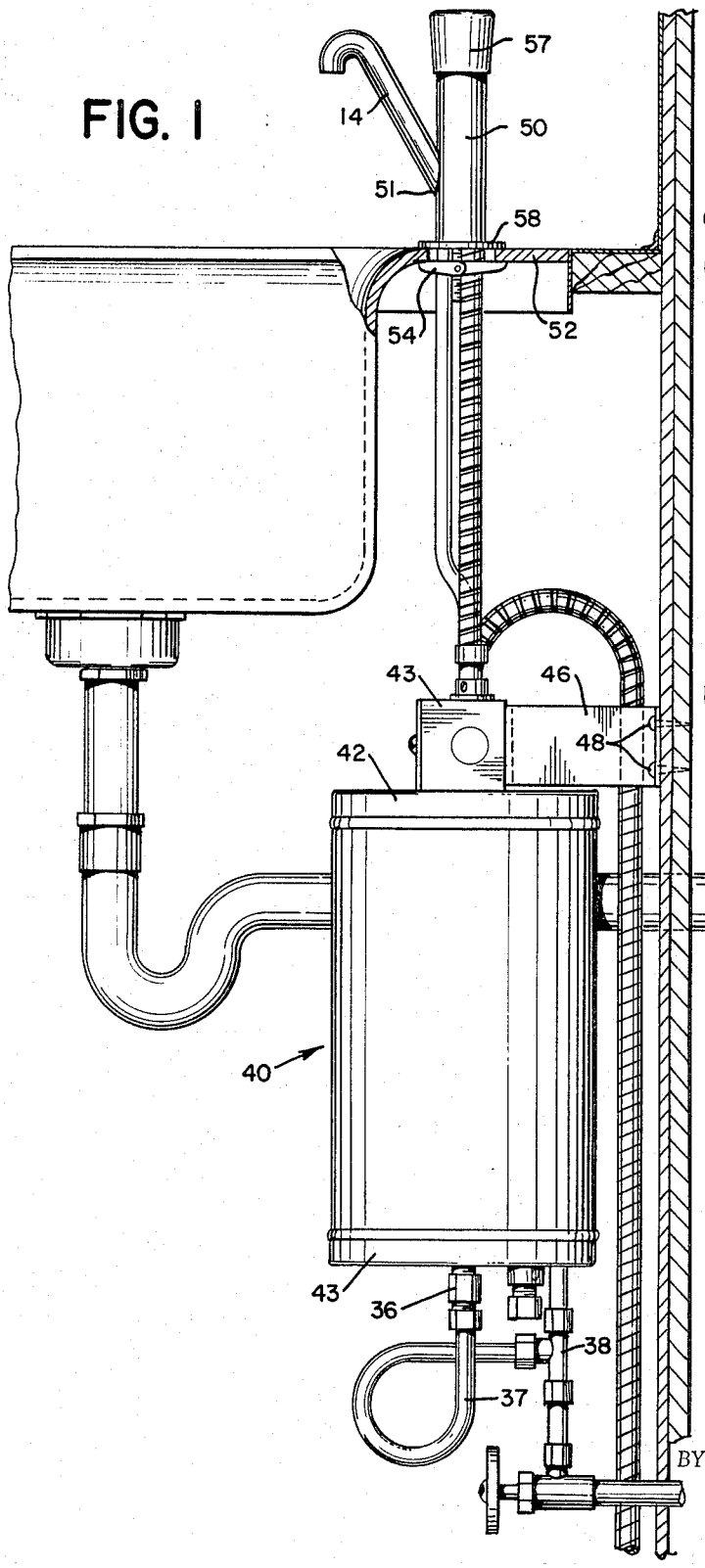
April 30, 1968 H. C. FISCHER 3,381,110

HOT WATER HEATER

Filed May 28, 1965 3 Sheets-Sheet 1

FIG. 1



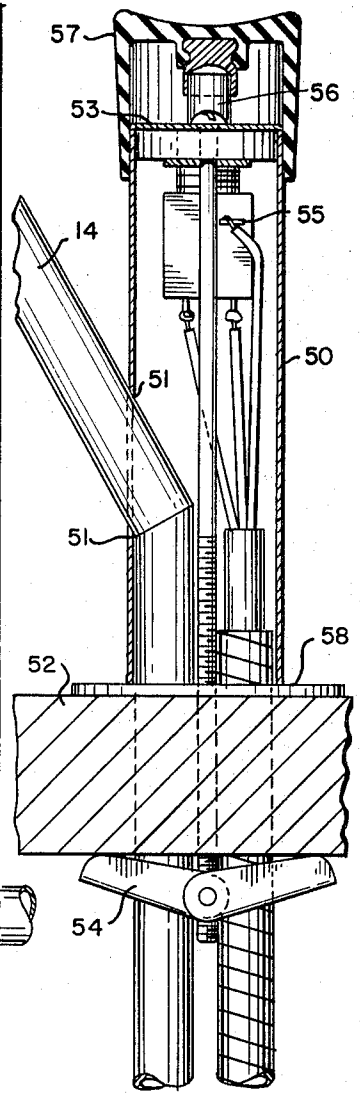


FIG. 4

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HOT WATER HEATER

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FIG. 2

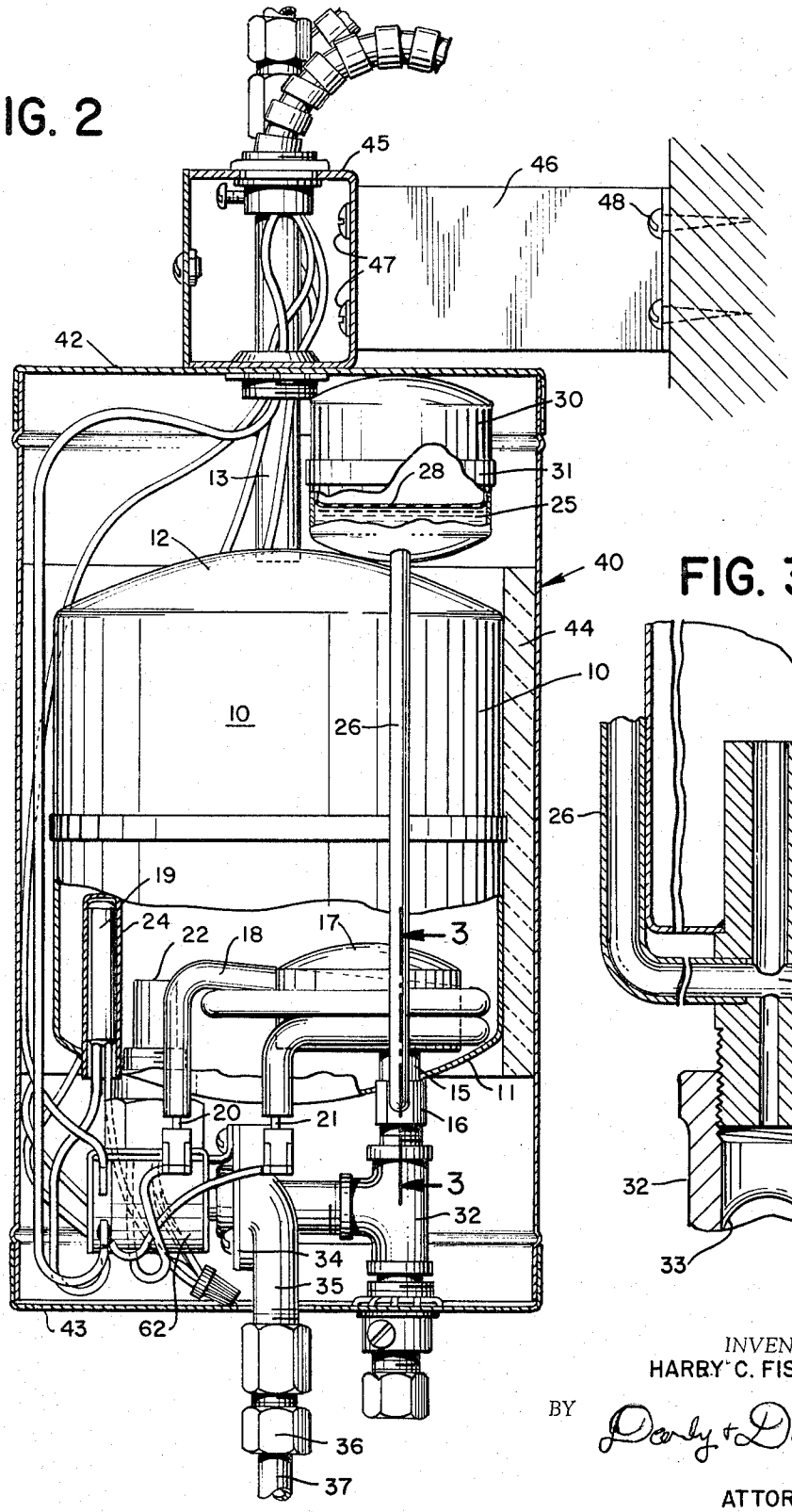


FIG. 3

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HOT WATER HEATER

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FIG. 5a

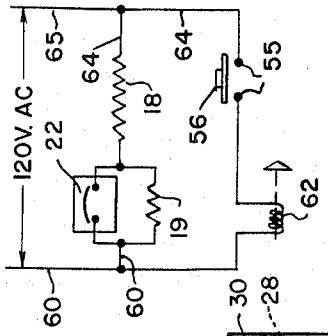


FIG. 6a

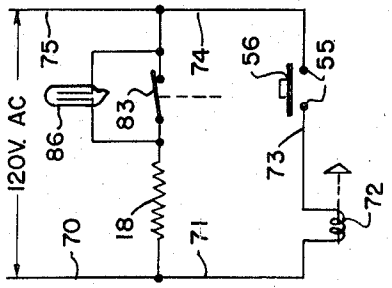


FIG. 5

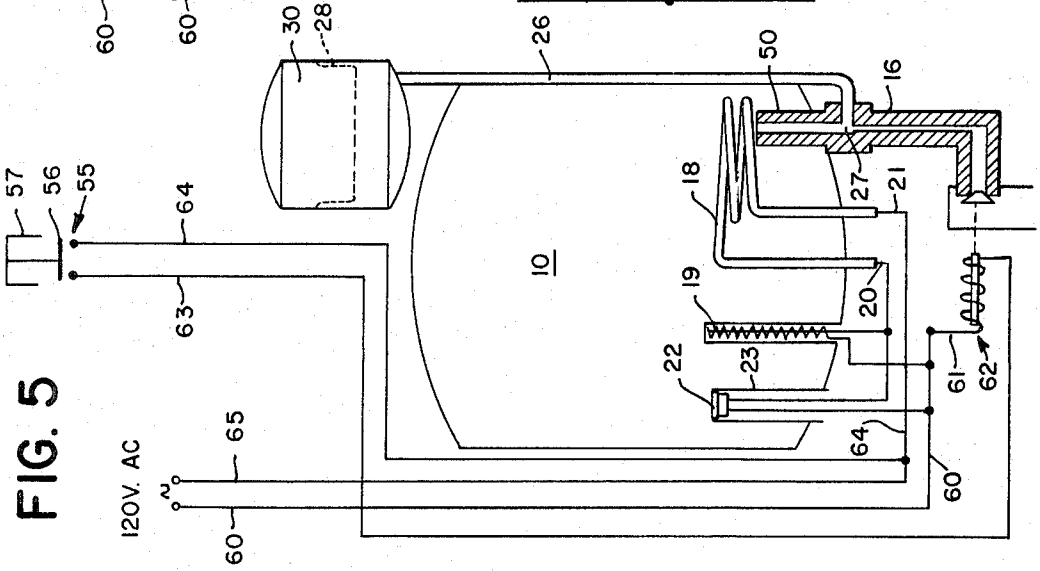
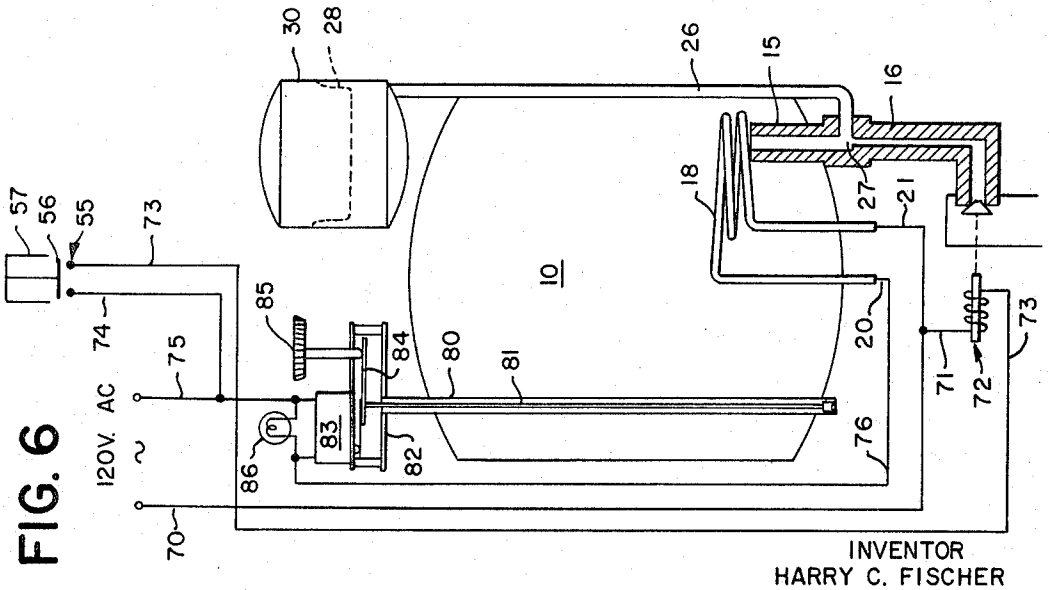


FIG. 6



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United States Patent Office 3,381,110 Patented Apr. 30, 1968

3,381,110

HOT WATER HEATER

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Filed May 28, 1965, Ser. No. 459,698
10 Claims. (Cl. 219—312)

ABSTRACT OF THE DISCLOSURE

The disclosure herein describes a water heater having a small storage tank capacity adapted to supply the limited quantities of hot water such as are required for example, in the making of instant beverages. The heater utilizes electrical energy for heating and is arranged so that the faucet control unit may be located in the desired location which is not dependent upon the location of the storage tank. An expansion reservoir provides for water expansion and assures that the expansion will not cause water to drip from the spigot during periods when the faucet is unoperated. Additionally, a venturi nozzle in the inlet to the storage tank serves to empty the expansion reservoir into the lowest portion of the storage and heating tank, thereby preventing flow of water to the spigot directly from the expansion reservoir at a relatively low temperature when the faucet is first operated.

The present invention relates to a hot water heater and particularly to a hot water heater having a relatively small storage capacity and adapted particularly to supplying of small quantities of hot water such as would be utilized in the making of beverages as for example instant coffee, instant tea, etc.

More particularly still the hot water heater of the present invention is adapted to utilize electric power as the source of heat energy and to provide means to care for the expansion of the water as it is heated in order to prevent dripping of the faucet connected to the heater.

Additionally, the water heater of the present invention is arranged so that it is not necessary that the faucet control be in a particular location with respect to the water heater proper thus making it possible to readily install the water heater in a home beneath the sink without limiting the exact location, as is the case with water heaters of the type which are presently on the market and represented, for example, by the heater shown in my prior Patent 2,903,551.

It is an object of the invention to provide a hot water heater of relatively low storage capacity which is adapted to supply water at a predetermined temperature, normally just under the boiling point.

It is another object of the invention to provide a water heater of the type described having an expansion reservoir so that the water as it expands during heating can flow into the reservoir and does not drip from the faucet, the expansion reservoir being located within a housing and hence not subject to room air currents and the like which tend to increase heat loss.

It is still another object of the invention to provide such a water heater which is electrically operated and thermostatically controlled and wherein a continuously operating secondary heating element serves to maintain the water at the desired temperature at all times.

It is a further object of the invention to provide means for emptying the expansion tank as water is drawn from the main water tank to thus assure that the expansion reservoir will be in condition to receive water from the main tank during the next heating cycle.

It is a still further object of the invention to provide the expansion reservoir with a flexible diaphragm like closure which assures that there will be no contamination

of water or contact of air with the water while at the same time placing the expansion reservoir under atmospheric pressure.

Other objects and features of the invention will be apparent when the following description is considered in connection with the annexed drawings, in which,

FIGURE 1 is a side elevational view of a water heater in accordance with my invention installed beneath a sink of the ordinary household type;

FIGURE 2 is a vertical cross sectional view of the water heater of FIGURE 1 showing the relative location of the various components thereof. In this view the discharge faucet and control therefor have been omitted.

FIGURE 3 is a fragmentary vertical cross sectional view taken on the plane of the line 3—3 of FIGURE 2 and showing the "pump T" or venturi arrangement for causing water to be removed from the expansion reservoir at each operation of drawing water from the heater proper;

FIGURE 4 is a fragmentary enlarged vertical cross section taken through the spigot portion of FIGURE 1 showing particularly the arrangement of the output spigot and of the control for the inlet valve;

FIGURE 5 is a diagrammatic view of the water heater of FIGURE 1 showing a preferred arrangement of electrical heater units utilizing a main and secondary electrical heater;

FIGURE 5*a* is a schematic wiring diagram of the electrical components of the water heater of FIGURE 5;

FIGURE 6 is a diagrammatic view of the water heater of FIGURE 1 showing another form of heater arrangement and of thermostatic control therefor; and

FIGURE 6*a* is a schematic wiring diagram of the electrical components of the water heater of FIGURE 6.

Referring now to the drawings and particularly to FIGURES 1 through 4, it will be seen that the water heater comprises a water tank **10** of generally cylindrical form with the usual substantially hemispherical ends **11** and **12**. Suitably fixed in the upper end **12** is an outlet pipe **13** which, as seen particularly in FIGURES 1 and 4, is joined to a spigot **14**.

Fixed in the lower end **11** of the tank **10** is an inlet pipe **15** which is, in fact, a part of a pump T **16**, the portion **15** being welded or soldered to the end **11** as is clearly shown in FIGURE 3. Mounted above the upper end of the portion **15** of the pump T **16** is a generally cup-shaped deflector member **17**, the member being mounted so that its closed end faces upwardly. This member **17** prevents a direct flow of water from the inlet to the outlet and assures that the water will be heated before it is discharged.

Mounted in the tank **10** near the bottom thereof in any suitable manner is an electrical heater **18** which may be of the "Calrod" type with the electrical terminals **20** and **21** thereof extending through the lower end **11** of the tank **10** and being fastened therein by suitable means making a water-tight connection.

Likewise fixed in the lower end wall **11** of the tank **10** is a thermostatic unit **22**, the electrical terminals of which extend through the end **11**, the thermostat housing **23** being fixed with a watertight connection in the end **11**. Also mounted in the end **11** is a small heater **19**, the heater being inserted in a tube **24**, the mounting of the tube being such that a watertight connection is formed. In a typical heater the main heater element **18** may be rated at 1000 watts whereas the small secondary heater **24** may be rated at the order of 35 watts the main heater serving to bring the water to a set temperature as determined by the thermostat **22** while the small heater **24** maintains the water at the set temperature serving to make up for heat losses.

Suitably supported above the top of the tank **10** is an

expansion reservoir 25 which is connected by means of the tube 26 to the pump T 16 and specifically to the venturi nozzle 27 at the throat thereof.

The expansion reservoir is provided with a flexible diaphragm of plastic or rubber 28 which is suitably cemented to the sides of the cylindrical reservoir and serves to close that reservoir while permitting the water therein to be under atmospheric pressure only. It will be understood that although a metallic top 30 is provided for the expansion reservoir the joint 31 formed between the top and bottom portions is not airtight and thus provides the atmospheric pressure mentioned.

The inlet to the pump T 16 is through a pipe T 32, the horizontal inlet opening 33 of which is coupled to a solenoid valve 34, the inlet to which valve consists of a pipe 35.

In normal practice pipe 35 is connected by means of a compression fitting such as shown at 36 to a copper tube 37 which in turn is connected to the cold water supply line through any convenient means such as a T in that line as indicated at 38 in FIGURE 1.

The lower opening of pipe T 32 has a pipe nipple connected thereto which extends downwardly and which is capped at its lower end serving as a clean out in order that the pump T can be cleaned if this be necessary.

The elements thus far described are mounted within a housing 40 which may be formed of sheet metal and which comprise a cylindrical portion 41 and two flanged end portions 42 and 43. The tank 10 is surrounded with heat insulating material as is indicated at 44 in order to reduce the heat loss to a minimum.

The outlet pipe 13 previously described extends upwardly through the end portion 42 and through an electrical junction box 45. The threaded upper portion of pipe 13 is provided with suitable means, not shown, for holding the pipe in position relative to the junction box thus forming the main support for the tank 10 and the auxiliary elements previously described. Junction box 45 is supported by means of a mounting bracket 46 which is suitably fastened to the rear surface of the junction box, as for example by means of screws 47, and is in turn fastened at its other end to the rear wall of the sink enclosure by means of wood screws 48 or other suitable fastenings, such for example as toggle bolts.

As is readily seen from FIGURE 1, a combined spigot and valve control is mounted above a sink or other shelf-like member with an outlet tube formed as part of the spigot 14 connected by means of a compression fitting with the upper end of the pipe 13. The spigot 14 is enclosed within a larger tubing 50, the spigot being fixed to the wall of the large tubing 50 where it passes through that wall as indicated at 51 in FIGURES 1 and 4.

Tube 50 is closed at its upper end and is held against the upper surface of the sink or shelf member designated 52 in FIGURES 1 and 2 by means of a toggle bolt which passes through the tube closure 53 and through the opening in the shelf member 52, the toggle member 54 then seating against the undersurface of the shelf 52.

Mounted within the tube 50 is a switch 55 which is actuated by means of a button 56. In order to make a splash proof closure a cup shaped insulating member 57 is placed over the end of tube 50. Thus pressure on the center of the cup member 57 will depress the switch actuator or button 56 and close the contacts of the switch. As indicated in FIGURE 4 a washer 58 is placed between the lower end of the tubing and the upper surface of the shelf 52, this member preferably being of rubber or like material so that it serves as a gasket to prevent leakage of water into the tube 50 or the opening in shelf 52.

The circuit diagram for the device thus far described in shown in FIGURE 5. It will be observed that when the push button 56 is depressed by pressure on member 57 a circuit is completed from one side of the 120 volt A.C. line over conductors 60 and 61, through the winding 62 of the solenoid valve 34, and thence over conductor 63, the closed contacts of switch 55 and conductors 64 and 65 to the opposite side of the A.C. line. Additionally it will be seen that the heater elements are connected in circuit as shown in FIGURES 5 and 5*a*. Specifically, the circuit leads from one side of the alternating current line over conductor 60 through the thermostat 22, thence through the main heater 18 and over conductors 64 and 65 to the other side of the line. The small heater 19 is connected across the terminals of the thermostat 22 so that when the thermostat contacts open the main heater is put in series with the small heater and the resulting heat output is approximately equal to the value of the small heater.

As shown in FIGURES 6 and 6*a* the main elements of the water heater are identical with those described above. However, a different type of thermostat has been utilized and the auxiliary heater 19 has been omitted. In the circuit diagrams of the two figures just mentioned a circuit leads from one side of the A.C. source, over conductors 70 and 71 to the winding 72 of the solenoid, thence over conductor 73 to the contacts of switch 55 and, when member 57 is depressed, through those contacts and over conductors 74 and 75 to the other side of the A.C. line. In this arrangement no auxiliary heater such as 19 is provided and a thermostat comprising a copper tube 80 and Invar rod 81 is placed in a well in the tank 10.

The upper end of the copper tube is supported in a fixed position by means of the bracket 82 which is in turn supported from the body of a microswitch 83. Thus as the tube 80 expands the lever 84 will move and will cause the microswitch 83 to open its contacts. In this arrangement means are provided as illustrated schematically at 85 to preload the operating lever 84 so that the temperature at which the switch contacts close may be adjusted.

Also with this arrangement a neon lamp 86 is connected across microswitch 83 so that the point at which the switch contacts close can be determined and the adjustment means 85 operated in accordance with the indication given. The microswitch 83 and heater 18 are connected in series across the A.C. line in normal manner.

More particularly the circuit leads from one side of the A.C. line over conductor 70 through the heater 18, to conductor 76, thence through the contacts of the microswitch and over conductor 75 to the opposite side of the line.

As indicated herein the arrangement of the device indicated in FIGURES 5 and 5*a* is the preferred form because with this arrangement a simple snap action thermostat may be utilized with a low wattage heater constantly energized and making up for the heat loss. The arrangement of FIGURES 6 and 6*a* require adjustment of the thermostat and is subject to somewhat greater drift than is the case with the form of FIGURES 5 and 5*a*.

However, in both forms the arrangement is one in which water is heated under atmospheric pressure and therefore no pressure relief valves are required since any over-temperature and formation of steam causes no damage but merely permits steam to exit through the spigot without causing pressure in the system.

It will be observed that although the system is under atmosphereic pressure the diaphragm 28 in the expansion reservoir prevents air from entering the system while permitting atmospheric pressure to be exerted on the fluid in the expansion reservoir. Of course atmospheric pressure is also exerted through the discharge spigot and pipe 13 on the fluid in the main tank.

Due to the use of the separate expansion reservoir and the use of the solenoid valve and push button control therefor, the discharge spigot and the control therefor may be located in a suitable location without the necessity that they be directly above the heater tank as has been the case in prior arrangement of this general type. As a result the unit is adapted to mounting within then enclosure normally provided under a sink or lavatory and may occupy a desired location therein, since it is

only necessary that the copper tube joining the outlet pipe **13** and the spigot be bent to conform to the relative locations and the BX tubing carrying the leads to the push button control for the solenoid valve likewise bent. Further the location of the expansion reservoir within the housing **40** reduces heat loss since the water in the reservoir is not subjected to room air currents and temperature as is true is devices of this general type in which the expansion reservoir is located above the working surface, such as a sink or partially above that surface.

The device operates as follows.

Initially the push button **56** is operated by means of the overlying member **57** which causes operation of the solenoid valve which then permits the tank **10** to fill, ordinarily with cold water. When the electrical connections to the unit have been completed the heater element **18** (considering now the form of the device shown in FIGURES 2, 5 and 5*a*) is energized so that as the tank is filled the water begins to be heated. When the water has reached the temperature determined by the thermostat—which may be in the neighborhood of 200° to 205°—the thermostat operates, opens its contacts, and shuts off the main heater. The secondary or auxiliary heater **19** continues to operate to maintain the temperature at the desired setting, this heater being of a rating such that it compensates for heat loss.

The device of FIGURES 6 and 6*a* operates in substantially the same manner as described above. However, due to the type of thermostat utilized in a device of those figures, it is more suitable for use in some circumstances since the thermostat can be adjusted to provide water at a lower temperature which is desirable if, for example, paper cups are being utilized for the serving of beverages.

As the water heats it expands and since the expansion reservoir is at a lower level than the spigot, water flows into the expansion reservoir. Upon the next operation of the solenoid valve which, as described, permits water to enter the tank **10** from below, water flowing through the venturi nozzle causes the expansion water to be sucked out of the expansion reservoir and discharged back into the tank **10**. At the same time, of course, the water pressure produced in the tank **10** forces hot water out from the spigot.

As in prior systems of this type, should the temperature become sufficiently high so that some steam is formed, it will simply leave the system through the outlet spigot and no pressure will be built up at any place in the system which might be dangerous.

While I have described preferred embodiments of the invention, it will be understood that I wish to be limited not by the foregoing description, but solely by the claims granted to me.

What is claimed is:

1. In a water heater of the type described, in combination, storage tank, means for heating water in said storage tank, an expansion reservoir located outside of and adjacent the top of said heating tank, an outlet pipe leading from the top of said heating tank to a point of discharge, a venturi nozzle, means connecting the inlet of said venturi nozzle to a source of water, means connecting the outlet of said venturi nozzle to an opening into said heating tank near the bottom thereof, and means connecting a suction port at the throat of said venturi nozzle to said expansion reservoir.

2. A water heater in accordance with claim **1** wherein said expansion reservoir is closed by a flexible diaphragm subjecting the contents thereof to atmospheric pressure while confining water therein.

3. A device in accordance with claim **1** wherein the inlet to said venturi nozzle is controlled by a valve means and wherein the operator for said valve is located remotely therefrom.

4. In a water heater of the type described, in combination, a storage tank, said tank comprising a generally cylindrical container having closed ends, an expansion reservoir, said reservoir being located adjacent the top of said tank, electrical heating means within said tank, a discharge pipe leading from the top of said tank, a spigot connected by flexible tubing to said discharge pipe, a venturi nozzle, the outlet of said nozzle being within said tank, an inlet connection to said venturi nozzle, a valve controlling flow to said venturi inlet, a solenoid controlling said valve, a connection from a throat port of said venturi nozzle to said expansion reservoir and means located adjacent said spigot for operating said solenoid valve whereby water enters said heating tank near the bottom thereof and heated water is discharged through said spigot, flow through said venturi causing discharge of water present in said expansion reservoir.

5. A device in accordance with claim **4** wherein at least one electrical heating unit is immersed in water in said tank adjacent the bottom of said tank and wherein a thermostat in heat conductive relation to the fluid in said tank controls the flow of current to said heating element.

6. A water heater according to claim **4** wherein an electrical heating unit is immersed in the water in said tank being placed adjacent the bottom of said tank, a second electrical heating element of lower capacity is also immersed in the water of said tank adjacent the bottom of said tank, and wherein a thermostat is in heat conductive relationship to the water in said tank, the contacts of said thermostat being connected across said second heating element and said contacts and said second heating elements being connected in series with said main heating unit to thereby connect said main heating unit directly across the line when the temperature of the water in said tank falls beneath a predetermined value, and to connect said low capacity heating element and said main heating unit in series across the line when said thermostat contacts open, said second heating element being effectively energized to compensate for heat losses from the system.

7. In a water heater of the type described, in combination, a heating tank, an expansion reservoir located adjacent the top of said heating tank with the bottom of said reservoir slightly above the top of said tank, an enclosure for said tank and said reservoir, a discharge pipe fixed in the top of said heating tank, a valve means controlling the flow of water into said heating tank, electrical heating means in said heating tank, thermostatic control means for said heating means, means for emptying said expansion reservoir during each operation of said valve means, and control means for said valve means, said location of said expansion reservoir in said enclosure serving to reduce heat loss therefrom.

8. In a water heater of the type described, in combination, a heating tank having at least one electrical heating element located therein, an expansion tank located adjacent said heating tank with the level of the bottom of said expansion reservoir slightly above the level of the top of said heater tank, a discharge pipe fixed to said heater tank at the top thereof, said discharge pipe extending upwardly, an insulating enclosure about said heater tank and expansion reservoir, a bracket mounted on said discharge pipe, said bracket being adapted to be fixed to a surface to support said unit, a venturi nozzle fixed adjacent the bottom of said heater tank with the outlet thereof within said heater tank, a solenoid valve connected in the inlet to said venturi nozzle to control the flow of water therethrough, a connection external to said heater tank from the bottom of said expansion reservoir to the throat port of said venturi nozzle, a diaphragm closing said expansion reservoir and lying upon the surface of water therein, said diaphragm being sealed to the reservoir walls, a thermostatically controlled electrical heating element located in said heater tank, a combined discharge spigot and control switch adapted to be located above said heater tank and said expansion reservoir and means connecting said discharge pipe with said spigot, said means being flexible to permit varying the location of said spigot and control switch relative to said

heater tank, and means connecting said control switch in circuit with said solenoid valve whereby operation of said solenoid valve controls flow of water through said spigot, said electrical connection to said control switch being flexible to permit said variable location of the spigot and switch unit.

9. A device in accordance with claim 8 wherein said combined spigot and switching unit comprises a tube, a discharge spigot within said tube, the end of said spigot passing through the wall of said tube and being formed to discharge water downwardly therefrom, a switch mounted in said tube above the point of emergence of the spigot therefrom, a closure member extending across said tube at the top thereof, a switch operator extending through said closure member, a flexible cap on said tube, said cap engaging said switch operator, the downwardly depending flanges of said cap being sealed to said tube to prevent entry of water into said switch.

10. A device in accordance with claim 9 wherein said mounting bracket includes an electrical junction box wherein electrical connections are made to a power source and to the heater, thermostat, solenoid valve and control switch.

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