SUMMARY OF THE INVENTION

The present invention involves various aspects of a container and/or dispenser for use in selectively dispensing numerous types of loose materials, such as dry products, and precisely controlled hot water, including both temperature and volume. Suitable dry products for use with the novel dispenser disclosed herein include one or more varieties of tea, spices, coffee, dried foods, other powders and the like. For purposes of illustration, the container and dispenser described herein shall be described with respect to the dispensing of loose leaf tea. However, it shall be appreciated that the system could be easily applied to other loose materials, such as, but not limited to, those listed above. In one further form, the dispenser may include a coin/bill acceptor and/or credit card terminal or like device for use as a vending machine, in another form, electronic payments such as mobile payments, room keys or fobs for making a room charge, or other types of commonly used and/or know payment methods may be provided for.

According to a first aspect of the present invention, there is provided a dispenser for dispensing a specified volume of water at a specified temperature into a waiting user vessel, comprising:

a water line for receiving water from a water source;

a first holding tank for storing water at a first predetermined temperature, the first holding tank having a first inlet for receiving water, a first temperature sensor, a first outlet having a first pump, and a first heater for maintaining water within the first holding tank at a first predetermined temperature;

a second holding tank, separate from the first holding tank, for storing water at a second temperature different from the first predetermined temperature, the second holding tank having a second inlet, a second temperature sensor, and a second outlet having a second pump;

a first recirculation valve in fluid communication with the first outlet, wherein the first recirculation valve is operable to selectively divert water from the first outlet between a first recirculation loop which returns water to the first holding tank or a first water dispense line;

a water dispense port in fluid communication with the first water dispense line and a second water dispense line connected to the second outlet, wherein the water dispense port is configured to dispense water from the first holding tank and the second holding tank into the vessel;

a first flowmeter positioned between the first outlet and the water dispense port and in fluid communication with the water from the first holding tank;

a second flowmeter positioned between the second outlet and the water dispense port and in fluid communication with the water from the second holding tank;

an electronic controller for receiving input from the first temperature sensor, the second temperature sensor, the first flowmeter and the second flowmeter and controlling the first pump, the second pump, and the first recirculation valve in order to recirculate water in the first holding tank and subsequently dispense the specified volume of water through the water dispense port.

According to a second aspect of the present invention, there is provided a method of operating a dispenser having a first holding tank and a second holding tank to dispense a specified volume of water at a specified temperature into a waiting user vessel, comprising:

at least partially filling the first holding tank by electronically opening a first water inlet valve connected to a pressurized water supply line and the second holding tank by electronically opening a second water inlet valve connected to the pressurized water supply line;

heating and periodically recirculating the water in the first holding tank using a first heater and a first pump, a first recirculation valve and a first recirculation loop until a first temperature sensor determines the temperature of the water contained in the first holding tank is at a first predetermined temperature;

heating and periodically recirculating the water in the second holding tank using a second heater and a second pump, a second recirculation valve and a second recirculation loop until a second temperature sensor determines the temperature of the water contained in the second holding tank is at a second predetermined temperature;

electronically calculating, using the temperatures reported by the first temperature sensor and the second temperature sensor, the volume of water to be dispensed from the first tank (V_1) and the second holding tank ($V_{2)}$ in order to dispense the specified volume of water at the specified temperature into a waiting user vessel;

electronically actuating the first recirculation valve to divert water from the first pump through a first flow meter to a water dispense port;

operating the first pump and receiving first electronic signals from the first flow meter to dispense the volume of water V_1 from the first holding tank through the water dispense port and into the user vessel;

electronically actuating the second recirculation valve to divert water from the second pump through a second flow meter to a water dispense port; and

operating the second pump and receiving second electronic signals from the second flow meter to dispense the volume of water V_2 from the second holding tank through the water dispense port and into the user vessel.

An illustrative embodiment of the present invention is a loose leaf tea system including a plurality of containers and dispenser as well as a hot water dispenser. The tea containers each serve to store a given variety of tea leaves or grounds prior to activation of the system. Upon activation, the dispenser positions the selected tea container, measures and loads a selected amount of that variety of tea into a hopper for dispensing, such as into a waiting cup, tea pot, or a tea infuser, and also dispenses the appropriate amount of hot water at the proper temperature for the selected type and volume of tea. The amount of tea and volume of water may be selected based upon user operation of one of a number of quantity indicating/selection buttons provided in a user interface or may be otherwise input by the user, such as by rotating a dial or pushing a button or lever. The temperature of the hot water may be programmed into the dispenser for each variety of tea based upon tea expert recommendations and/or the user may be able to input the temperature or modify the recommendation based upon their personal preferences. The container is preferably a sealed canister, such as a blow molded opaque container, which is sealed when positioned on the dispenser so as to not expose the material contained to light, air and/or moisture. Below the opening in each container a mechanism is provided for loading the tea into a measuring hopper below. Each mechanism preferably seals when not in use so as to prevent the tea in the container from coming into contact with the outside atmosphere prior to entering the hopper below. Furthermore, the dispenser is able to operate the mechanism such that it loads a desired amount of tea (e.g. by weight), specified by the user, into the hopper. Once the

requirements, including a dispenser which only dispenses water at a selected volume and temperature, or a dispenser which dispenses water at a selected temperature and some other loose material.

As shown in FIGs. 1-8, the tea dispenser 20, and in particular rear portion 28, provides an apparatus, system, and method for dispensing hot water on-demand across a wide range of precisely controlled temperatures and/or volumes. Rear portion 28 includes a first hot water tank 100, which maintains water at a first temperature, and a second hot water tank 200, which maintains water at a second temperature which is higher than the first temperature. In one form, the first hot water tank 100 is larger in volume than the second hot water tank 200. In other forms, the second hot water tank 200 may be larger in volume than the first hot water tank 100 or the two may be of equal size.

It has been found that the vast majority of teas are to be steeped at a temperature between 71.11°C (160° F) and 100°C (212° F). Accordingly, for purpose of non-limiting example, when the tea dispenser 20 is utilized for tea, the water in the first hot water tank 100 is maintained at or slightly above/below 71.11°C (but preferably at least 32.22°C) [160° F (but preferably at least 90° F)], while the water in the second hot water tank 200 is maintained at or slightly below 100°C (i.e. within 5.56°C) [212° F (i.e. within 10° F)]. It is desirable to maintain the water in the second hot water tank below the boiling point of water, which is 100°C (212° F) (depending upon altitude), to prevent pressure build up and/or increase water loss through steam. By mixing water from the first and second hot water tanks (100 and 200 respectively) in differing ratios, hot water at any temperature between 71.11°C (160° F) and 100°C (212° F) can be quickly and accurately dispensed by dispenser 20 at a desired temperature and in a desired volume.

Middle portion 24 of dispenser 20 also includes an electronic controller 30 which receives inputs regarding temperature and flow from a number of sensors which will be described herein and controllably operates other components of dispenser 20 in order to dispense water at the desired temperature and volume. Each of the first hot water tank 100 and the second hot water tank 200 includes a water supply inlet 102 / 202 through which additional water is fed in order to fill and/or replenish the tanks. Each water supply inlet 102 / 202 is in fluid communication with a controlled supply valve 104 / 204. Each controlled supply valve 104 / 204 is connected to and fed by water supply line 34. In one form, water supply line 34 is in fluid communication with a water supply input 36 located on the rear of the external housing of dispenser 20. In one manner of use, the water supply input 36 is connected to a convention pressurized water supply line. Water supply line 34 may include

area prior to the tea dispenser 20 being operable to dispense the tea in step 1600. It shall be appreciated that in some forms agitator 56 may only be operated intermittently during a dispense cycle and not continuously.

Now that the tea dispensation cycle is complete, the next step begins the hot water dispensation cycle. As shall be appreciated, in the arrangement of dispenser where only hot water is to be dispenses, the process may omit some or all of the preceding steps. This cycle beings at step 1610 with the electronic controller 30 receiving the current temperature of hot water tank 100 (as reported by temperature sensor 108) and the temperature of hot water tank 200 (as reported by temperature sensor 208) to determine the volume of water to be dispensed from each of the first hot water tank 100 and the second hot water tank 200. In one form, the electronic controller may also energize pipe heating elements 124 and 224 to bring the first hot water outlet tube 112 and the second hot water outlet tube 212 up to an elevated temperature so as to minimize any radiant heat loss from the water. In one form, the circulation pumps 120 and 220 may be operated continuously so that this temperature reading may be taken right away. However, in other forms, the circulation pumps 120 and 220 may be run only periodically, in which case the electronic controller 30 would activate the circulation pumps 120 and 220 for a brief time before reading the water temperatures. In the next step, step 1620, the electronic controller 30 utilizes the volume of hot water desired, the temperature of water desired, and the temperatures received in step 1510 to determine the amount of water that needs to be dispensed from each of the first hot water tank 100 and the second hot water tank 200 in order to properly dispense the predetermined volume of water at the selected temperature. For example, it may be determined by electronic controller 30 that 10 ounces of water needs to be dispensed from second hot water tank 200 and that two ounces of water from first hot water tank 100 needs to be dispensed in order to ultimately dispense 12 ounces of water at 82.22°C (180º F). Once these volumes are determined, in step 1630, electronic controller 30 activates first water pump 114 and opens first output valve 116 to begin dispensing hot water from the first hot water tank 100. Simultaneously, or in an interleaved fashion, electronic controller 30 activates second water pump 214 and opens second output valve 216 to begin dispensing hot water from the second hot water tank 200. In one form, the speed of the first and second water pumps 114 and 214 are adjusted so that the time to dispense the desired volume remains relatively constant, thereby providing a near uniform hot water profile across the dispense cycle and preventing hotter or colder water than desired from being dispensed at any given time. During the dispensing of step 1630,

adjustment in order to quickly dispense tea and/or hot water up to a certain percentage of the desired amount and then go through several speed reductions in order to accurately and quickly arrive at the desired weight.

It shall also be appreciated that the above method may be adapted for use with dispenser 21 disclosed below. For example, recirculation loops may be utilized in place of the recirculation pumps and the direction control valves are utilized to select between dispense and recirculate mode at the appropriate times.

An alternate form of a tea dispenser 21, which utilizes valves and recirculation loops in place of the circulation pumps 120 and 220 of tea dispenser 20, is shown in a design view in FIG. 10. It shall be appreciated that all components of tea dispenser 21 are the same as those shown and described with respect to tea dispenser 20 in FIGs. 1-8, except where indicated below.

Tea dispenser 21 includes a first hot water tank 100, which maintains water at a first elevated temperature, and a second hot water tank 200, which maintains water at a second temperature which is higher than the first temperature. In one form, the first hot water tank 100 is larger in volume than the second hot water tank 200. In other forms, the second hot water tank 200 may be larger in volume than the first hot water tank 100 or the two may be of equal size. In one other form, one of water tanks 100 or 200 may lack a heating element and utilize room temperature water.

For purpose of non-limiting example, when the tea dispenser 21 is utilized for tea, the water in the first hot water tank 100 is maintained at or slightly above/below 71.11°C (160° F), while the water in the second hot water tank 200 is maintained at or slightly below 100°C (212° F). By mixing water from the first and second hot water tanks (100 and 200 respectively) in differing ratios, hot water at any temperature between 71.11°C (160° F) and 100°C (212° F) can be quickly and accurately dispensed by dispenser 21 at a desired temperature and in a desired volume.

Each water tank 100 / 200 of dispenser 21 includes a water supply inlet 102 / 202 and a controlled supply valve 104 / 204 through which additional water is controllably supplied in order to fill and/or replenish the tanks using water supply line 34 (not shown) and water supply input 36 (also not shown). Each of the first hot water tank 100 and the second hot water tank 200 also includes a heating element 106 / 206. In other forms, only one tank may be heated. Also located within each of the first hot water tank 100 and the second hot water tank 200 are temperature sensors 108 and 208 which provide electrical signals to electronic controller 30 (not shown) which utilizes those signals to control the operation of heating

What is claimed is:

1. A dispenser for dispensing a specified volume of water at a specified temperature into a waiting user vessel, comprising:

a water line for receiving water from a water source;

a first holding tank for storing water at a first predetermined temperature, the first holding tank having a first inlet for receiving water, a first temperature sensor, a first outlet having a first pump, and a first heater for maintaining water within the first holding tank at a first predetermined temperature;

a second holding tank, separate from the first holding tank, for storing water at a second temperature different from the first predetermined temperature, the second holding tank having a second inlet, a second temperature sensor, and a second outlet having a second pump;

a first recirculation valve in fluid communication with the first outlet, wherein the first recirculation valve is operable to selectively divert water from the first outlet between a first recirculation loop which returns water to the first holding tank or a first water dispense line;

a water dispense port in fluid communication with the first water dispense line and a second water dispense line connected to the second outlet, wherein the water dispense port is configured to dispense water from the first holding tank and the second holding tank into the vessel;

a first flowmeter positioned between the first outlet and the water dispense port and in fluid communication with the water from the first holding tank;

a second flowmeter positioned between the second outlet and the water dispense port and in fluid communication with the water from the second holding tank;

an electronic controller for receiving input from the first temperature sensor, the second temperature sensor, the first flowmeter and the second flowmeter and controlling the first pump, the second pump, and the first recirculation valve in order to recirculate water in the first holding tank and subsequently dispense the specified volume of water through the water dispense port.

2. The dispenser of claim 1, wherein the first predetermined temperature is greater than the second temperature.

3. The dispenser of claim 2, wherein the first predetermined temperature is between 94.44 °C and 100°C (i.e. between 202 and 212 degrees Fahrenheit).

4. The dispenser of claim 1, wherein the second temperature is room temperature.

5. The dispenser of claim 1, further comprising a means for determining the boiling temperature of water and adjusting the first predetermined temperature.

6. The dispenser of claim 5, wherein the means for determining the boiling temperature of water and adjusting the first predetermined temperature comprises a barometer.

7. The dispenser of claim 1, wherein the first outlet further includes a first outlet valve and the second outlet further includes a second outlet valve, wherein each of the first outlet valve and the second outlet valve are selectively controlled by the electronic controller.

8. The dispenser of claim 1, wherein the first pump and the second pump are variable speed pumps.

9. The dispenser of claim 1, wherein the first recirculation valve comprises two or more distinct valves.

10. The dispenser of claim 1, further comprising a dispense valve controlled by the electronic controller to close the water dispense port.

11. The dispenser of claim 1, wherein the second holding tank includes a second heater for maintaining water within the second holding tank at the second temperature.

12. The dispenser of claim 11, wherein the second temperature is above 32.22°C (i.e. above 90 degrees Fahrenheit).

13. The dispenser of claim 1, further comprising a second recirculation valve connected to the second outlet, wherein the second recirculation valve is operable to selectively divert water from the second outlet between a second recirculation loop which returns water to the second holding tank or a second water dispense line and wherein the second recirculation valve is controlled by the electronic controller.

14. The dispenser of claim 13, wherein the second recirculation valve comprises two or more distinct valves.

15. The dispenser of claim 1, wherein the at least one of the first inlet and the second inlet is in in fluid communication with the water line.

16. A method of operating a dispenser having a first holding tank and a second holding tank to dispense a specified volume of water at a specified temperature into a waiting user vessel, comprising:

at least partially filling the first holding tank by electronically opening a first water inlet valve connected to a pressurized water supply line and the second holding tank by electronically opening a second water inlet valve connected to the pressurized water supply line;

heating and periodically recirculating the water in the first holding tank using a first heater and a first pump, a first recirculation valve and a first recirculation loop until a first temperature sensor determines the temperature of the water contained in the first holding tank is at a first predetermined temperature;

heating and periodically recirculating the water in the second holding tank using a second heater and a second pump, a second recirculation valve and a second recirculation loop until a second temperature sensor determines the temperature of the water contained in the second holding tank is at a second predetermined temperature;

electronically calculating, using the temperatures reported by the first temperature sensor and the second temperature sensor, the volume of water to be dispensed from the first tank (V_1) and the second holding tank ($V_{2)}$ in order to dispense the specified volume of water at the specified temperature into a waiting user vessel;

electronically actuating the first recirculation valve to divert water from the first pump through a first flow meter to a water dispense port;

operating the first pump and receiving first electronic signals from the first flow meter to dispense the volume of water V_1 from the first holding tank through the water dispense port and into the user vessel;

electronically actuating the second recirculation valve to divert water from the second pump through a second flow meter to a water dispense port; and

operating the second pump and receiving second electronic signals from the second flow meter to dispense the volume of water V_2 from the second holding tank through the water dispense port and into the user vessel.

17. The method of claim 16, wherein said operating the first pump and said operating the second pump occur at least partially at the same time.

18. The method of claim 16, wherein volume V_1 and volume V_2 add up to the specified volume.

19. The method of claim 16, further comprising the steps of:

recirculating the water in the second holding tank using the second pump, the second recirculation valve and the second recirculation loop immediately prior to said operating the second pump.

20. The method of claim 19, further comprising the steps of:

recirculating the water in the first holding tank using the first pump, the first recirculation valve and the first recirculation loop immediately prior to said operating the first pump.