Sept. 16, 1958 D. WILLIAMS 2,852,018

TWO TEMPERATURE WATER HEATING SYSTEM

Filed Sept. 23, 1954

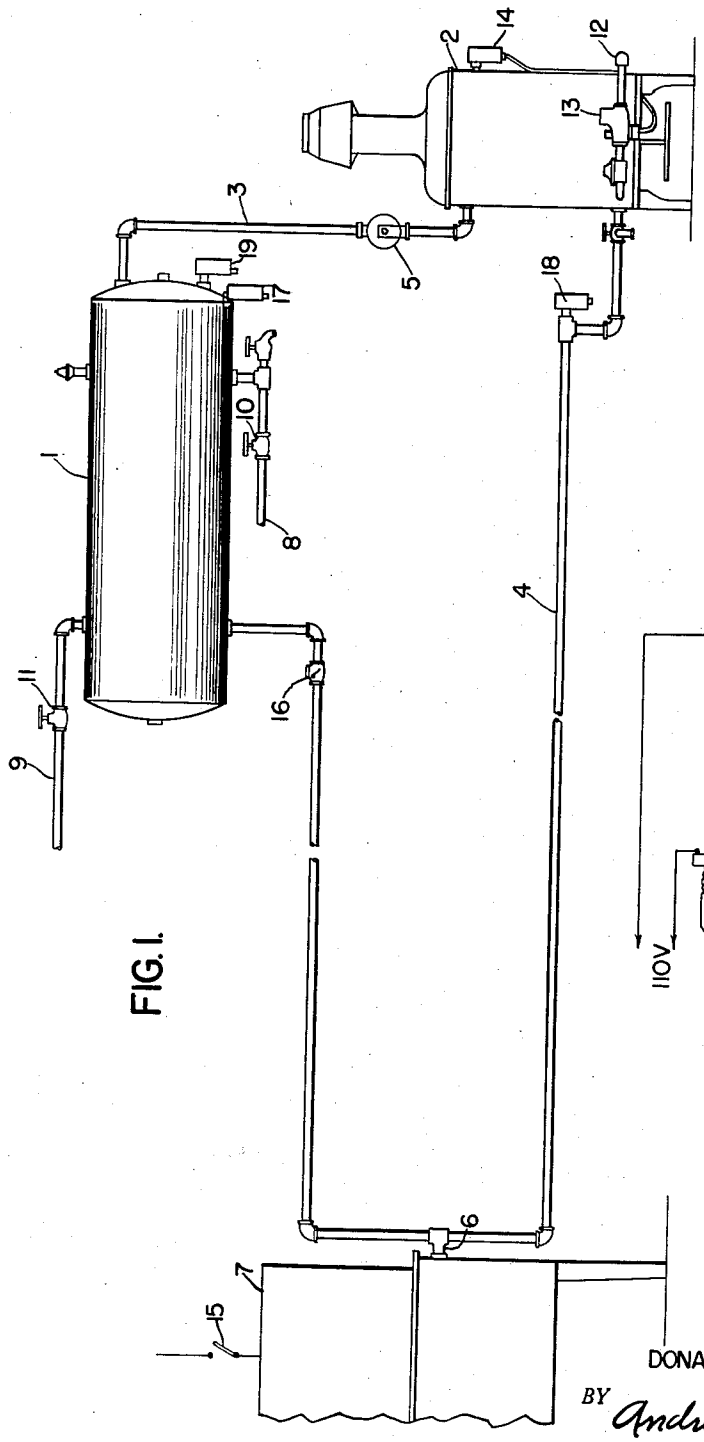


FIG. I.

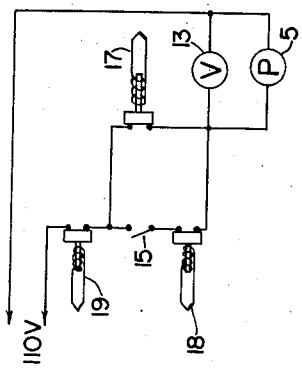


FIG. 2.

INVENTOR.
DONALD WILLIAMS

BY Andrus & Sceales

Attorneys

United States Patent Office 2,852,018
Patented Sept. 16, 1958

2,852,018

TWO TEMPERATURE WATER HEATING SYSTEM

Donald Williams, Kankakee, Ill., assignor to A. O. Smith Corporation, Milwaukee, Wis., a corporation of New York

Application September 23, 1954, Serial No. 457,828

6 Claims. (Cl. 126—362)

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.

Commercial water heating systems generally supply water at about 140° F. for washing operations and/or water at a higher temperature 180° F. for rinsing or sanitizing purposes by means of two heaters, or by means of a heater containing a mixing valve or by other such devices. The commercial water heating system under United States Patents No. 2,591,400 and 2,291,023 assigned to a common assignee with the present application is directed to a water heating system in which a single heater is used in a combination with a storage tank and pump to supply water at two temperatures. In this system, approximately 140° F. water is supplied from the tank for normal usage. Water at approximately 140° F. is maintained in the tank by passing the water from the tank through a heater and returning the heated water to the tank through a hot water line. Water discharged from the heater and returning to the tank will be at sanitizing temperatures. Sanitizing water is drawn from this hot water line through a discharge line to the apparatus of use which may be a dishwashing machine or the like. With this system there is no storage required for the 180° F. sanitizing water, yet the 180° F. water is readily available for rinsing or sanitizing operations.

However, in a system such as that described in the above patents, the heater and storage tank are usually in a remote location from that of the dishwashing machine. For example, the heater and storage tank may frequently be in the boiler room while the dishwashing machine is located in the kitchen, a considerable distance from the boiler room. In such cases, the discharge line extending from the hot water line to the dishwashing machine is of considerable length and water standing in the discharge line during periods of non-use of the dishwashing machine may cool below the sanitizing temperature. On resuming operation of the dishwashing machine, this cooled water in the discharge line is initially drawn and this reduces the temperature of the rinse water below the temperature necessary for sanitization.

The present invention provide a water heating system in which the long discharge line from the hot water line to the dishwashing machine is minimized, and thus the water in the discharge line which may cool below the sanitizing temperature during periods when sanitizing water is not being drawn to the dishwashing machine is negligible.

In addition, the heater of the present system is actuated to heat water to the sanitizing temperature on starting of the dishwashing machine or on closing of a switch located at the dishwashing machine and not on drawing of water to the dishwashing machine as was required heretofore. In the conventional water heating systems, water had to be drawn for rinsing before the heater was actuated, but now the heater is actuated when the dishwashing machine is started, and this is usually a period of time before sanitizing water is drawn for rinsing.

The sanitizing rinse water used by the dishwashing machine is drawn intermittently in most type of dishwashing machines. The dishes are placed in the machine and washed through a period of several seconds. The washing operation is then stopped and the rinsing operation is begun which operates for several seconds. During this interval between rinse draws, the temperature in the hot water line may drop below the sanitizing temperatures. Also, as the flow of dishes into a machine is not constant, standby periods of several minutes between batches of dishes produce a still further greater drop in the sanitizing water temperature lines.

The water heating system of the present invention comprises generally a water storage tank, a gas-fired water heater, and a circulating pump which is disposed in the water line between the tank and the heater. Water for washing operations at about 140° F. is drawn directly from the storage tank and hot water at sanitizing temperature (about 180° F.) passes within a hot water line which extends from the heater to a position adjacent the dishwashing machine and returns to the storage tank. A discharge line of minimum length connects the hot water line to the dishwashing machine.

The pump and a solenoid operated gas valve for the heater are connected in parallel and this parallel branch is in turn connected in series with a temperature responsive control which is disposed in the tank and set for approximately 140° F. With this electrical connection water will be pumped and heated until the temperature of the water in the tank reaches 140° F. at which time the control will open the circuit.

In addition, a toggle switch at the dishwashing machine or the main switch of the dishwashing machine and a second control which is disposed in the hot water line adjacent to the heater and which is set for approximately 180° F. are connected in parallel with the first control. This circuit is closed by closing the toggle switch at the dishwashing machine or by closing the main switch of the dishwashing machine to begin the operation of the dishwashing machine. Closing of the circuit results in water being heated until the temperature of the water in the hot water line reaches the temperature of said control, at which time this second control will open the circuit.

A third control located in said storage tank and set at from 10 to 20 degrees higher than the first control located in said tank is wired in series and ahead of all other controls. This third control functions mainly as a safety device opening the circuit to all controls in the event that the tank temperature reaches this pre-determined high temperature setting such as might occur in the event that the toggle switch is accidently left closed and until the dishwashing operation is completed.

The drawings furnished herewith illustrate the best mode presently contemplated of carrying out the invention as set forth hereinafter.

In the drawing:

Figure 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 adapted for use 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 hot water conduit 4 to a position adjacent the apparatus which is to use the sanitizing

water and then returns to the storage tank 1 to provide a closed circulating system. The water is circulated through the system by pump 5 which is located in the conduit 3, as shown in the drawing, or alternately, in the conduit 4.

A discharge line 6 of minimum length connects the hot water conduit with the apparatus 7, such as a dish-washing machine, which is to intermittently utilize the sanitizing water.

Cold water is supplied to the storage tank 1 through a conduit 8 and hot water at a temperature of about 140° F. is drawn from the hot water tank 1 through a conduit 9. The conduits 8 and 9 may be closed or opened as desired by means of valves 10 and 11, respectively.

The hot water heater 2 is of a conventional 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 12 and the flow of gas within line 12 is controlled by a solenoid operated gas valve 13. A water temperature control thermostat 14 is disposed in the coiled conduit and is responsive to the water temperature therein. The thermostat 14 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 a sanitizing temperature of about 180° F. is discharged from the heater into the hot water conduit 4.

The operation of the dishwashing machine is controlled by a toggle switch 15. The switch 15, 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 and adapted to be closed at the same time that the dishwashing machine is turned on, may be used in place of the switch 15.

Water is prevented from returning from the storage tank 1 through conduit 4 to the heater and to the dishwashing machine 7 by means of a check valve 16 which is disposed in the conduit between the discharge line 6 and the storage tank 1. Check valve 16 permits the flow of water from the heater 2 to tank, when sanitizing water is not being drawn at the dishwashing machine and prevents the flow of lower temperature water from the tank 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 17 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 gas valve 13 are connected in parallel and the control 17 is connected in series with the parallel circuit of the pump and gas valve. With this connection the gas valve 13 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 17 opens the circuit to close valve 13 and shut down pump 5.

The temperature of the sanitizing water is controlled by a temperature control 18 which is disposed in conduit 4 between heater 2 and discharge line 6. The control 18 is responsive to temperature of the water in conduit 4 and is connected in series with toggle switch 15 or the dishwashing machine operating switch. The control 18 and switch 15 are connected in parallel with the control 17, as shown in Fig. 2.

In this second circuit the toggle switch 15 or 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. With the toggle switch or dishwashing machine switch closed the pump will circulate water through the system and the gas valve will be open to admit gas to the burner whenever the temperature in conduit 4 falls below the temperature setting of control 18 which is usually about 180° F. When the temperature in conduit 4 exceeds the control setting, the control 18 opens the circuit to close valve 13 and shut off the pump.

In the conventional type of water heating system sanitizing water generally has to be drawn from the system in order to actuate the pump and heater, or the heater will operate for short periods of time to maintain normal standby heat losses. However, with the present system the pump and heater are actuated on closing of the toggle switch 15 or the switch at the dishwashing machine which precedes the dishwashing operation. As the need for rinsing or sanitizing water usually occurs after a period of time following the starting of the dishwashing machine, the water is heated to the sanitizing temperature so that hot sanitizing water will be immediately available upon demand.

Thus, it is not necessary in the present system to draw sanitizing water at the dishwashing machine in order to actuate the pump and heater, but rather the pump and heater are actuated on closing of the toggle switch 15 which occurs at the start of the dishwashing operation.

The most effective results occur if the control 18 is placed directly in the conduit 4 rather than being in a well as in the conventional type thermostats.

In the event that the toggle switch 15 is not opened after the completion of the dishwashing operation a safety means is provided which will open the circuit to prevent overheating of the water in the system. This safety means takes the form of a temperature control 19 which is disposed in contact with the water in storage tank 1.

The control 19, as shown in Fig. 2, is connected between the power source and the parallel branch formed by control 17 and control 18 and switch 15. With this wiring all electric power to the system will be cut off in the event that the temperature in the tank reaches the temperature setting of control 19. When the temperature of the water tank falls below the temperature setting of control 19, the circuit will be re-established. Thus, control 19 will open the circuit and prevent controls 17 and 18 from actuating pump 5 and gas valve 13 whenever the temperature of the water in the tank reaches 160° F. or other control setting. As previously pointed out, this condition would probably only arise if the toggle switch 15 were maintained closed after the dishwashing operation was completed and thus enabling the aquastat 18 to continue to actuate the pump and heater.

While the two aquastats 17 and 19 are shown to be separate, it is contemplated that a single two-contact aquastat may be employed in place of the two individual members.

By extending conduit 4 from the heater to the dishwashing machine regardless of the relative distance between the heater and dishwashing machine, the length of the discharge line 6 is minimized so that there will be a limited length of piping within which the sanitizing water can cool beneath the sterilizing temperature during idle periods. With the present water heating system sanitizing water is circulated to adjacent the dishwashing machine and thus when water is drawn for rinsing purposes there will be a minimum quantity of cool water initially drawn to the dishwashing machine. This construction makes it possible to draw hot water at a sanitizing temperature at all times regardless of the length of the period of nonoperation. The present installation includes a definite provision for preventing the water in pipe lines between the heaters of the dishwashing machine from cooling below 180° F. and this provision is essential in order to maintain proper sanitation standards.

As the heater is actuated at the beginning of the dishwashing operation rather than on the drawing of rinse water to the dishwashing machine, a supply of rinse water of 180° F. is assured at all times.

The present water heating system provides a maximum

water heating efficiency and accurate control of temperatures by locating the control which controls the heating of water to the sanitizing temperature in the hot water line 4 adjacent the heater.

The present water heating system also provides a safety control which will shut off the heater and pump when the water in the storage tank exceeds the temperature setting of the safety control.

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

I claim:

1. In a water heating system adapted to deliver heated water, a hot water storage tank adapted to contain heated water at a relatively low temperature, a water heater, a first conduit providing communication between the tank and the heater, an apparatus to utilize water heated to a sanitizing temperature and disposed at a remote location with respect to said tank and said heater, switch means adapted to be actuated prior to utilizing sanitizing water at said apparatus, a second conduit extending from the heater to a position adjacent said apparatus and thence to the storage tank to provide with said first conduit a complete circuit containing said tank and heater, a discharge conduit providing communication between said second conduit and the apparatus for supplying sanitizing water to the apparatus, a pump disposed in said circuit of said first and second conduits to circulate the water therein, means in the portion of said second conduit between the discharge conduit and tank to at all times prevent flow of water from the tank through said second conduit portion to the discharge conduit and likewise to prevent reverse flow of water in the system, means responsive to the temperature of the water in the tank to actuate said pump and said heater when the temperature of the water in said tank falls below said low temperature, and means responsive to the temperature of the water in said second conduit at a position between said heater and said discharge conduit and connected electrically in series with said switch means for actuating said pump and said heater when the water at said position falls below the sanitizing temperature.

2. A water heating system adapted to deliver heated water at a low temperature and at a high temperature, which comprises a water storage tank adapted to contain low temperature heated water and having an inlet and outlet therein for introducing cold water and for withdrawing low temperature heated water respectively, a water heating unit, a conduit providing communication between said tank and said heating unit, an apparatus to utilize water heated to the high temperature and disposed at a remote location with respect to the tank and the heating unit, a switch electrically conneced to said apparatus to actuate the same, a high temperature water conduit extending from the heating unit to a position adjacent said apparatus and returning to said tank, said tank, first named conduit, heating unit and high temperature conduit providing a closed system for the circulation of the water, a discharge conduit of minimum length providing communication between the high temperature conduit and said apparatus for supplying high temperature water to said apparatus, pumping means for circulating the water in the system, thermostat means responsive to the temperature of the water in the tank, an electrical circuit connecting said thermostat means with said pumping means and said heating unit and a source of electrical energy for actuating said pumping means and said heating unit when the temperature of the water in the tank falls below the low temperature, second thermostat means responsive to the temperature of the water in the high temperature conduit, a second electrical circuit connecting said second thermostat means and said switch in shunt across said first thermostat means for actuating said pumping means and said heating unit on closing of said switch when the water in said high temperature conduit falls below said high temperature, and third thermostat means responsive to the temperature of the water in the tank and connected in series with said first and second electrical circuits and adapted to open said circuits when the water in said tank is heated to a predetermined temperature intermediate said low temperature and said high temperature.

3. In a water heating system adapted to deliver heated water at a relatively low temperature and to sanitizing type apparatus at a high temperature, a storage tank for containing the low temperature water, a water heating unit, a low temperature water line connecting the tank and the heating unit, a high temperature water line connecting the heating unit to the tank and extending to a remote location with respect to said tank and said heating unit adjacent a sanitizing apparatus disposed to intermittently utilize water heated to said high temperature, said tank, heating unit, low temperature line and high temperature line comprising a closed system for circulation of said water, switch means to be closed on starting of the operation of the sanitizing apparatus, a discharge conduit of minimum length providing communication between the high temperature line and said apparatus for supplying high temperature water to said apparatus, pumping means for circulating the water in the system, control means responsive to the temperature of the water in the high temperature line, an electrical circuit connecting said control means with said switch means and said pumping means and said heating unit and a source of electrical energy, said control means adapted to close the circuit when the switch means is closed and when the temperature of the water in the high temperature line falls below said high temperature to heat water to said high temperature and circulate heated water through the system, second control means responsive to the temperature of the water in the tank, and a shunt circuit connected across said first control means and said switch means, said second control means adapted to close said shunt circuit when the temperature of the water in the tank falls below said low temperature to heat water and circulate heated water through the system.

4. A water heating system adapted to deliver heated water at two different temperatures, which comprises a hot water storage tank adapted to contain heated water at a first temperature, means to supply cold water to the tank, means to withdraw first temperature heated water from the tank, a water heater, a first conduit providing communication between the tank and the heater, an apparatus to utilize water heated to a second temperature higher than said first temperature and disposed at a remote location with respect to said tank and heater, switch means adapted to be actuated prior to utilizing the second temperature water at said apparatus, a second conduit extending from the heater to a position adjacent said apparatus and thence to the storage tank to provide with said first conduit a complete circuit containing said tank and heater, a discharge conduit providing communication between said second conduit and the apparatus for supplying second temperature water to the apparatus, a pump disposed in said circuit of said first and second conduits to circulate the water therein, means in the portion of said second conduit between the discharge conduit and tank to at all times prevent flow of water from the tank through said second conduit portion to the discharge conduit and likewise to prevent reverse flow of water in the system, means responsive to the temperature of the water in the tank to actuate said pump and heater when the temperature of the water in said tank falls below said first temperature, and means responsive to the temperature of the water in said second conduit at a position between said heater and discharge conduit and connected electrically in series with said switch means for actuating said pump and said heater when the water at said position falls below the second temperature water.

5. A water heating system adapted to deliver heated water at two different temperatures, which comprises a hot water storage tank adapted to contain heated water at first temperature, means to supply cold water to the tank, means to withdraw first temperature heated water from the tank, a water heater, a first conduit providing communication between the tank and the heater, an apparatus to utilize water heated to a second temperature higher than said first temperature and disposed at a remote location with respect to said tank and heater, switch means adapted to be actuated prior to utilizing the second temperature water at said apparatus, a second conduit extending from the heater to a position adjacent said apparatus and thence to the storage tank to provide a complete circuit containing said tank and heater, a discharge conduit providing communication between said second conduit and the apparatus for supplying second temperature water to the apparatus, a pump disposed in said circuit of said first and second conduits to circulate the water therein, means in the portion of said second conduit between the discharge conduit and tank to at all times prevent flow of water from the tank through said second conduit portion to the discharge conduit and likewise prevent reverse flow of water in the system, means to maintain the water in said tank at said first temperature at all times, and means responsive to the temperature of the water in said second conduit at a position between said heater and discharge conduit and connected electrically in series with said switch means for actuating said pump and said heater when the water at said position falls below the second temperature water.

6. A water heating system adapted to deliver heated water at two different temperatures, which comprises a hot water storage tank adapted to contain heated water at a first temperature, means to supply cold water to the tank, means to withdraw first temperature heated water from the tank, a water heater, a first conduit providing communication between the tank and the heater, an apparatus to utilize water heated to a second temperature

higher than said first temperature and disposed at a remote location with respect to said tank and heater, switch means adapted to be actuated prior to utilizing the second temperature water at said apparatus, a second conduit extending from the heater to a position adjacent said apparatus and thence to the storage tank to provide with said first conduit a complete circuit containing said tank and heater, a discharge conduit providing communication between said second conduit and the apparatus for supplying second temperature water to the apparatus, a pump disposed in said circuit of said first and second conduits to circulate the water therein, means in the portion of said second conduit between the discharge conduit and tank to at all times prevent flow of water from the tank through said second conduit portion to the discharge conduit and likewise to prevent reverse flow of water in the system, means responsive to the temperature of the water in the tank to actuate said pump and heater when the temperature of the water in said tank falls below said first temperature, means responsive to the temperature of the water in said second conduit at a position between said heater and discharge conduit and connected electrically in series with said switch means for actuating said pump and said heater when the water at said position falls below the second temperature water, and safety means responsive to the temperature of the water in said tank to prevent actuation of said pump and heater when said tank water exceeds a third predetermined temperature between said first and said second water temperatures.

References Cited in the file of this patent

UNITED STATES PATENTS

1,722,884	Autrey	July 30, 1929
1,780,379	Durdin	Nov. 4, 1930
1,843,566	Lake	Feb. 2, 1932
2,291,023	Burklin	July 28, 1942
2,591,400	Burklin	Apr. 1, 1952