.

[0023] Water heater appliance **100** further includes a controller **150** that is configured for regulating operation of water heater appliance **100**. Controller **150** is in, e.g., operative, communication with upper heating element **118**, lower heating element **119**, compressor **122** (and thus sealed system **120** generally), and tank temperature sensor **130**. Thus, controller **150** may selectively activate upper and lower heating elements **118** and **119** and/or compressor **122** in order to heat water within interior volume **114** of tank **112**, e.g., in response to signals from tank temperature sensor **130** and other signals as discussed herein

[0024] It should be understood that controller **150** may be integrated within water heater appliance **100**, in certain exemplary embodiments. However, in alternative exemplary embodiments, controller **150** may be separate from other components of water heater appliance **100** and be positioned outside of casing **102**. Thus, controller **150** may be positioned remotely relative to casing **102**, e.g., within a building housing water heater appliance **100**. In such exemplary embodiments, controller **150** may wirelessly communicate with other components of water heater appliance **100**.

[0025] Controller **150** includes memory and one or more processing devices such as microprocessors, CPUs or the like, such as general or special purpose microprocessors operable to execute programming instructions or micro-control code associated with operation of water heater appliance **100**. The memory can represent random access memory such as DRAM, or read only memory such as ROM or FLASH. The processor executes programming instructions stored in the memory. The memory can be a separate component from the processor or can be included onboard within the processor. Alternatively, controller **150** may be constructed without using a microprocessor, e.g., using a combination of discrete analog and/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.

[0026] Controller **150** may operate upper heating element **118**, lower heating element **119** and/or compressor **122** in order to heat water within interior volume **114** of tank **112**. As an example, a user may select or establish a set temperature, t_s, for water within interior volume **114** of tank **112**, or the set temperature t_s for water within interior volume **114** of tank **112** may be a default value. Based upon the set temperature t_s for water within interior volume **114** of tank **112**, controller **150** may selectively activate upper heating element **118**, lower heating element **119** and/or compressor **122** in order to heat water within interior volume **114** of tank **112** to the set temperature t_s for water within interior volume **114** of tank **112**. The set temperature t_s for water within interior volume **114** of tank **112** may be any suitable temperature. For example, the set temperature t_s for water within interior volume **114** of tank **112** may be between about one hundred degrees Fahrenheit and about one hundred and eighty-degrees Fahrenheit. As used herein with regards to temperature approximations, the term "about" means within ten degrees of the stated temperature.

[0027] Controller **150** also includes a network interface (not shown). The controller **150** of water heater appliance **100** may include any suitable components for interfacing with one more networks, such as a network **160**. For example, the network interface may include transmitters, receivers, ports, controllers, antennas, or other suitable components for interfacing with network **160**. The network interface may establish communication with network **160** via a connection **152**. Connection **152** may be any suitable medium, e.g., wired or wireless.

[0028] Network **160** may be any type of communications network, such as a local area network (e.g. intranet), wide area network (e.g. Internet), or some combination thereof. In general, communication between controller **150** and network **160** may be carried via associated network interfaces using any type of connection, using a variety of communication protocols (e.g. TCP/IP, HTTP), encodings or formats (e.g. HTML, XML), and/or protection schemes (e.g. VPN, secure HTTP, SSL). In particular, network **160** may be a wireless local area network (WLAN) configured to conform to IEEE 802.11.

[0029] As may be seen in FIG. **2**, controller **150** may receive data or information from various sources via network **160**. For example, controller **150** may be in communication with a utility **162** that is providing power to the appliance **100**. In exemplary embodiments, the utility may be an electrical utility which is providing electrical power to the appliance **100**. The utility **162** may send signals to the controller **150**, in some cases via a network **160**, to control operation of the appliance **100**. For example, utility **162** may send signals regarding the demand status of the utility **162**, i.e. whether the demand status is operating at peak load, peak generation, or normal operation (between peak load and peak generation). For example, utility **162** may send peak load signals and peak generation signals (as well as normal operation signals). In exemplary embodiments, the peak load and peak generation signals may correspond to different line frequencies; i.e. the frequency of oscillations of alternating current being transmitted from the utility to the end user and thus to the appliance **100**. For example, in some embodiments, a peak generation signal may be a line frequency of greater than a normal line frequency, i.e. 50 Hertz or 60 Hertz. A peak load signal may be a line frequency of less than a normal line frequency, i.e. 50 Hertz or 60 Hertz. Accordingly, a non-peak generation signal may be a signal that corresponds to normal operation or peak load operation, and may thus in some embodiments be considered to be a normal line frequency or a frequency of less than a normal line frequency, i.e. at or below 50 Hertz or at or below 60 Hertz. In other embodiments, the peak load and peak generation signals may be electronic signals received (either wirelessly or via a wired connection) by the controller **150**, such as from the utility **100**. In general, a peak load signal indicates that demand on the utility **162** is in excess of the amount of power being generated, and may be associated with a relatively higher power price. In general, a peak generation signal indicates that the amount of power being generated by the utility is in excess of the demand, and may be associated with a relatively lower power price.

[0030] Notably, while in some embodiments controller **150** is configured, via a wired or wireless connection, to receive electronic signals as discussed, in other embodiments, controller **150** may simply be configured to receive line frequencies from the utility **162**. In either case, controller **150** may receive signals in accordance with the present disclosure.

[0031] Signals as discussed above may be received by the controller **150**. The controller **150** may advantageously utilize the received signals to control operation of the appliance **100**. For example, the controller **150** through measurement of the voltage oscillations may analyze the line frequency, and may thus be instructed via the utility **162** demand response signal. Such instruction may include, as discussed herein, deactivating particular heat sources when the line frequency shows signs of sagging, indicating high demand, and is thus considered a peak load signal. Such instruction may further include, as discussed herein, activating particular heat sources when the line frequency shows signs of surging, indicating low demand, and is thus considered a peak generation signal. Such features of water heater appliance **100** are discussed in greater detail below in the context of FIG. **3**.

[0032] FIG. 3 illustrates a method 300 for operating a water heater appliance in accordance with one embodiment of the present disclosure. Method 300 may be used to operate any suitable heat pump water heater appliance. For example, method 300 may be used to operate water heater appliance 100. Thus, method 300 is discussed in greater detail below in the context of water heater appliance 100. In exemplary embodiments, controller 150 may be configured or programmed to implement various steps of method 300. Operation of an appliance 100 as discussed herein may advantageously be relatively cost and energy efficient by taking advantage of peak generation periods to heat water within the appliance 100.

[0033] Method 300 may include, for example, the step 310 of receiving a peak generation signal, such as from utility 162 as discussed above. Method 300 may further include, for example, the step 320 of activating one or more secondary heating element 118, 119 when the peak generation signal is received. Such activation may be performed upon receipt of the peak generation signal and in response to the peak generation signal. Such activation may cause heating of water within tank 112 by the secondary heating elements 118, 119. In exemplary embodiments, the secondary heating elements 118, 119 may be electrical resistance elements, although alternatively, other suitable secondary heating elements 118, 119 as discussed herein may be utilized. Such activation may advantageously facilitate heating of water within the tank 112 during peak generation times, and thus in many cases at relatively lower cost to the consumer.

[0034] Method 300 may further include, for example, the step 315 of increasing a set temperature t_s when the peak generation signal is received. For example, the set temperature t_s may be increased to a temperature value above a predetermined value, i.e. a value set by the user or a default value, as discussed above. In some embodiments, for example, the set temperature t_s may be increased to a maximum set temperature value, i.e. a maximum value at which the set temperature t_s can be set. Step 315 in exemplary embodiments may occur before step 320. Further, in some embodiments, step 320 may occur at least partially as a result of the occurance of step 315. In other words, because the set temperature t_s is increased, one or more secondary heating elements may be activated.

[0035] Method 300 may further include, for example, the step 330 of activating the sealed system 120 when the peak generation signal is received. Such activation may be performed upon receipt of the peak generation signal and in response to the peak generation signal. Notably, activation of the sealed system 120 may in some embodiments cause the sealed system 120 to function in a "warm-up" state, rather than in an operational state. When the sealed system 120 is operational, the system 120 is performing active heating operations as discussed herein. When the sealed system 120 is warming up, the system 120 is preparing to perform active heating operations, and for example, the throttling device 126 is cycling between open and closed positions to equalize pressures within the system 120. Notably, the compressor 122, may operate when the sealed system 120 is operational, but may not operate when the sealed system 120 is warming up.

[0036] Method 300 may further include, for example, the step 340 of deactivating the one or more secondary heating elements 118, 119 when the sealed system 120 is operational after activation or when a non-peak generation signal is received, such as from the utility 162, subsequent to receipt of the peak generation signal. For example, in some cases, the sealed system 120 may become operational (after warming up) before the peak generation period has ended. In these cases, the secondary heating elements 118, 119 may be deactivated, and the sealed system 120 allowed to actively heat the water within the tank 112. Such deactivation may occur, for example, upon initiation of operation of the sealed system 120. In other cases, the peak generation period may end before the sealed system 120 becomes operational. In these cases, the secondary heating elements 118, 119 may be deactivated to cease power consumption thereby. In exemplary embodiments, whichever case occurs first after step 320 and 330 may cause the one or more secondary heating elements 118, 119 to be deactivated.

[0037] Method 300 may further include, for example, the step 350 of deactivating the sealed system 120 when a non-peak generation signal is received, such as from the utility 162, subsequent to receipt of the peak generation signal (i.e. subsequent to step 310). Such deactivation may occur whether the sealed system 120 is operational or warming up, and may occur to cease power consumption thereby.

[0038] Method 300 may further include, for example, the step 335 of decreasing the set temperature t_s when a non-peak generation signal is received. For example, the set temperature t_s may be decreased to a temperature value below the value to which the set temperature t_s was previous increased (i.e. in step 315). In some embodiments, the set temperature t_s may be decreased to a predetermined value, i.e. a value set by the user or a default value, as discussed above. Step 335 in exemplary embodiments may occur before step 340 (when step 340 occurs due to receipt of a non-peak generation signal) and/or step 350. Further, in some embodiments, step 340 (when step 340 occurs due to receipt of a non-peak generation signal) and/or step 350 may occur at least partially as a result of the occurance of step 335. In other words, because the set temperature t_s is decreased, the one or more secondary heating elements and/or sealed system 120 may be deactivated.

[0039] 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 method for operating a heat pump water heater appliance, the method comprising:

receiving a peak generation signal;

activating a secondary heating element of the heat pump water heater appliance when the peak generation signal is received;

activating a sealed system of the heat pump water heater appliance when the peak generation signal is received; and deactivating the secondary heating element when the sealed system is operational after activation or when a non-peak generation signal is received subsequent to receipt of the peak generation signal.

2. The method of claim **1**, further comprising deactivating the sealed system when the non-peak generation signal is received subsequent to receipt of the peak generation signal.

3. The method of claim **1**, wherein the secondary heating element is an electrical resistance heating element.

4. The method of claim **1**, wherein the peak generation signal is a line frequency of above 60 Hertz.

5. The method of claim **1**, wherein the non-peak generation signal is a line frequency of at or below 60 Hertz.

6. The method of claim **1**, further comprising increasing a set temperature for the heat pump water heater appliance when the peak generation signal is received.

7. The method of claim **6**, wherein the set temperature is increased to a maximum set temperature value.

8. The method of claim **1**, further comprising decreasing the set temperature for the heat pump water heater appliance when the non-peak generation signal is received.

9. The method of claim **8**, wherein the set temperature is decreased to a predetermined set temperature value.

10. A heat pump water heater appliance, the heat pump water heater appliance comprising:

a tank defining a chamber, the tank further defining an inlet aperture and an outlet aperture;

a hot water conduit extending through the outlet aperture and in fluid communication with the chamber of the tank, the hot water conduit configured for directing a flow of water out of the chamber of the tank;

a cold water conduit extending through the inlet aperture and in fluid communication with the chamber of the tank, the cold water conduit configured for directing a flow of water into the chamber of the tank;

a sealed system configured to heat water within the chamber of the tank;

a secondary heating element configured to heat water within the chamber of the tank;

a controller in communication with the sealed system and the secondary heating element, the controller configured for:

receiving a peak generation signal;

activating the secondary heating element when the peak generation signal is received;

activating the sealed system when the peak generation signal is received; and

deactivating the secondary heating element when the sealed system is operational after activation or when a non-peak generation signal is received subsequent to receipt of the peak generation signal.

11. The heat pump water heater appliance of claim **10**, wherein the controller is further configured for deactivating the sealed system when the non-peak generation signal is received subsequent to receipt of the peak generation signal.

12. The heat pump water heater appliance of claim **10**, wherein the secondary heating element is an electrical resistance heating element.

13. The heat pump water heater appliance of claim **10**, wherein the peak generation signal is a line frequency of above 60 Hertz.

14. The heat pump water heater appliance of claim **10**, wherein the non-peak generation signal is a line frequency of at or below 60 Hertz.

15. The heat pump water heater appliance of claim **10**, wherein the controller is further configured for increasing a set temperature for the heat pump water heater appliance when the peak generation signal is received.

16. The heat pump water heater appliance of claim **15**, wherein the set temperature is increased to a maximum set temperature value.

17. The heat pump water heater appliance of claim **10**, wherein the controller is further configured for decreasing the set temperature for the heat pump water heater appliance when the non-peak generation signal is received.

18. The heat pump water heater appliance of claim **17**, wherein the set temperature is decreased to a predetermined set temperature value.

19. The heat pump water heater appliance of claim **10**, wherein the controller is in communication with a network, the network in communication with a utility.

20. The heat pump water heater appliance of claim **19**, wherein the controller is in wireless communication with the network.

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