Jan. 9, 1940. G. C. EVANS 2,186,860

WATER HEATING SYSTEM FOR BOTTLE WASHING MACHINES

Filed May 26, 1938 3 Sheets-Sheet 1

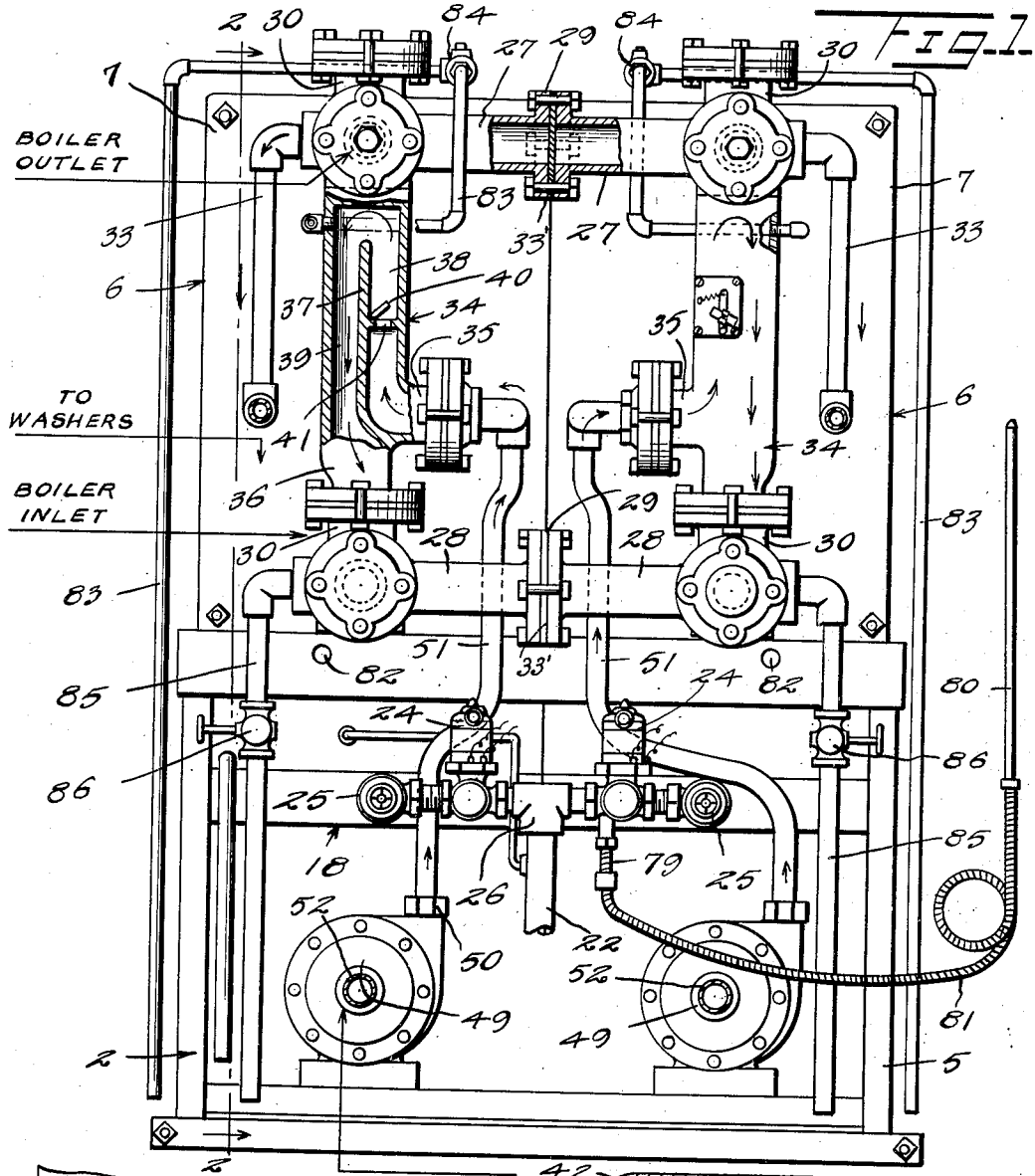


Fig. 1.

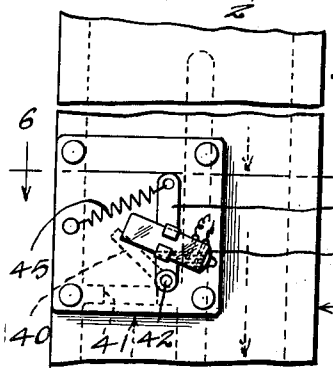


Fig. 5.

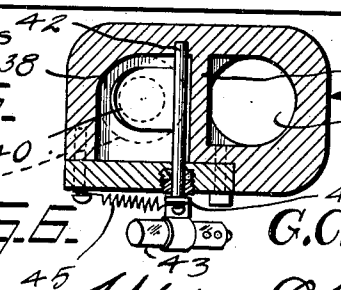


Fig. 6.

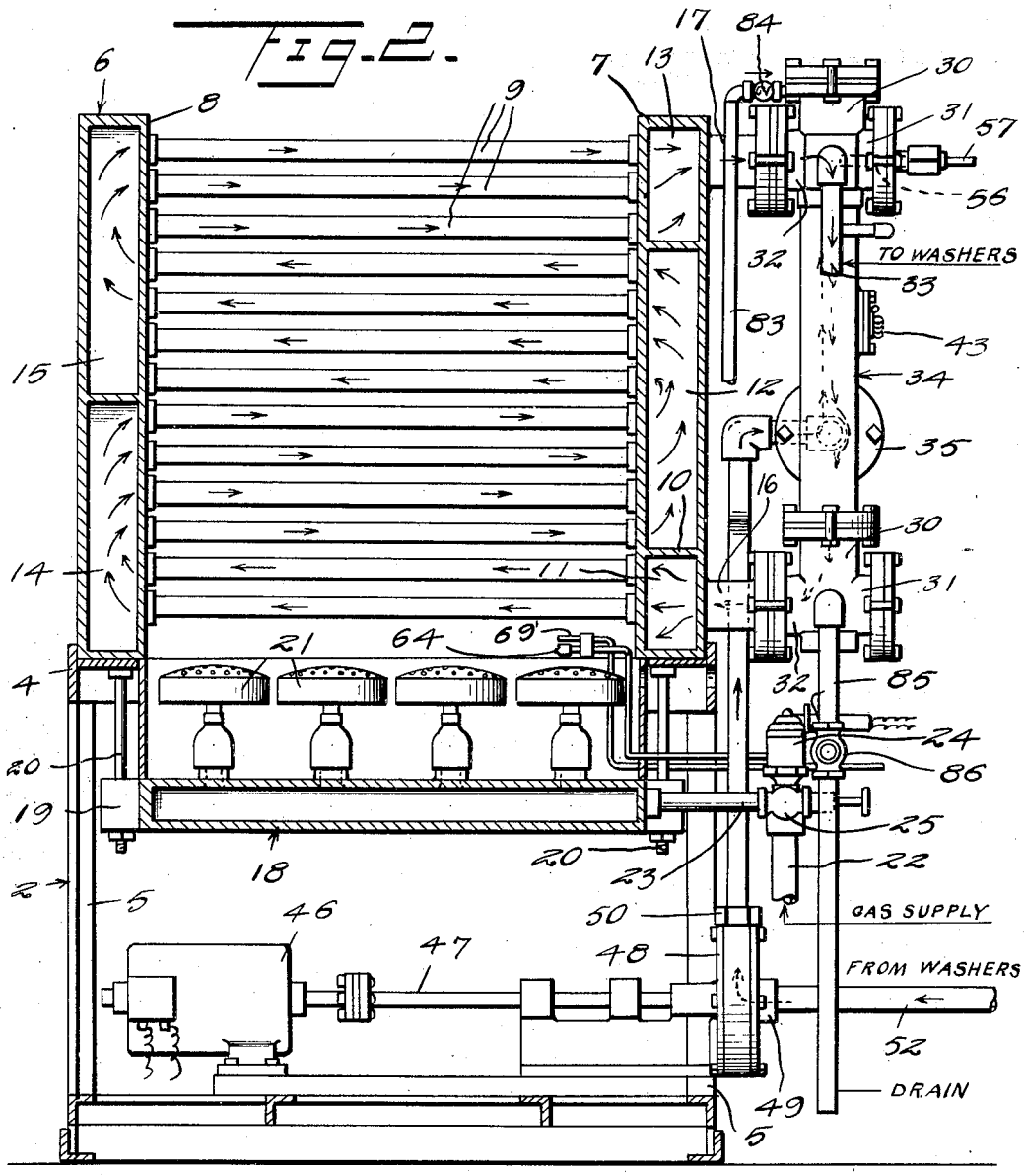
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WATER HEATING SYSTEM FOR BOTTLE WASHING MACHINES

Filed May 26, 1938 3 Sheets-Sheet 2

Fig. 2.



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WATER HEATING SYSTEM FOR BOTTLE WASHING MACHINES

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Fig. 3.

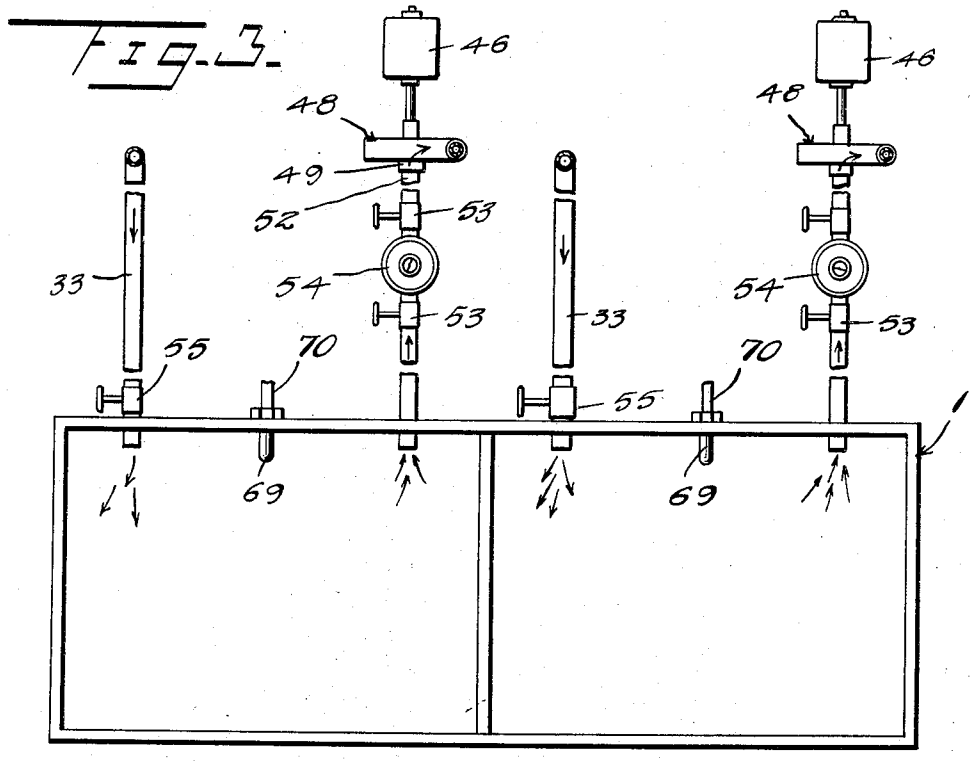
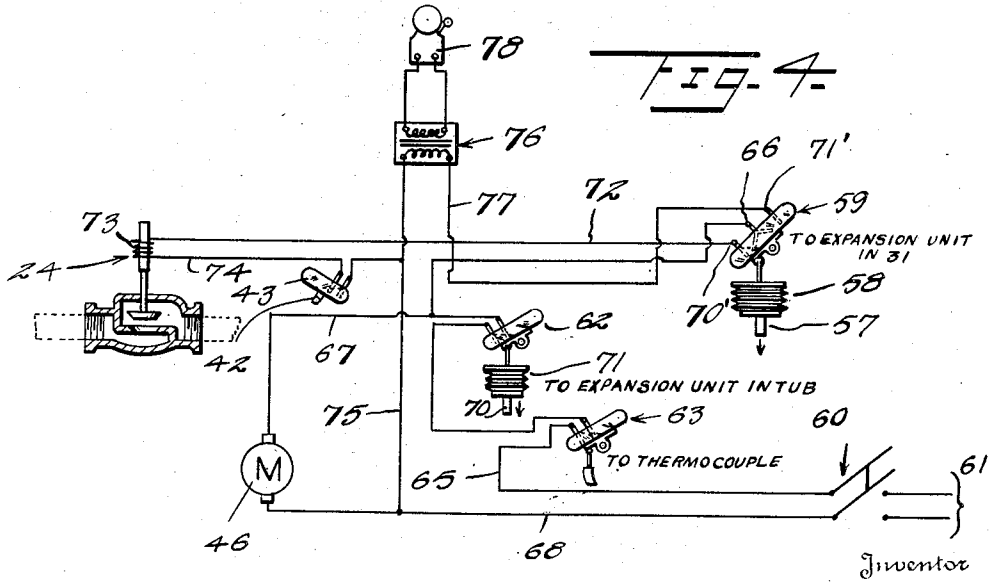


Fig. 4.



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WATER HEATING SYSTEM FOR BOTTLE WASHING MACHINES

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8 Claims. (Cl. 237—8)

This invention relates to improvements in water heating and circulating apparatus and is directed particularly to an improved form of such apparatus for use in connection with washers, particularly washers designed for cleansing bottles in bottling plants.

The principal object of the present invention is to provide a novel and improved water heating unit of compact construction which will function to constantly supply to washing receptacles, water or other washing fluid of a desired temperature and which is so constructed and arranged that the heating of the fluid will be cut down or shut off in the event that the system becomes choked so that the development of a dangerous situation through the continued heating of the fluid will be avoided.

Another object of the invention is to provide an improved water heating unit for washing receptacles such as are used in bottling plants wherein a novel method of circulating the heated washing fluid is employed for the purpose of obtaining a maximum of efficiency from the unit.

Still another object of the invention is to provide in an automatically controlled water heating system such as is hereinafter set forth, a novel means for effecting the stopping of the operation of the heater in the event that the system becomes clogged for any reason so that a continuous free flow of fluid therethrough cannot be maintained.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming part of this specification, with the understanding, however, that the invention is not to be confined to any strict conformity with the showing of the drawings but may be changed or modified so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings:

Figure 1 is a view in front elevation of a two unit structure constructed in accordance with the present invention and designed to provide heated fluid for two or more washing tanks, as hereinafter described, parts of the structure here shown being in section.

Figure 2 is a sectional view taken substantially upon the line 2—2 of Figure 1.

Figure 3 is a view in plan of a pair of tubs or washers showing the fluid conducting pipes connected therewith by which the fluid is carried to and from the washers.

Figure 4 is a circuit diagram for the electric units associated with the heating unit.

Figure 5 is a view in elevation of a detailed portion of the heating unit.

Figure 6 is a sectional view on the line 6—6 of Figure 5.

The present invention constitutes an improvement upon the system set forth in Patent No. 2,048,602 of July 21, 1936, in that water heating and circulating mechanism is more compactly designed and operates more efficiently than the structure set forth in this prior patent.

In the heating structure embodying the present invention, an arrangement is disclosed for taking care of two separate washers or tubs, which are indicated by the numeral 1 in Figure 3, and which are designed particularly, as set forth in the prior patent referred to, for use in cleansing bottles or other receptacles employed in bottling or similar plants or for tubs used for any other purpose where it is desired to maintain the water therein at a fairly constant temperature and wherein the water of one tub is to be kept separate from that of the other tub.

The heating unit disclosed in Figures 1 and 2, comprises a base of any suitable structure, indicated generally by the numeral 2, and here shown as being made up of a bottom frame 3, a top frame 4 and vertical corner posts 5, joining the top and bottom frames. The top frame 4 of the base has mounted thereon a water tube unit of novel construction, which is indicated generally by the numeral 6. This unit 6 is made up of the two hollow heads 7 and 8 which are of substantial length and width, as shown in Figure 1, and of relatively shallow depth as disclosed in Figure 2. The head 7 may be referred to as the main head of the heater and the head 8 as a supplemental head for purposes of distinction and, as shown in Figure 2, these heads are disposed vertically upon opposite sides of the top frame 4 of the base and have the confronting walls connected by the water tubes 9 whereby water or other fluid may pass from one head to the other.

The interiors of the heads 7 and 8 are divided by horizontal partition walls 10, the head 7 having two of these walls to separate its interior into the inlet, intermediate and outlet chambers 11, 12 and 13, respectively, while the head 8 has only a single partition so that it is divided into the two chambers 14 and 15 which are respectively, inlet and outlet chambers for the fluid circulated through the unit.

Upon the outer side of the main head 7 are formed the inlet and outlet nipples 16 and 17

respectively, which are flanged as shown to facilitate the attachment of coupling units thereto, as hereinafter described.

Suspended within the base 2 below the top frame 4 is a gas heater manifold 18, the sides of which are provided with lugs 19 through which suspension bolts 20 pass for connection with the underside of the base frame 6, as shown in Figure 2, and carried upon and leading from the top of this manifold 18 is a series of gas burner units 21, which are grouped in the area between the confronting faces of the heads 7 and 8 so that when these burners are lighted the flames therefrom will be directed upwardly against the water or liquid tubes 9. While the area between the heads 7 and 8 has not here been illustrated as being closed, it will be understood that the sides and the top of this area will, in practice, be walled up with suitable insulation material so that the heat from the burners will be confined around the tubes 9, one of the walls near the top of the unit being provided merely with a suitable escape opening for products of combustion as is the practice in connection with heater structures such as ovens or the like.

The numeral 22 designates a gas supply line which leads into a lead-in pipe 23 through which fuel gas is conducted into the manifold 18 and this lead-in line is provided with an electro-magnetically actuated valve 24 and between this valve and the manifold is a hand operated valve 25. In the set up here illustrated, the supply pipe 22 is connected with a T-coupling 26 (Figure 1) between which coupling and the pair of manifolds 18, the lead-in lines 23 are connected, each of these lines having an electro-magnetically operated valve 24 therein.

As previously stated, two complete fluid heater units are here illustrated coupled together to form one compact unit designed for use in association with a pair of washers, such as are shown in Figure 3, and, therefore, there are two of the water tube structures disposed in side by side relation upon the base 2, as shown in Figure 1, and the main head 7 of each of these structures has the inlet and outlet flanged nipples or couplings 16 and 17 which lead respectively, into the inlet and outlet chambers 11 and 13 of the main head.

The numerals 27 and 28 designate respectively, upper and lower header castings, each of which is of elongated tubular form, having a flange 29 at one end and at the opposite end being provided with the three laterally directed flanged angles 30, 31 and 32. In addition, the end of each header casting opposite from the flange 29 has a port for the connection therewith of a discharge pipe 33. The upper pair of header castings 27 and the lower pair have their flanges 29 bolted together in the two unit structure, as shown in Figure 1, with a separating plate 33' therebetween and these castings are disposed so that the flanged angles 30 thereof are directed upwardly, as shown in Figure 2, and each of the upper header castings has the flanged angle 32 thereof bolted or otherwise secured to the flange of the outlet nipple 17. The lower castings 28 have their flanged angles 32 bolted or otherwise secured to the flanged inlet nipples 16 and the upwardly directed flanged angle 30 is open and alined with the upwardly directed angle 30 of the overlying casting 27.

Interposed between each pair of vertically spaced header castings 27 and 28 is a vertically disposed circulating spacer casting, which is indicated as a whole by the numeral 34. Each of these spacers has at one end a laterally directed flanged nipple 35 and a longitudinally directed flanged open end 36 and the interior of the spacer is longitudinally divided by the wall 37 which extends from adjacent the end 36 to a point short of the opposite end of the spacer which is closed, as shown in Figure 1, and which is disposed against the underside of a header casting 27. This division wall 37 divides the spacer into the two longitudinally extending passageways 38 and 39 which merge at the closed end of the spacer and one of which at the other end leads through the nipple 35, while the other one leads through the open end 36 so that when the spacer is in the position shown in Figure 1, with the flange of the end 36 secured to the flange of the upwardly directed angle 30 of the lower header 28, communication will be established between the passages 38 and 39 and the inlet chamber 11 of the adjacent water tube unit.

Within the passage 38 of each spacer, a flap valve 40 is pivotally mounted to be controlled by the flow of fluid through the restriction 41. This valve, as shown in Figures 5 and 6, is mounted to oscillate on a shaft 42 which extends to the outside of the spacer and has secured to its outer end a mercury switch 43 which is carried by the crank arm 44 which has an end joined to the shaft 42, as shown in Figure 5. A spring 45 connecting the free end of the arm 44 with a fixed part of the adjacent structure, normally tends to oscillate the valve 40 to closed position. This valve actuated switch 43 is a circulation controlled switch and operates to maintain the electro-magnetically actuated valves 24 open so that gas may flow to the burner units, so long as there is a free circulation of fluid through the system. The operation of this valve with the other electrical elements is hereinafter more specifically described.

Mounted upon a suitable support in the bottom part of the base 2 below each water tube unit 6 is an electric motor 46, the armature shaft of which is connected by the shaft 47 with the rotor (not shown) of a pump 48, the inlet and outlet connections of which are indicated respectively, by the numerals 49 and 50. The outlet 50 of each pump is connected by the pipe 51 with the inlet nipple 35 of the overlying spaces 34 and the inlet 49 of each pump has a return pipe line 52 connected therewith, which leads from a washer 1, as shown in Figure 3. In the return line 52 are placed two hand operated valves 53 between which is a strainer unit 54 through which the fluid from the washer must pass before reaching the circulating pump 48 and the supply pipe 33 for each washer 1 is also preferably provided with a hand valve 55 so that while the motors 46 of the units may be run at constant speed, the rate of supply and withdrawal of fluid for the washers can be regulated as desired.

Secured in the angle 31 of each of the upper header castings and extending into the casting in the direction of the opposite angle through which the heated fluid passes in leaving the chamber 13 of the adjacent water tube unit, is a heat responsive expansion bulb 56 which is coupled through the medium of a tube 57 with an expansion unit in the form of a bellows 58 which is in turn connected with and actuates, under the conditions hereinafter described, a circuit controlling switch mechanism which is indicated as a whole in the circuit diagram of Figure

4, by the numeral 59. By reason of the location of this heat responsive expansion unit 56, if the circulation of the fluid through the system is slowed up for any reason so that the water in the tubes 9 becomes excessively heated, this unit will be promptly affected and will actuate the switch mechanism 59 to close the electro-magnetic valve 24.

Referring more particularly to the circuit diagram, there is shown the electrical connection between the several electrical elements of the control mechanism for the heater. While these elements have not been shown in detail in association with the heater structure, it will be understood that they may be mounted in any convenient manner upon the structure, if desired. In this circuit lay-out there is indicated a main control switch 60 through which current flows from the supply circuit 61 to the several electrical elements. The numerals 62 and 63 designate respectively switch units which are connected with the tubs 1 and with the pilot 64 which is located adjacent the burners 21. These switch units 62 and 63 are connected in series relation in the electric current conducting wire 65 which leads to the center terminal 66 of the switch unit 59 and the motor 46 is connected between the switch units 59 and 62 on one side by the wire 67 and on its other side with the return circuit wire 68. In each of the tubs shown in Figure 3 is a heat responsive expansion bulb 69 connected by the tube 70 with the bellows 71 which is coupled with the oscillating switch 62, as shown, so that upon the expansion of fluid in this bulb 69 as a result of increased temperature of the water in the tube above a desired point, the bellows 71 will be actuated to oscillate the switch 62 and thus interrupt the flow of current to the motor 46 and effect the closing of the valve 24.

The control switch 63 is adapted to be actuated by a thermo-couple 69' of a standard type, which is supported as shown in Figure 2 in the proper relation with the pilot 64 to maintain the switch 63 closed while the pilot is burning. In the event that the pilot goes out, the thermo-couple 69' will operate to oscillate the switch 63 to a position to open the circuit and stop the operation of the motor 46 and close the magnetic valve.

As will be seen from the circuit diagram, the switch 59 which is set to operate at a much higher temperature than the switch 62, has in addition to the central terminal 66, the two oppositely positioned terminals 70' and 71'. The terminal 70' is connected by the wire 72 with one side of the coil 73 of the electro-magnetic valve, this terminal 70' being the one which is in circuit with the valve when the mechanism is in operation. The other side of the electro-magnetic valve is connected by the wire 74 with one side of the switch 43 which is under the control of the fluid flow through a spacer casting 34 and the other side of this flow controlled switch 43 is connected to the return side 68 of the circuit by the wire 75. This wire 75 also is connected with one end of the primary side of a transformer unit 76, the other end of the primary coil of this instrument being connected by the wire 77 with the terminal 71' of the switch 59. The secondary of the transformer 76 is coupled with a signal bell 78 and from the diagram it will be readily apparent that when the high temperature switch is actuated by the heat responsive unit 56 to interrupt the flow of current to the electro-magnetic valve, the transformer will be put in circuit and this will result in the operation of the signal bell 78 to indicate that something is wrong in the system.

In the operation of the heater structure, reference being made to one only of the two connected units shown in Figure 1, when the electric current is turned on by closing the switch 60 after the pilot 64 has been lighted and sufficient time has elapsed to cause the thermo-couple 69' at the pilot to respond so that the switch 63 may be closed, the pump or circulator will be put into operation through the starting of the motor 46 and the electro-magnetic valve 24 will be opened automatically. It will, of course, be understood that since the fluid in the system is at a temperature below that necessary to effect the actuation of the valves 59 and 62 through the medium of the heat responsive devices 56 and 69 respectively, these two latter valves will be closed and, therefore, as soon as the pump starts operating, the flow of fluid past the valve 40 will oscillate the switch 43 and close the circuit for the electro-magnetic valve 24 thus opening this valve to permit gas to flow to the burners 21 which will be lighted by the pilot 64. The solution or wash fluid will then pass continuously through the heating element until its temperature has been raised to the degree at which the heat responsive bulb 69 has been set to effect the oscillation of the switch 62 and interruption of the motor current and the current maintaining the magnetic valve open. Thus, when the temperature of the fluid in the system has reached the desired point, the heating of the fluid will be stopped until its temperature again drops to the point where the heat responsive devices 69 will act to close the switch 71' and thus start up the circulation again and light the burners 21. As previously explained, if the circulation of the fluid from the washer to the heater unit should be reduced for any reason, the temperature of the fluid will rise at the outlet of the heating unit to a point sufficient to affect the heat responsive device 56 with the result that the switch 59 will be oscillated, turning off the gas supply to the burners and energizing the signal or alarm bell 78. If the reduction of the fluid flow through the system should increase to the point where a complete stoppage of flow occurs, such as might be the case if the strainers 54 became clogged, then the spring 45 would operate to shut the valve 40 and, at the same time, oscillate the switch 43 which would interrupt the flow of current through the coil of the electro-magnetic valve and thereby shut off the gas flow to the burners.

The gas supply pipe for the pilot 64 is connected into the gas line 22 at a suitable point ahead of the electrically controlled valve 24 and there is also provided a nipple 79 for the attachment of a suitable torch 80 through the medium of a flexible hose 81, which may be employed to relight the pilot by inserting the end of the torch through the opening 82 in the wall of the housing enclosing the burners.

In establishments where the heater structure embodying the present invention may be employed, the washers 1 are usually disposed at an elevation considerably lower than the water tubes and, therefore, when the system is shut down there is a possibility of a siphonic action occurring which would drain off most or all of the water from the tubes of the heater into the washers and thus when the system is started up, flames from the burners would play against tubes having no water therein so that the same

would more than likely be seriously damaged. In order to avoid this, there is connected into the upper end of each spacer, a pipe line 83 which is carried to an elevation above the water tubes, as shown, and then carried downwardly so that the end of the same which is left open is located near the floor upon which the heater structure stands. In this pipe line is a one-way valve 84 which opens inwardly or in the direction of the spacer with which the pipe is connected so that when fluid is flowing through the spacer, none can be forced through the pipe 83 past the valve 84, but when the system is shut down, air may flow past the valve 84 and into the upper end of the spacer so as to check any siphonic action which would tend to drain off the water from the tubes back to the washers.

In order that the system may be drained when desired, the outer ends of the lower header castings 23 have coupled therewith the drain pipes 85 in each of which is a hand valve 86.

While the present illustration and description of the invention has been confined to two connected heater units and a pair of tubs or receptacles, it is to be understood that the heater units shown in Figures 1 and 2 may be increased in number together with the washers or tubs in accordance with the size of the establishment in which the mechanism is to be used and it will also be readily apparent that in increasing the number of heater units over what is shown in Figure 1, the vertically disposed spacer castings will be connected at their tops and bottoms by additional header castings such as are indicated by the numerals 27 and 28.

In addition to increasing the number of units with an increased number of washers, as above stated, one unit or a pair of units such as is shown might be employed for heating the contents of several washers by employing the washer and heated fluid circulating piping system arranged as shown in the system set forth in the patent hereinbefore referred to. With this piping arrangement, the fluid which is heated and used in one washer for washing bottles or other bodies may be employed by running it through suitable coils to heat up another fluid in another washer in which the coils are located.

What is claimed is:

1. A fluid heating and circulating system, comprising a fluid receiving receptacle, a fluid supply pipe and a fluid discharge pipe connected with the receptacle, a fluid heating unit connected with said pipes and forming with the same and the receptacle a closed fluid circuit, an electro-magnetically controlled gas firing means for said heating unit, an electrically operated circulator in said fluid circuit, a one-way valve in said circuit which is held opened by the movement of fluid in the circuit by the circulators, means controlled by said last valve which operates to interrupt the flow of electrical current to said electromagnetic valve when the fluid flow in the circuit is interrupted, a high temperature operated thermostat in said circuit adjacent the discharge side of the fluid heating unit, a fluid working temperature controlling thermostat in said receptacle, and means which are so constructed and arranged that upon operation of the fluid working temperature thermostat under the influence of an increased temperature, the flow of electric current to said electro-magnetically operated valve and said electrically operated circulator will be interrupted and upon the operation of the high temperature operated thermostat the electro-magnetically operated valve only will be actuated for the closing of the valve.

2. A fluid heating unit for a system of the character described, comprising a water heater including a chambered head, gas fired means for the heater, an outlet nipple for said head and disposed adjacent the top thereof, an inlet nipple for the head and disposed adjacent the bottom thereof, means for connecting a fluid carry-off pipe with said outlet nipple, a vertically disposed hollow body between said nipples and interiorly divided to form an up-flow and a down-flow passage, the passages being connected adjacent their upper ends, said down-flow passage being in communication with said inlet nipple, a circulator connected with the lower end of said up-flow passage, electro-magnetically controlled valve means governing the flow of gas to said gas fired means, and electric circuit controlling means for said magnetically controlled valve in one of said passages which is so constructed and arranged as to interrupt the flow of current to said electrical valve when the flow of fluid through the passages is interrupted.

3. A fluid heating and circulating unit for a system of the character described, comprising a heater, including a chambered head, a gas fired burner for the heater, said head having an upper inlet nipple and a lower outlet nipple, means for connecting a carry-off pipe with said upper nipple, an electric motor operated circulator, means forming a fluid passageway from said circulator to said inlet nipple, said passageway having in its length a reverted portion forming vertically disposed up-flow and down-flow sides, the said passageway extending upwardly to an elevation approaching that of the outlet nipple, a gas supply line leading to said burner, an electromagnetic valve in said line, a one-way valve in said passage which is maintained open by fluid flowing therethrough, a switch connected with said one-way valve and controlling the flow of current to said electro-magnetic valve, said switch being in circuit interrupting position when said one-way valve is closed, and a temperature operated unit in said outlet nipple controlling the flow of electric current to said electro-magnetic valve and operating to interrupt the current flow thereto upon excessive rise of temperature in the heater.

4. A fluid heating and circulating unit for a system of the character described, comprising a water heater having a lower inlet and an upper outlet, a gas fired burner for the heater, means for connecting a carry-off pipe with said outlet, an electric motor operated circulator, means forming a fluid passageway from said circulator to said inlet, said passageway having in its length a reverted portion forming vertically disposed up-flow and down-flow sides, the said passage extending upwardly to an elevation approaching that of the outlet, a gas supply line leading to said burner, an electro-magnetic valve in said line, a one-way valve in said passageway which is maintained open by fluid flowing therethrough, a switch connected with said one-way valve and controlling the flow of current to said electromagnetic valve, said switch being in circuit interrupting position when said one-way valve is closed, circuit controlling means common to the electromagnetic valve and the motor of the circulator and means for introducing air into said fluid pasage at the high point thereof, said means comprising a pipe communicating with

the passage and a one-way valve arranged to open only toward the passage.

5. A fluid heating unit for a system of the character described, comprising a water heater including a chambered head, gas fired means for the heater, an outlet nipple for said head and disposed adjacent the top thereof, an inlet nipple for the head and disposed adjacent the bottom thereof, means for connecting a fluid carry-off pipe with said outlet nipple, a vertically disposed hollow body between said nipples and interiorly divided to form an up-flow and a down-flow passage, the passages being connected adjacent their upper ends, said down-flow passage being in communication with said inlet nipple, a circulator connected with the lower end of said up-flow passage, electromagnetically controlled valve means governing the flow of gas to said gas fired means, electric circuit controlling means for said magnetically controlled valve in one of said passages which is so constructed and arranged as to interrupt the flow of current to said electrical valve when the flow of fluid through the passages is interrupted, a thermostat actuated switch in circuit with said electric circuit controlling means and operating upon an excessive rise of temperature in the heater while the fluid flow is uninterrupted, to energize said electromagnetic valve for the closing of the same, and an electrically operated signal element having said thermostatically operated switch coupled therewith, said thermostatically actuated switch operating to effect the flow of current through the signal element simultaneously with its actuation for the opening of the circuit having said magnetic valve therein.

6. A control circuit for a water heating system which includes a water receptacle, a gas fired heater, an electric motor operated circulator and pipes connecting the receptacle, heater and circulator in a fluid circuit; comprising two thermostatically controlled switches connected in series, one switch thermostat being in the receptacle, the other switch thermostat being at the fluid outlet side of the heater, a magnetically operated valve in series with said switches and controlling the flow of gas to said heater, and said electric motor being electrically connected across the switch controlled by the receptacle thermostat.

7. A control circuit for a water heating system which includes a water receptacle, a gas fired heater, an electric motor operated circulator and pipes connecting the receptacle, heater and circulator in a fluid circuit; comprising two thermostatically controlled switches connected in series, one switch thermostat being in the receptacle, the other switch thermostat being at the fluid outlet side of the heater, a magnetically operated valve in series with said switches and controlling the flow of gas to said heater, and said electric motor being electrically connected across the switch controlled by the receptacle thermostat, the said last-mentioned switch being arranged to receive current in advance of the other switch and the magnetically operated valve and operating when opened to stop said motor and effect the closing of the valve.

8. A control circuit for a water heating system which includes a water receptacle, a gas fired heater, an electric motor operated circulator and pipes connecting the receptacle, heater and circulator in a fluid circuit; comprising two thermostatically controlled switches connected in series, one switch thermostat being in the receptacle, the other switch thermostat being at the fluid outlet side of the heater, a magnetically operated valve in series with said switches and controlling the flow of gas to said heater, said electric motor being electrically connected across the switch controlled by the receptacle thermostat, and an electrically operated signal connected across said valve and motor and connected on one side with the switch associated with the heater outlet, said last switch when actuated by the attached thermostat, while the other switch remains closed, closing a circuit through the signal.

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