An appliance and method for operating the appliance based on a water hardness determined from a water supply identifier indicative of the geographical source of the water.
APPLIANCE WITH WATER HARDNESS DETERMINATION

BACKGROUND OF THE INVENTION

[0001] Conventional automatic cleaning appliances, such as washing machines, dishwashers and dryers, for example, typically operate on an article using one or more cycles of operation. The cleaning appliances may often perform the cycle of operation using a resource, such as water, and at least one consumable, such as a wash aid, a rinse aid, a stain or wrinkle remover or a fragrance.

[0002] The efficacy of the cleaning cycle of operation may be dependent on one or more variable operating parameters, some of which may be related to the environmental conditions. For example, the water hardness is known to effect the efficacy of wash aids, such as detergents and bleaches, as well as rinse aids. If the water hardness is known, various operating parameters may be adjusted, generally by the appliance controller, to compensate for the water hardness.

SUMMARY OF THE INVENTION

[0003] A method for operating a cleaning appliance configured to execute a water consuming operating cycle where a water hardness is determined from a water supply identifier indicative of the geographical source of the water, and a parameter of the operating cycle may be set based on the determined water hardness.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIG. 1 is a perspective view of a clothes washer according to an embodiment of the invention.

[0005] FIG. 2 is a perspective view of the clothes washer of FIG. 1 according to an embodiment of the invention.

[0006] FIG. 3 is a perspective view of the dispensing system of FIG. 6 according to an embodiment of the invention.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0008] Referring now to FIG. 1, a first embodiment of the invention is illustrated as a horizontal axis clothes washer 10. The clothes washer 10 may include a cabinet 12 enclosing a tub 14 in which a rotatable drum 16 is located. A door 18 may be provided for selective access to the interior of the drum 16. The interior of the drum 16 defines a cleaning chamber 20 in which one or more articles to be cleaned may be placed.

[0009] Referring now to FIGS. 1 and 2, a water supply system comprising a pump 22, fluidly coupled with a water supply 24, a flush valve 26 and a circulation valve 28, may be provided for transporting the fluid to the dispenser drawer 30 and the tub 14, respectively.

[0010] The washer 10 may further comprise a sump line 32 fluidly connecting a sump 34 with the pump 22 for recirculating the fluid from the sump 34 back to the tub 14. A heater 36 may be located within the sump 34 to selectively heat the liquid contained therein. The sump 34 may also be fluidly coupled with a drain pump 38 through a drain line 39 for draining liquid from the sump 34 to a household drain (not shown).

[0011] The flush valve 26 may be provided for selectively delivering liquid from the pump 22 to the dispenser drawer 30. A pump output line 40 may be provided for fluidly connecting the flush valve 26 with the pump 22. The flush valve 26 may also be fluidly connected with the dispenser drawer 30 through a flush line 42 for selectively flushing the contents of the dispenser drawer 30 to the tub 14 and sump 34. In this manner, fresh water from the water supply 24 may be delivered by the pump 22 to the dispenser drawer 30 in a controlled manner through the flush valve 26.

[0012] The dispenser drawer 30 may be fluidly connected with the tub 14 through a dispensing valve 44. The dispensing valve 44 may be fluidly connected on a first side with the dispenser drawer 30 through a dispenser output line 46 and on the second side with the tub 14 through a dispensing line 48. In this manner, the dispensing valve 44 can selectively control the flow of liquid from the dispenser drawer 30, through the dispenser output line 46 and the dispensing line 48 into the tub 14.

[0013] The dispenser drawer 30 is not limited to any particular type of dispenser and may be any type of dispenser capable of dispensing a predetermined or variable amount of chemistry. For example, the dispenser 30 may be a bulk dispenser. An example of which is described in U.S. application Ser. No. 12,165,712, filed Jul. 1, 2008, entitled A HOUSEHOLD CLEANING APPLIANCE WITH A DISPENSING SYSTEM OPERABLE BETWEEN A SINGLE USE DISPENSING SYSTEM AND A BULK DISPENSING SYSTEM. The dispenser 30 may dispense any type of chemistry for treating or cleaning items such as wash aids, detergents, detergent boosters and additives, fabric softeners, sanitizers, stain removers, wrinkle inhibitors, fragrances and insect repellant, for example.

[0014] The pump 22 may further be fluidly coupled with a circulation valve 28 through the pump outlet line 40. The circulation valve 28 may be fluidly coupled with the tub 14 through a recirculation line 52 for recirculating liquid from the sump 34 to the tub 14. In this manner, liquid contained within the sump 34 can be drawn from the sump 34 through the line 32 by the pump 22 and recirculated back to the tub 14 through the recirculation line 52.

[0015] The washer 10 may further be provided with a motor (not shown) for selectively rotating the drum 16. The motor may be a direct drive motor or a belt drive motor. The cabinet 12 may also enclose additional components typically found in a conventional clothes washer such as motors, pumps, fluid lines, controls, sensors, transducers, and the like. Such components will not be described further herein except as necessary for a complete understanding of the invention.

[0016] The clothes washer 10 may also have a controller 56 configured to execute a water consuming cycle of operation. The controller 56 may be operably coupled with the pumps 22 and 38, the water supply 24, the dispensing drawer 30, the sump 34, the heater 36, the motor and any other components of the washer 10 for executing a cycle of operation selected by the user. The controller 56 may further be operably coupled with the flush valve 26, the circulation valve 28 and the dispensing valve 44 for controlling the flow of liquid from the water supply 24 to the various components of the washer 10.

[0017] The controller 56 may be provided with a central processing unit (CPU) 58 communicably coupled with a memory 60. The CPU 58 is able to exchange information bi-directionally with the memory 60. Some or all of the memory 60 may be an internal memory associated with the controller 56, the CPU 58 or any other component of the clothes washer 10 or an external memory located external to the clothes washer 10. If any of the memory 60 is stored...
external to the clothes washer 10, the controller 56 may communicate with the memory 60 by any suitable communication means, such as a telephone line or the Internet, for example.

[0018] One or more cycles of operation may be stored in the memory 60 and are executed by the controller 56 by actuation of the various components of the washer 10. Non-limiting examples of cycles of operation that may be stored in the memory 60 and executed by the controller 56 include a delicate wash cycle, a normal wash cycle, a wash cycle for dark colored items, a quick wash cycle, a sanitize cycle and a de-wrinkle cycle. The cycles of operation available may vary depending on the type of cleaning appliance.

[0019] One or more cycles of operation may have one or more operating parameters that may be set by the user through a user interface 62, determined by sensor data or determined automatically based on the setting of another parameter or the selected cycle of operation for completing the cycle of operation. Non-limiting examples of operating parameters include the soil level of the load, the load size and the load type.

[0020] The user interface 62 may include an illuminated display panel, any combination of knobs, buttons or dials selectively operable by the user or an LCD, LED or OLED touch panel. The user may select a cycle of operation and set one or more operating parameters through the user interface 62.

[0021] The operation of the various components of the washer 10 may be based on the cycle of operation and the operating parameters selected by the user or determined automatically based on the selected cycle of operation. For example, the controller 56 may control the operation of the heater 36 to heat the liquid in the sump 34 to a default temperature based on a wash cycle selected by the user. In another example, the user may select a wash cycle and a desired spin speed for completing the selected cycle of operation.

[0022] According to the present invention, the controller 56 may also be used to determine a water hardness value. The water hardness may be used to set one or more operating parameters used by the controller 56 to complete a cycle of operation selected by the user. An identifier indicative of the geographical source of the water may be manually entered through the user interface 62 and used by the controller 56 to determine a water hardness value. The controller 56 may then set one or more parameters for completing a cycle of operation based on the determined water hardness.

[0023] The water hardness may be determined by the controller 56 by a water supply identifier that is manually entered through an interface that is connected with the controller 56. The interface may be a user interface 62 for controlling the appliance or an interface located on a component of the appliance, such as the dispenser drawer 30, for example. The water supply identifier may be any indicia, such as an alphanumeric, alphabetic or numeric indicia, indicative of the geographical source of the water. The geographical source of the water may be a well or a municipal, city, town, village, district or township water supply system.

[0024] The water supply identifier indicative of the geographical source of the water may be in the form of a postal code or a telephone number, for example. Postal codes or post codes may have different names depending on the country of origin. For example, postal codes are often referred to as a zone improvement plan or ZIP code in the United States of America or a postal index number or PIN code in India. Postal codes are usually assigned to geographical areas and thus may provide information for identifying the geographical source of the water.

[0025] Telephone numbers, including the area code, may also be used to identify the geographical source of the water. For example, if the source of the water is a household well, the water supply identifier may be in the form of the home owner's telephone number. If the source of the water is a city water supply system, the water supply identifier may be in the form of the phone number of the city water treatment plant.

[0026] The water supply identifier may also be a combination of the type of water supply and the geographical source of the water. For example, within a given geographical area, identified for example by a ZIP code or telephone number, some residents may receive water through a municipal, city, town, village, district or township water supply system, while others receive water from a household well. This may be important as the municipal water supply for a given geographical area may be different than the water supplied from individual household wells within the same geographical area. The water hardness level for residents living within the same geographical area may vary depending on whether or not their water is supplied by a municipal, city, town, village, district or township water supply system or a household well. The water supply identifier may be used to identify the geographical area where the water is being consumed and whether the water is being supplied directly from that location, such as by a household well, or from a water supply system that may or may not be in the same geographical area, such as a municipal, city, town, village, district or township water supply system.

[0027] The controller 56 may determine the water hardness from the water supply identifier by looking up the water hardness in a data table of corresponding water supply identifiers and water hardness values. The table may be stored in the memory 60 associated with the controller 56 or some other component of the appliance.

[0028] The table may also be stored in a memory external to the appliance. For example, the memory 60 may be in the form of an external database that is accessible directly or indirectly, such as through the internet. The controller 56 may communicate with the external database through a communications network such as a telephone or cable line or a wireless network.

[0029] The table may also be stored on an external device that may be connected with the appliance such as a laptop computer or a USB flash drive. The device may be connected with the appliance during the installation and set-up of the appliance or during a service call through a universal serial bus (USB) or any other type of interface port such as a serial or parallel port. The controller 56 may determine the water hardness from the table stored in the external device during the installation and set-up or a service call and store the water hardness value in the memory 60 or some other memory associated with the appliance.

[0030] The water hardness value determined by the controller 56 may be used to set parameters set by default based on a cycle of operation chosen by the user and parameters that are set manually by the user through the user interface 62. For example, the water hardness value may be used to determine the amount of rinse water to use in each of the different cycles of operation available to the user for selection. The water hardness value may also be used in combination with one or more additional parameters for setting one or more operating
parameters. For example, the water hardness value and the concentration of a detergent may be used to determine the amount of detergent to add during a wash cycle depending on the load size, cycles selected, and soil level selected by the user or determined by sensor data. Additional examples of parameters that may be set to complete a cycle of operation include the concentration of the treatment chemistry, the soil level, the size and type of the load, the number and duration of rinse cycles, temperature and spin speed settings. Various maintenance items may also be considered. For example, the timing and/or frequency of maintenance cycles, such as the clean washer cycle, executed by the consumer; the timing and/or frequency of running a maintenance cycle for a steam generator for either a washer or dryer to prevent calcification or other build-up on or in the steam generator system, like the steam nozzle; and timing and/or frequency of heating element due to calcification or other build-up.

[0031] FIG. 3 illustrates a non-limiting example of a user interface 62 for which a user may enter a water supply identifier that the controller 56 may use to determine a water hardness value. The user interface 62 may generally be used to select a mode of operation, a cycle of operation for the appliance and set one or more parameters for completing the cycle of operation. The user interface 62 may include a water hardness mode button 64 and a set of selection buttons 66. An illuminated display 68 may be provided for communicating the results of the selection of the mode button 64 or one of the selection buttons 66 with the user.

[0032] The user may use the mode button 64 to enter the water hardness determining mode and to select a setting or entry. The available modes, settings and user entries may be selected by pressing and holding the mode button 64 for a pre-determined amount of time. While the user interface 62 is described having a separate set of water hardness determining buttons, entry into the water hardness determining mode may also be incorporated into existing buttons or knobs on the user interface 62.

[0033] Once the water hardness determining mode of operation has been selected, the user may use the selection buttons 66 to scroll through and select or set one or more features or settings available in the mode. The selection buttons 66 may include a pair of left and right moving buttons 70 for scrolling forwards and backwards through a list of options and a pair of up and down buttons 72 for scrolling upwards and downwards through a list of options. Additionally, the pair of left and right moving buttons 70 and the pair of up and down buttons 72 may be used for changing an alphabetic or numeric value.

[0034] A method will now be described for determining the water hardness value using the user interface 62 according to an embodiment of the invention. The user may first enter the water hardness determining mode by pressing the mode button 64 on the user interface 62 such that the water hardness determining mode is displayed in the illuminated display panel 68. For example, the illuminated display panel 68 may display the word “water hardness” to identify the water hardness determining mode has been selected.

[0035] In the water hardness determining mode, the user may make a selection from one or more options by using the selection buttons 66 to scroll through the available options. Examples of available options include identifying the source of the water as a household well or municipal water supply system and the type of water supply identifier that will be entered, such as a postal code or a telephone number. Rather than selecting from one or more options, the user may be prompted by the display panel 68 or a user manual or instruction sheet to enter a pre-determined type of water supply identifier.

[0036] The water supply identifier may be selected from a list of water supply identifiers that correspond to water hardness values stored in a data table. For example, a user may use the selection buttons 66 to scroll through and make selections in a hierarchical list to select a water supply identifier. If the appliance is located in the United States of America, the user may first scroll through a list of states and select the state in which the appliance is located. The selection of a state by the user brings up a new list from which the user may make a selection. For example, the selection of a state brings up a list of counties in the selected state, the selection of a county brings up a list of townships in the selected county and so forth. The user interface 62 may continue to prompt the user to make a selection until the user makes a selection that corresponds to a water hardness value that is stored in the data table.

[0037] The water supply identifier may also be entered manually. For example, selection buttons 66 may be used to enter the water supply identifier in the form of alphanumeric, numeric or alphabetic indicia. The up and down buttons 72 may be used to scroll through a list of available numerals, letters and symbols. If the water supply identifier is in the form of a ZIP code, the user may use the up and down buttons 72 to select the first number in the ZIP code. After the first number has been selected, the display panel 68 may automatically prompt the user to enter the next digit by a flashing cursor or other place marker, for example.

[0038] Once the water supply identifier has been entered, the controller 56 looks up the water hardness in a table of corresponding water supply identifiers and water hardness values. The water hardness value may then be used by the controller 56 for setting one or more parameters in a cycle of operation selected by the user.

[0039] The process of determining a water hardness value need not be repeated each time the appliance is operated. The water hardness value can be determined and stored in a memory associated with or accessible by the controller 56 and accessed by the controller 56 each time a cycle of operation is selected by the user. For example, the water hardness value can be determined by the user or a service person during the installation and set-up of the appliance. The water hardness determining process can also be repeated throughout the life of the appliance, for example if the appliance is not working properly, is moved to another location or if the source of the water supply changes.

[0040] The determined water hardness value may be used by the controller 56 to determine the amount of a treatment or cleaning chemistry to add during a cycle of operation selected by the user. The controller 56 may determine the amount of treatment or cleaning chemistry to add based only on the determined water hardness value and the selected cycle of operation. Alternatively, the controller 56 may also take into account one or more parameters set by the user or determined by sensor data in determining the amount of treatment or cleaning chemistry to add.

[0041] For example, the user may select a cycle of operation for the appliance 10 such as a normal wash cycle. The concentration of the wash detergent present in the dispenser drawer 30 may be entered into the user interface 62 at some previous point in time, such as when the dispenser 30 is filled,
or it may be entered by the user during the selection of the cycle of operation. The controller 56 may automatically use the determined water hardness value and the concentration of detergent to determine the amount of detergent to add during the completion of the selected wash cycle. Alternatively, the amount of detergent to be added determined by the controller 56 may be displayed to the user through the user interface 62. The user may accept the determined amount of detergent by pressing the appropriate selection button on the user interface 62 or the user may override the amount of detergent determined by the controller 56.

Other parameters that may be used alone or in combination with other parameters by the controller 56 in determining the amount of detergent or other chemistry to add include the soil level of the load and the size and type of the load, the cycle selected, for example.

The determined water hardness value may also be used by the controller 56 to determine the number and duration of one or more steps in a cycle of operation selected by the user. For example, the controller 56 may use the water hardness value to determine the length of the wash step and the length and number of rinse steps in a wash cycle selected by the user as well as the number of times a wash-aid such as detergent is dispensed and the time it is dispensed during each cycle. The controller 56 may use the water hardness value alone or in combination with other parameters such as the type and concentration of chemistry to be dispensed during the selected cycle, the soil level of the load and the size and type of the load.

While the invention has been described in the context of a single user interface 62, one or more interfaces may be used to determine the water hardness, enter information regarding the contents of the dispenser drawer 30 and select a cycle of operation. For example, an additional interface may be included on or near the dispenser 30 for determining the water hardness and/or entering the concentration of detergent in the dispenser 30. The user interface 62 may then be used for controlling the appliance, selecting a cycle of operation and setting parameters.

While the invention is described in the context of a horizontal axis clothes washer 10, the invention is not limited to a horizontal axis clothes washer in particular or to a clothes washer in general. The invention may also be used in a vertical axis clothes washer or any other suitable appliance such as a dish-washer or a clothes dryer, for example.

While the invention has been described in connection with certain specific embodiments thereof, it may be understood that this is by way of illustration and not of limitation and the scope of the appended claims should be construed as broadly as the prior art will permit.

What is claimed is:

1. A method for operating a cleaning appliance having a controller configured to execute a water consuming operating cycle having at least one operating parameter:
   - receiving a water supply identifier indicative of the geographical source of the water;
   - determining a water hardness from the water supply identifier; and
   - setting a parameter of the operating cycle based on the water hardness.

2. The method according to claim 1, wherein the receiving of the water supply identifier comprises receiving the water supply identifier from a user of the cleaning appliance.

3. The method according to claim 1, wherein the receiving of the water supply identifier comprises manually entering the water supply identifier into the controller.

4. The method according to claim 3, wherein the manually entering the water supply identifier into the controller comprises manually entering the water supply identifier into a user interface operably coupled to the controller.

5. The method according to claim 1, wherein the water supply identifier comprises a geographic code.

6. The method according to claim 5, wherein the geographic code is at least one of a postal ZIP code, postcode and postal code.

7. The method according to claim 5, wherein the geographic code is at least one of a telephone area code and telephone number.

8. The method according to claim 1, wherein the water supply identifier comprises at least one of an alphanumeric, numeric and alphabetic indicia.

9. The method according to claim 1 wherein the water supply identifier indicates the geographical source of the water as one of a household well, a municipal, a city, a town, a village, a district and a township water supply system.

10. The method according to claim 1, wherein the determining the water hardness comprises looking up the water hardness in a table of corresponding water hardness values and water supply identifiers.

11. The method according to claim 1, wherein the table is stored in a memory associated with the controller.

12. The method according to claim 1, wherein the table is stored in a memory external to the cleaning appliance.

13. The method according to claim 1, wherein the setting of the parameter comprises setting at least one of:
   - an amount of a wash aid to be dispensed;
   - an amount of a drying additive to be dispensed;
   - an amount of a scent additive to be dispensed
   - a duration of a wash cycle; and
   - a duration of a rinse cycle.

14. The method according to claim 1, wherein the setting of the parameter further comprises setting the parameter based on the determined water hardness and a user-selected parameter.

15. The method according to claim 14, wherein the user-selected parameter comprises at least one of:
   - load size,
   - load type,
   - cycle,
   - soil level,
   - treating chemistry concentration,
   - temperature,
   - spin speed,
   - number of rinses in a cycle, and
   - duration of rinse in a cycle.

16. A cleaning appliance comprising:
   - a cleaning chamber for receiving an article to be cleaned;
   - a water supply fluidly coupled with a cleaning chamber to supply water from a water supply source to the cleaning chamber;
   - a user interface configured to receive a water supply identifier indicative of a geographical source for the water supply source; and
   - a controller operably coupled to the water supply and the user interface and configured to determine a water hard-
ness based on the water supply identifier and execute a water consuming cycle of operation based on the determined water hardness.

17. The cleaning appliance according to claim 16 wherein the controller comprises a table of corresponding water hardness values and water supply identifiers.

18. The cleaning appliance according to claim 17 wherein the appliance comprises a clothes washer comprising:
a rotatable drum defining the cleaning chamber for receiving an article to be cleaned;
a bulk dispenser fluidly connected with at least one of the water supply and the cleaning chamber and configured to dispense an amount of at least one of a wash aid, a drying additive and a scent additive;
a controller operably connected with the bulk dispenser for determining the at least one of an amount of a wash aid, a drying additive and a scent additive to be dispensed; and
a controller operably connected with the rotatable drum and the water supply for determining at least one of a duration of a wash cycle and a rinse cycle.

19. The cleaning appliance according to claim 18, comprising a bulk dispenser operably coupled to the controller and configured to dispense a selectively variable amount of wash aid.

20. The cleaning appliance according to claim 19, wherein the controller controls the bulk dispenser to dispense an amount of wash aid based on the determined water hardness.

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