

Water Heater

FIELD OF THE INVENTION

The present invention relates to a water heater for use in a hot water shower and the like.

BACKGROUND OF THE INVENTION

An electric instantaneous water heater as an example of a conventional water heater will be described with reference to FIG. 5, FIG. 6, and FIG. 7. FIG. 5 is an external view of it, FIG. 6 is a control block diagram, FIG. 7 is a structural drawing of a feedwater pressurizing pump as a component of the electric instantaneous water heater.

Water from water intake pipe 1 is adjusted for its flow by flow adjusting knob 2 and fed into the main body. Then the water is heated by heat source (hereinafter called heater) 8 and discharged from shower head 7 via shower hose 6. Hot water switch 4 also serves the function of water stopping cock.

Motor section 17 of feedwater pressurizing pump 14 is an AC-powered brush motor. Motor section 17 and pump section 18 are formed of separate components from each other and pump section 18 is driven by motor section 17 via shaft 19.

System operation will be described below.

When power switch 3 is turned on, power lamp controlling section 10 lights up power lamp 9a. Then, if hot water switch 4 is turned on by the user going to take a shower, water taken in through water intake pipe 1 is discharged from shower head 7. By a water flow due to the discharged water, flow switch 11 is turned on. Upon turning on of flow switch 11, feedwater-pressurizing-

pump driving section 13 starts feedwater pressurizing pump 14 operating.

Since an AC-powered motor is used as the motor, voltage is applied to the water heater main body through feedwater-pressurizing-pump driving section 13.

Then, if heater power adjusting volume switch 5 is turned on, heater controlling section 12 determines that power switch 3, hot water switch 4, flow switch 11, and heater power adjusting volume switch 5 are all in their ON states. Here, flow switch 11 turns on when the flow of water taken in from water intake pipe 1 exceeds a predetermined flow. Then, heater lamp controlling section 15 allows heater lamp 9b to light up. Thereby, the user is informed of start of power supply to heater 8 as the heat source. Power lamp 9a and heater lamp 9b constitute a display section.

The amount of power supply to heater 8 is set by adjustment made by the user of heater power adjusting volume switch 5. According to the set value, heater controlling section 12 controls the power supplied to heater 8.

When the shower bathing is ended, hot water switch 4 is turned off. In accordance therewith, a water stopping function is performed, namely, water discharging is stopped, flow switch 11 is turned off, current supply to heater 8 is cut off, and heater lamp 9b goes out.

Owing to the above described operations and configurations, a hot water shower can be taken. Further, by checking power lamp 9a and heater lamp 9b, the operating conditions can be recognized.

When the flow is decreased due to clogging of feedwater filter 16 or the like, water intake pipe 1 is once removed to take out feedwater filter 16.

Feedwater filter 16 taken out is washed and then refitted.

However, there have been problems with configurations of conventional art examples as mentioned below:

- a. When the feedwater pressure is low, a sufficient flow cannot be

secured and hence a comfortable feeling cannot be obtained from the use of the shower.

b. When water pressure is so low as is disabled to turn the flow switch on, the shower cannot be used.

c. A large noise is produced because an AC brush motor is used in the feedwater pressurizing pump, and hence the user needs to care about the time of day when the shower is used and about the surrounding neighborhood.

d. When a shower is used in an area where water quality is bad, such troubles as clogging of the filter frequently occur. In such a case, maintenance work must be made every time. Since the filter is attached to the main body of water heaters in conventional arts, maintainability of the system becomes poor.

SUMMARY OF THE INVENTION

Example embodiments of the present invention are made to overcome the above mentioned problems with conventional arts and accordingly it is an object of the example embodiments to provide a water heater capable of providing a sufficient shower flow even if it is used where the feedwater pressure is low, produces a low noise, and good in maintainability.

In accordance with a first aspect of the present invention, there is provided a water heater where water is pressurized by a feedwater pressurizing pump and heated by an electric heater, said water heater comprising: a heat source section comprising a heater incorporated in a tank; the feedwater pressuring pump for installation in an intake-water path for feeding water to said heat source section; a voltage converter for driving said feedwater pressurizing pump; a flow switch for detecting a water flow through the intake-water path; an operating section for

giving instructions for operation of said heat source section, a control section for controlling said heater of said heat source section and said feedwater pressurizing pump following instructions given by said operating section, wherein, when said operating section has given instructions for operation, said control section first causes said feedwater pressurizing pump to drive via said voltage converter and then causes said heater of said heat source section to heat water in conjunction with detection of a water flow by said flow switch.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an external view of an electric instantaneous water heater according to a first embodiment of the present invention.

FIG. 2 is a control block diagram of the electric instantaneous water heater.

FIG. 3 is a structural drawing of a feedwater pressurizing pump as one of the components of the electric instantaneous water heater.

FIG. 4 is a structural drawing of an electric instantaneous water heater according to a second embodiment of the present invention.

FIG. 5 is an external view of a conventional electric instantaneous water heater.

FIG. 6 is a control block diagram of the conventional electric instantaneous water heater.

FIG. 7 is a structural drawing of a feedwater pressurizing pump as one of the components of the conventional electric water heater.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be described below with reference to the accompanying drawings.

(First Exemplary Embodiment)

A first exemplary embodiment of the invention will be described below.

with reference to FIG. 1 to FIG. 3.

FIG. 1 is an external view of an electric instantaneous water heater as the water heater of the first embodiment, FIG. 2 is a control block diagram showing an internal structure of the electric instantaneous water heater, and FIG. 3 is a structural drawing of a feedwater pressurizing pump as a constituent of the water heater.

As shown in FIG. 1, the electric instantaneous water heater is made up of water intake pipe 21, flow adjusting knob 22a with a feedwater filter incorporated therein, power switch 23, operating section 25 included hot water switch 24 and heater power adjusting volume switch 25a, shower hose 26, shower head 27, heat source (heater) 28, and a display section 29 formed of power lamp 29a and heater lamp 29b. As shown in FIG. 2, there are further provided controller 30, power lamp controlling section 30a, heater controlling section 30b, voltage converter 30c, flow switch 31, and feedwater pressurizing pump 32.

In accordance with inputs from hot water switch 24, flow switch 31, and heater power adjusting volume switch 25a, power lamp controlling section 30a and heater controlling section 30b drive heat source (hereinafter called heater) 28 and display section 29 having power lamp 29a and heater lamp 29b. Further, voltage converter 30c drives feedwater pressurizing pump 32 in accordance with an input from hot water switch 24 regardless of whether flow switch 31 is turned on or not. At the same time, power lamp controlling section 30a lights up power lamp 29a.

As shown in FIG. 3, feedwater pressurizing pump 32 is integrally formed of pump section 33 and motor section 34. Pump section 33 includes back casing 33a made of polyphenylenesulfide (PPS) resin, front casing 33b made of polyphenylenether (PPE) resin, rotor 33c, shaft 33d, bearing 33e, and

washer 33f. Motor 34 is a DC brushless motor and stator 34a of the same is arranged as shown in FIG. 3.

At the time of normal use, power switch 23 is turned on first. Then, if hot water switch 24 serving the function of water stopping cock is turned on, feedwater pressurizing pump 32 is driven by means of voltage converter 30c. At the same time, the water from water intake pipe 21 is flowed through shower hose 26 to be discharged from shower head 27. The flow of water due to the discharging is detected by flow switch 31 and, thereupon, power supply to heater 28 is started. Heater controlling section 30b performs control such that the power set by heater power adjusting volume switch 25a is supplied to heater 28.

Incidentally, power lamp controlling section 30a, heater controlling section 30b, and voltage converter 30c compose a controller.

When water quality is bad and filter clogging occurs, the filter can be removed by having filter knob 22a of flow adjusting knob 22, which is of a type incorporating a feedwater filter therein, fully turned to the open side. The filter after being washed can be refitted by turning filter knob 22a to the close side.

Since, as described above, feedwater pressurizing pump 32 is formed integral with a DC brushless motor, it can be configured to be smaller than that of conventional type which is composed of an AC motor (larger in size than the DC motor) and a pump section. Also, the degree of freedom of its mounting in a water heater can be increased. Further, since the noise is small, the shower can be used without caring about the time of day when the shower is used and the surrounding neighborhood. Further, since designs are made to prolong the operating life of components of the feedwater pressurizing pump, the frequency of required maintenance for exchanging pump components and so on can be greatly reduced. Hence, a high level of user satisfaction can be ensured.

Further, by having the pump operation of feedwater pressurizing pump 32 associated with turning on of hot water switch 24, the pump can be driven regardless of the water flow and, hence, a sufficient shower pressure can be secured even if the feedwater pressure is extremely low.

In addition, by the configuration in which motor section 34 and pump section 33 are formed integral, number of components is made smaller than in conventional configurations and, hence, frequency of occurrence of troubles can be greatly reduced. Even if a trouble occurs, it can be repaired having other components in the water heater not affected thereby so much.

Further, since the pump section is formed of PPS (polyphenylenesulfide) resin and PPE (polyphenylenether) resin, high resistance to heat and pressure can be obtained. Therefore, even when the user has blocked the openings in the shower head by error, for example, the pump is prevented from being immediately damaged and is kept in safety. Further, a damage is not produced due to hot water from the heat source when a backflow of water has occurred on account of breaks of water service or the like.

Further, flow adjusting knob 22a including feedwater filter is installed on the water feeding side of the water heater main body for ease of removal. Therefore, the user can make maintenance work easily without using a tool.

(Second Exemplary Embodiment)

A second exemplary embodiment will be described below with reference to FIG. 4. FIG. 4 is a structural drawing of an instantaneous water heater of the second exemplary embodiment.

In the present embodiment, supplied water from water intake pipe 121 is passed through feedwater pressurizing pump 122 and delivered to delivery pipe 126 to be supplied to water heater 129 and discharged from shower head

130. Since feedwater pressurizing pump 122 is in the same configuration as feedwater pressurizing pump 32 in the first embodiment, detailed description of the same will be omitted.

In normal use, water stopping cock 131 is opened. If, in this state, the user turns on operating switch 127a of operating section 127, communication section 125 (not shown) informs control section 124 of the turning on of switch 127a. Then, status judgment section 124a (not shown) as a constituent of control section 124 judges that operating switch 127a is on. After this judgment has been made, feedwater pressurizing pump 122 is operated by a DC voltage converted by voltage converter 123. Then, operation lamp 128a is lighted by a signal from display controlling section 124b as a constituent of control section 124. Water from water intake pipe 121 is passed through water heater 129 and discharged from shower head 130. The flow of water due to the discharging is acknowledged by flow switch 132 and thereby power supply to heater 134 is started. At this time, the supplied power to heat source (heater) 134 is controlled such that it attains the power value that is set by heater power adjusting volume switch 133. Further, flow control is accomplished by operating flow adjusting switch 127b.

Further, under abnormal conditions of feedwater pressurizing pump 122, the pump operation can be immediately stopped by abnormal stopping section (not shown).

Further, it is adapted such that, when a predetermined period of time has passed, operation time detecting section (not shown) outputs an information signal, whereupon communication section 125 issues a signal to display section 128 of the water heater main body so that a display is made to urge the user to make a check and part replacement of feedwater pressurizing pump 122.

Further, when the feedwater pressurizing pump is installed in a water

supply pipe, if it is arranged such that communication section 125 transmits data allowing results of determination made by the status judgment section to be displayed on the display section of the water heater, then, the status of the feedwater pressurizing pump installed at the place separate from the water heater main body can be acknowledged by the user being in the place of installation of the water heater main body (the shower room, for example). This improves usability of the water heater very much.

Claims

1. A water heater where water is pressurized by a feedwater pressurizing pump and heated by an electric heater, said water heater comprising:
a heat source section comprising a heater incorporated in a tank;
the feedwater pressurizing pump for installation in an intake-water path for feeding water to said heat source section;

a voltage converter for driving said feedwater pressurizing pump;
a flow switch for detecting a water flow through the intake-water path;
an operating section for giving instructions for operation of said heat source section; and

a control section for controlling said heater of said heat source section and said feedwater pressurizing pump following instructions given by said operating section, wherein,

when said operating section has given instructions for operation, said control section first causes said feedwater pressurizing pump to drive via said voltage converter and then causes said heater of said heat source section to heat water in conjunction with detection of a water flow by said flow switch.

2. The water heater according to claim 1, wherein said feedwater pressurizing pump has a DC brushless motor and a pump section integral with each other.

3. The water heater according to claim 1 or 2, wherein said feedwater pressurizing pump is for installation within a main body of said water heater and adapted to operate in conjunction with a hot water switch included in said operating section.

4. The water heater according to claim 1 or 2, wherein said feedwater pressurizing pump is for installation outside a main body of said water

heater including said heat source section and is adapted to operate in conjunction with a hot water switch included in said operating section.

5. The water heater according to any one of claims 1 to 4, wherein the material of said pump section of said feedwater pressurizing pump is at least one of polyphenylenesulfide and polyphenylenether.

6. The water heater according to any one of claims 1 to 5, further comprising a detachable filter inserted in the intake-water path upstream of said feedwater pressurizing pump.

7. The water heater according to any one of claims 1 to 6, further comprising an abnormal stopping section for stopping operation of said feedwater pressurizing pump under abnormal operating conditions of said feedwater pressurizing pump.

8. The water heater according to any one of claims 1 to 7, further comprising an operation time detection section for detecting an operating period of time of said feedwater pressurizing pump and outputting an information signal when a predetermined period of time has passed.