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TWO-TEMPERATURE WATER HEATING SYSTEM

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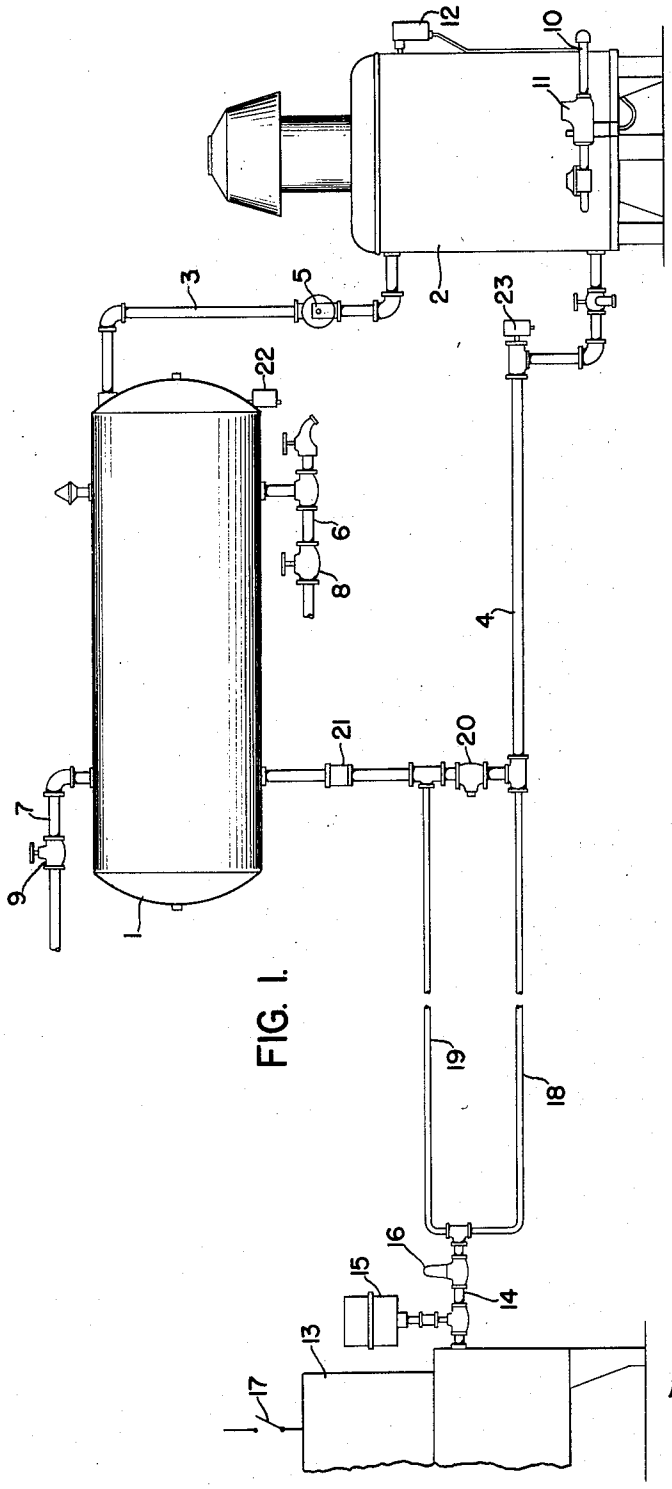


FIG. 1.

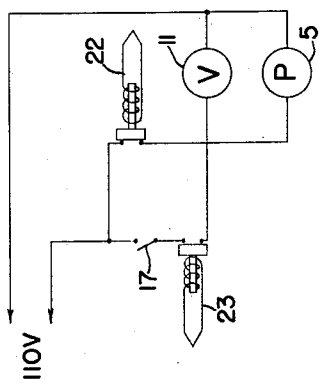


FIG. 2.

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TWO TEMPERATURE WATER HEATING SYSTEM

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This invention relates to a water heating system and more particularly to a system which can be utilized to supply water at two different temperatures.

A commercial water heating system, as disclosed in Patent No. 2,852,018, is adapted to supply water at about 140° F. for general purpose washing operations and/or water at a temperature of 180° F. for rinsing or sanitizing purposes. In a water heating system such as this, water for normal usage is stored in a storage tank at approximately 140° F. and the storage tank is connected to an instantaneous type water heater by a supply conduit. Heated water at the sanitizing temperature is returned from the water heater to the storage tank through a high temperature water conduit which extends to a location adjacent the dishwashing machine or the like, and sanitizing water is drawn from the high temperature water conduit to the dishwashing machine through a discharge line of minimum length. With this system, there is no storage required for the 180° F. sanitizing water, yet the 180° F. water continually circulates within the high temperature conduit and is readily available for rinsing or sanitizing operations.

As the water heater and storage tank are frequently located in a boiler room while the dishwashing machine is located in a kitchen which may be as far as 100 feet from the boiler room, a substantial length of piping is required for the high temperature loop which extends to the dishwashing machine and back to the storage tank. The material for this long extended loop is costly, and also there is a considerable heat loss from the high temperature heated water passing within the loop to the surrounding atmosphere.

The present invention is directed to an improvement for the above system in which the high temperature water conduit extends directly from the water heater to the storage tank and is adapted to conduct the water at a sanitizing temperature from the heater to the storage tank. A discharge line of minimum length is connected to the dishwashing machine or other apparatus utilizing the sanitizing water, and a pair of long delivery conduits are connected between the discharge line and the high temperature water conduit and provide a loop for the circulation of high temperature sanitizing water.

The delivery conduits are of a substantially smaller diameter than the high temperature water conduit and the discharge conduit so that the cost of installing the long extent of the delivery conduit is substantially reduced over the conventional system.

A flow control means, such as a cock valve, is disposed in the high temperature water conduit between the connections of the delivery conduits to the high temperature water conduit. By properly adjusting the control valve, the water will flow from the water heater to the storage tank and will flow through both the high temperature water conduit and through the loop formed by the delivery conduits so that the water in the loop will be at 180° F. at all times.

When water is drawn through the dishwashing machine, high temperature sanitizing water will flow simultaneously through both delivery conduits to the dishwashing machine so that the rate of water flow to the dishwashing machine is not reduced by using the smaller diameter delivery conduits.

The present invention reduces the installation cost of the water heating system particularly where the delivery conduits are of substantial length because of the use of the smaller diameter conduit. While the diameter of the delivery conduit is reduced, the capacity of water flow to the dishwashing machine is maintained due to the fact that water is permitted to flow through both delivery conduits to the discharge conduit and then to the dishwashing machine. In addition, as the diameter of the delivery conduit is reduced, the heat loss to the surrounding area will be decreased.

Other objects and advantages will appear in the course of the following description.

The drawings illustrate the best mode presently contemplated of carrying out the invention.

In the drawings:

Fig. 1 is a schematic representation of the water heating system of the present invention; and

Fig. 2 is a wiring diagram for the system of Fig. 1.

The drawings illustrate a water heating system designed to supply water at two different temperatures. One supply of water at about 140° F. is used for general washing operations and a higher temperature water of about 180° F. is used for sanitizing purposes.

The water heating system comprises a hot water storage tank **1** which is adapted to contain water at about 140° F. The tank **1** is connected to a gas fired water heater **2** by means of conduit **3**.

The water, which is heated in the heater **2**, is circulated from the heater through a high temperature water conduit **4** to the storage tank **1** to provide a closed circulating system. The water is circulated through the system by a pump **5** which is located in the conduit **3**, as shown in the drawing, or alternately in the conduit **4**.

Cold water is supplied to the system through a conduit **6** connected to tank **1**, and water at a temperature of about 140° F. is drawn from the storage tank through a conduit **7**. The conduits **6** and **7** may be closed or opened, as desired, by means of valves **8** and **9**, respectively.

The hot water heater **2** is of the conventional instantaneous type in which the water is passed through a coiled conduit and heated by a gas burner. Gas is supplied to the burner through a gas line **10** and the flow of gas within the line **10** is controlled by a solenoid operated gas valve **11**. A water temperature control thermostat **12** is disposed in the coiled conduit and is responsive to the water temperature therein. Thermostat **12** serves to modulate the flow of gas to the burner in response to the demand for heat or to turn the flow of gas on or off in response to the demand for heat, depending on the type of heater used. Hot water at the sanitizing temperature of about 180° F. is discharged from the heater to the high temperature water conduit **4**.

An apparatus **13**, such as the dishwashing machine or the like, is adapted to utilize the high temperature water for sanitizing purposes. A discharge conduit **14** of minimum length is connected to the dishwashing machine and a water hammer arrester **15** and pressure reducing valve **16** of conventional design are disposed in the discharge conduit **14**.

The operation of the dishwashing machine **13** is controlled by a toggle switch **17** which, when closed, will put the dishwashing machine into operation. The toggle switch is manually operated and is adapted to be closed during the dishwashing operation and to be opened after

the dishwashing has been completed. Alternately, a separate switch independent of the dishwashing machine is adapted to be closed at the time that the dishwashing machine is turned on and may be used in place of the switch 17.

According to the invention, a pair of delivery conduits 18 and 19 are connected between the discharge conduit 14 and the high temperature water conduit 4. The delivery conduits 18 and 19 extend from the high temperature water conduit 4, which is normally in the boiler room, to a location adjacent the dishwashing machine and thus, the length of the conduits 18 and 19 will be substantial and in some cases, up to 50 or 100 feet.

The conduits 18 and 19 are both usually provided with the same internal diameter and have a substantially smaller diameter than the internal diameter of the high temperature water conduit 4. Generally, the cross sectional area of the conduit 18 or 19 is about one-half the cross sectional area of the high temperature conduit 4, so that the total cross sectional area of the conduit 18 and 19 will be substantially equal to the cross sectional area of the conduit 4.

The connections of the conduits 18 and 19 are spaced apart on the conduit 4 and a flow control valve 20 is disposed in the conduit 4 between the connections of the conduits 18 and 19. Valve 20 is adapted to be manually adjustable to control the flow of high temperature water through conduit 4. By partially closing the flow control valve 20, a proportionately greater amount of water will bypass through conduit 18 and conduit 19, and around the control 20 to tank 1 when water is not being drawn to the dishwashing machine. Conversely, by opening the control 20, a smaller proportion of the water will flow through conduits 18 and 19.

Water is prevented from returning from the storage tank 1 through conduit 4 to the heater and to the dishwashing machine 13 by means of a check valve 21 which is disposed in the conduit 4 between the connection of the conduit 19 and the storage tank 1. Check valve 21 permits the flow of hot water from the heater 2 to the tank when sanitizing water is not being drawn at the dishwashing machine and prevents the flow of lower temperature water from the tank 1 through conduit 4 to the dishwashing machine when sanitizing water is being drawn.

The temperature of the water contained within tank 1 is maintained at about 140° F. by a temperature control 22 which is disposed in the wall of the tank and is responsive to the water temperature therein.

As shown in Fig. 2, the pump 5 and the gas valve 11 are connected in parallel and the control 22 is connected in series with the parallel circuit of the pump and gas valve. With this connection, the gas valve 11 is open to admit gas to the burner and the pump is operating to circulate water through the system whenever the temperature in the tank drops below 140° F. When the temperature in the tank exceeds 140° F., the control 22 opens the circuit to close valve 11 and shut down pump 5.

The temperature of the sanitizing water is controlled by a temperature control 23 which is disposed in conduit 4 between the heater 2 and the delivery conduit 18. The control 23 is responsive to the temperature of the water in conduit 4 and is connected in series with the toggle switch 17 or the dishwashing machine operating switch. The control 23 and the switch 17 are connected in parallel with the control 22, as shown in Fig. 2.

In this second circuit, the toggle switch 17 and the dishwashing machine switch must be initially closed in order for the pump to operate and the gas valve to open to admit gas to the burner. When the toggle switch or dishwashing machine switch closes, the pump will circulate water through the system and the gas valve will be open to admit gas to the burner whenever the temperature of the water in conduit 4 falls below the temperature setting of control 23, which is usually about 180° F. When the temperature of the water in conduit 4 exceeds the control setting, the control 23 opens the circuit to close valve 11 and shut off the pump.

The thermostatic control systems for the pump and gas burner are substantially similar to that described in Patent 2,852,018. However, it is contemplated that a control system, similar to that described in Burklin patent 2,591,400, wherein the gas burner and pump are actuated by a flow switch when water is drawn to the dishwashing machine can also be incorporated in place of the system described above.

In operation of the water heating system, when water is not being drawn to the dishwashing machine, if the water in the storage tank 1 falls below the setting of thermostatic control 22, the pump and burner will be operated to heat water in heater 2 and circulate high temperature sanitizing water through conduit 4 to tank 1. A portion of the hot water passing through conduit 4 will pass through valve 20 and a second portion of the heated water will bypass valve 20 and flow within the delivery conduits 18 and 19 to maintain the water in the delivery conduits at the sanitizing temperature. By proper adjustment of the valve 20, the amount of water flowing through conduits 18 and 19 can be varied as desired. Normally, the adjustment is such that the majority of the water will pass through the valve 20 and only a small amount of water sufficient to maintain the temperature will pass through conduits 18 and 19.

At the start of the dishwashing operation, the switch 17 is closed to actuate the pump 5 and open the gas valve 11. Heated water will then flow through conduit 4 with a portion of the heated water flowing through conduits 18 and 19. When water is drawn to the dishwashing machine, the heated water at the sanitizing temperature will flow through both the conduits 18 and 19 to discharge conduit 14 and hence, to the dishwashing machine. As the conduits 18 and 19 have smaller diameters than conduit 4, the rate of flow through each of the conduits is less than the flow through conduit 4. However, the total capacity of the conduits 18 and 19 is substantially equal to that of conduit 4 and discharge conduit 14, so that there is no restriction in the flow of sanitizing water to the dishwashing machine.

By extending the conduits 18 and 19 from the high temperature conduit 4 to a location adjacent the dishwashing machine, the length of the discharge line 14 is minimized so that there will be a limited length of piping within which the sanitizing water can cool beneath the sanitizing temperature during idle periods. Sanitizing water is circulated through conduits 18 and 19 to adjacent the dishwashing machine and thus when water is drawn for rinsing or sanitizing purposes there will be a minimum of cool water initially drawn to the dishwashing machine.

The present invention, by employing the smaller diameter delivery conduits of substantial length, reduces the installation cost of the water heating system, particularly when there is a long run between the boiler room and the dishwashing apparatus or other device using the sanitizing water. Even though a smaller diameter conduit is used for this delivery loop, there is no loss in capacity because the sanitizing water is free to flow to the dishwashing machine through both sections of the loop when water is drawn thereto. Further, as the delivery conduit has a smaller diameter, the heat loss to the atmosphere will be also reduced.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In a water heating system adapted to deliver two temperatures of heated water and including a hot water heater and a hot water storage tank, the improvement

comprising a high temperature water conduit connected between the water heater and the storage tank to conduct heated water at a sanitizing temperature from the water heater to the storage tank, an apparatus to utilize water at said sanitizing temperature, a discharge conduit of minimum length connected to said apparatus, a pair of delivery conduits of substantial length connecting the discharge conduit and said high temperature water conduit with the connections of said delivery conduits to said high temperature water conduit being spaced apart, each of said delivery conduits having a substantially smaller internal diameter than said high temperature conduit, and flow control means disposed in the high temperature conduit between the positions of connection of said delivery conduits to said high temperature conduits, said flow control means being adjustable to provide a flow of heated water at the sanitizing temperature from the water heater through the high temperature water conduit and simultaneously through said delivery conduits to the storage tank during periods when sanitizing water is not being drawn to said apparatus to thereby prevent cooling of the water in the delivery conduits below the sanitizing temperature, and on drawing sanitizing water to said apparatus, said sanitizing water flowing simultaneously through both delivery conduits from said high temperature water conduit to said apparatus to provide a double flow capacity to said apparatus.

2. In a water heating system adapted to deliver two temperatures of heated water and including a hot water heater and a hot water storage tank, the improvement comprising a high temperature water conduit connected between the water heater and the storage tank to conduct heated water at a high temperature to the storage tank, an apparatus to utilize water at said high temperature, a discharge conduit of minimum length connected to the apparatus, a looped delivery conduit having the ends thereof connected to said high temperature water conduit and said discharge conduit being connected to said delivery conduit at a location intermediate said ends, said delivery conduit having an internal cross sectional area substantially smaller than that of said high temperature conduit, and flow control means disposed in the high temperature conduit between the locations of connection of the ends of the delivery conduit to said high temperature conduit, said flow control means being adjustable to provide a flow of heated water at said high temperature from the water heater through said high temperature conduit and through said delivery conduit to the storage tank during periods when high temperature water is not being drawn to the apparatus to thereby prevent cooling of the water in said delivery conduit below said high temperature and on drawing water to said apparatus said high temperature water flowing from said high temperature conduit through both ends of said delivery conduit to said discharge conduit and then to the apparatus.

3. The structure of claim 1, in which the delivery conduits both have substantially the same internal diameter and the length of each delivery conduit is substantially the same.

4. The structure of claim 2, and including check valve means disposed in the high temperature water conduit between the storage tank and the location of the connection of the delivery conduit to said high temperature water conduit, said check valve means permitting free flow of said high temperature water from the water heatere to the storage tank during periods when high temperature water is not being drawn to said apparatus and preventing flow of water from the storage tank to the apparatus when high temperature water is being drawn thereto.

5. A hot water heating system comprising a hot water heater, a storage tank, a conduit connecting the hot water heater and the storage tank and disposed to conduct water from the storage tank to the hot water heater, a high temperature conduit connected between the storage tank and hot water heater and disposed to conduct heated water at a high temperature from the water heater to the storage tank, said hot water heater, storage tank, firs conduit and high temperature conduit providing a closed system for the circulation of water, second conduit means for withdrawing heated water from said storage tank, at a lower elevated temperature than said high temperature, means for introducing cold water into said system, pumping means for circulating water in said system, an apparatus to utilize water at said high temperature, a discharge conduit connected to said apparatus and having a minimum length, a pair of delivery conduits of substantial length connecting the discharge conduit and said sanitizing water conduit with the connections of said delivery conduits to said sanitizing water conduit being spaced apart, each of said delivery conduits having a substantially smaller internal diameter than said sanitizing conduit, and flow control means disposed in the sanitizing conduit between the positions of connection of said delivery conduits to said sanitizing conduit, said flow control means being adjustable to provide a flow of heated water at the sanitizing temperature from the water heater through the sanitizing water conduit and simultaneously through said delivery conduits to the storage tank during periods when sanitizing water is not being drawn to said apparatus to thereby prevent cooling of the water in the delivery conduits below the sanitizing temperature, and on drawing sanitizing water to said apparatus said sanitizing water flowing simultaneously through both delivery conduits from said sanitizing water conduit to said apparatus to provide a double flow capacity to said apparatus.

6. In a hot water system adapted to deliver two temperatures of heated water and including a hot water heater and a hot water storage tank, the improvement comprising a high temperature water conduit connected between the water heater and the storage tank to conduct high temperature heated water to said storage tank. adjustable valve means disposed in said high temperature conduit, an apparatus to utilize water at said high temperature, a discharge conduit of minimum length connected to said apparatus, and a looped conduit having a substantial length and extending to a location adjacent said apparatus, the ends of said looped conduit being connected to the high temperature conduit on either side of said valve means, said looped conduit having a substantially smaller diameter than said high temperature conduit, and said discharge conduit being connected to said looped conduit intermediate the ends thereof, said valve means being adjustable to provide flow of high temperature water from the water heater through the high temperature conduit and through said looped conduit to the storage tank during periods when high temperature water is not being drawn to said apparatus to thereby prevent cooling of the water in said looped conduit below said high temperature and on drawing water to the apparatus said high temperature water flowing from said high temperature conduit through both ends of the looped conduit to the apparatus to provide a double flow capacity thereto.

7. The structure of claim 2, in which the internal cross sectional area of said high temperature conduit is approximately twice that of said delivery conduit.

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