

27 OCT 2000

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## HEATED/COLD WATER SUPPLY APPARATUS

### FIELD OF THE INVENTION

The present invention relates to a heated/cold water supply apparatus used for heated-water shower and the like.

### BACKGROUND OF THE INVENTION

With reference to Fig. 8 and Fig. 9, an electric water heater will be described hereinafter as an example of a heated/cold water supply apparatus of the prior art.

Fig. 8 is a general view of a heated/cold water supply apparatus of the prior art. Fig. 9 is a block diagram of an electric circuit of the heated/cold water supply apparatus shown in Fig. 8.

As shown in Fig. 8 and Fig. 9, the heated/cold water supply apparatus of the prior art comprises a water inlet pipe 1, a flow control knob 2, a heated-water supply switch 3 having a water shut-off function, an operating switch-cum-temperature setting controller 4 comprised of an operating switch 8 and a potentiometer 12, a shower hose 5, and a showerhead 6. It is so composed that water supplied through the water inlet pipe 1 is led into a main body, and discharged in heated water from the showerhead 6 via the shower hose 5.

The heated/cold water supply apparatus of the prior art, when used as a bathing shower, operates in a manner as described hereinafter.

When a user turns on the heated-water supply switch 3 having water shut-off function, it discharges water from the showerhead 6 through the water inlet pipe 1. The user then turns the operating switch 8 on. This causes a lamp

controller 9 to light an operation indicator lamp 10. The lighting shows the user that electric power begins to energize a heater 15.

The user adjusts the potentiometer 12 to render a temperature regulator 11 to set a temperature of heated water. A power supply controller 13 controls a heater control means 14 according to the setting.

When turning off the heated-water supply switch 3, the water shut-off function operates to stop discharging water at an end of the shower use. The lamp controller 9 turns off the operation indicator lamp 10. At the same time, electric supply to the heater 15 is cut off.

The operation and configuration as described above make it adaptable for use as a heated-water shower. It can also be used for cold water shower when the operating switch 8 is turned off.

However, there are problems when the above apparatus of the prior art is used for bathing, as follows.

- It may require the user to take shower for a long time, if amount of water supplied through the water inlet pipe is not sufficient, thereby providing unsatisfactory effect of washing. In addition, it also impairs a pleasant feel, since it only provides a low water pressure sprayed from the showerhead.
- If amount of the water supplied through the inlet pipe fluctuates, a temperature of the discharged heated water also changes due to the fluctuation in amount of the shower water, and thereby making it difficult for the user to get a pleasant feel of taking shower.

Japanese Patent Laid-open Publication S63-294816 discloses a unique showering apparatus which comprises a tank for storing water for shower use, a

device for heating the water in the tank, a pump for delivering the heated water in the tank to a showerhead, a blower for supplying compressed air to the showerhead, and the showerhead for spraying the heated water and the compressed air supplied respectively by the pump and the blower after mixing them together.

However, the showering apparatus disclosed in the publication has the following problems.

- It is poor in convenience of use, since it has no provision for selecting delivery of heated/cold water alone and water mixed with air according to the purpose of use.
- It requires the user to either turn off an operating switch to change into cold water shower or adjust a temperature setting controller to lower temperature of the heated water, when he desires to cool down his body of a glow before finishing the shower. A sudden change in temperature of the shower water causes a large strain on a body of the user, if he switches to cold water shower by turning off the operating switch. In addition, an adjustment of the temperature setting controller may also cause a sudden change in temperature of the heated water, and manipulation for the adjustment is annoying.
- Furthermore, since temperature of the heated water delivered during shower use is maintained at a temperature adjusted in the beginning of use, it only gives a monotonous stimulation to the user's skin due to no change in temperature. It is not satisfiable for this reason in respect of providing a pleasant feel of taking shower.

## SUMMARY OF THE INVENTION

The present invention has been derived in recognition of the above problems of the prior art.

A heated/cold water supply apparatus of the present invention comprises a heated-water supply switch having a water shut-off function, a heater for heating water, a temperature regulator for setting a temperature of water to be heated by the heater, a power supply controller for controlling amount of electric power to the heater according to the set temperature, an operating switch for controlling electric power to the temperature regulator and the power supply controller, an air pump, a pump controller for controlling the air pump, and a heated-water discharge port.

The temperature regulator and the power supply controller receive supply of electric power from a first power supply unit according to an operation of the operating switch, and regulate temperature of the heated water from the heated-water discharge port.

The pump controller is so constructed that it is operable independently of functioning of the operating switch, so as to mix air supplied by the air pump into the heated water discharged from the heated-water discharge port.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a general view of a heated/cold water supply apparatus of a first exemplary embodiment of the present invention;

Fig. 2 is an electric circuit block diagram of the heated/cold water supply apparatus of the first exemplary embodiment of this invention;

Fig. 3 is a flow chart showing an operation of the heated/cold water supply

apparatus of the first exemplary embodiment of this invention;

Fig. 4 is an electric circuit block diagram of a heated/cold water supply apparatus of a second exemplary embodiment of this invention;

Fig. 5 is an electric circuit block diagram of a heated/cold water supply apparatus of a third exemplary embodiment of this invention;

Fig. 6 is a flow chart showing an operation of the heated/cold water supply apparatus of the third exemplary embodiment of this invention;

Fig. 7A through 7C are diagrammatic representations illustrating control operation of the heated/cold water supply apparatus of the third exemplary embodiment of this invention;

Fig. 8 is general view of a heated/cold water supply apparatus of the prior art; and

Fig. 9 is an electric circuit block diagram of the heated/cold water supply apparatus of the prior art.

## DETAILED DESCRIPTION OF THE INVENTION

Exemplary embodiments of the present invention will be described hereinafter with reference to accompanying figures.

### First Exemplary Embodiment

Fig. 1 illustrates a general view of a heated/cold water supply apparatus of a first exemplary embodiment of this invention. As shown in Fig. 1, the heated/cold water supply apparatus of the first exemplary embodiment of this invention, as it appears externally, comprises a water inlet pipe 30, a flow control knob 31, a heated-water supply switch 32 having a water shut-off function, an operating switch-cum-temperature setting controller 33, a pump switch 34, a

shower hose 35, a showerhead 36 defining a heated-water discharge port, and an air hose 37. Water is introduced into a main body via the water inlet pipe 30, and is discharged as heated water from the showerhead 36 through the shower hose 35. In addition, air 38 supplied by an air pump (to be described later) through the air hose 37 is mixed with heated water 39 within the showerhead 36.

Fig. 2 is an electric circuit block diagram of the heated/cold water supply apparatus of the first exemplary embodiment, and Fig. 3 is a flow chart showing an operation of the heated/cold water supply apparatus of this exemplary embodiment.

Referring now to Fig. 2 and Fig. 3, the present exemplary embodiment will be described hereinafter.

As shown in Fig. 2, an overheating protective device 41 is connected to a power source 42a through the heated-water supply switch 32. A first power supply unit 42 operates when the heated-water supply switch 32 is turned on. A pump controller 43 is so composed that it receives supply of electric power from a second power supply unit 58 through the pump switch 34 so as to be operable independently of functioning of an operating switch 45. An indicator means 43a provides an indication in conjunction with the pump switch 34. The structure comprises an air pump 44, the operating switch 45 to be turned on and off by the operating switch-cum-temperature setting controller 33, a lamp controller 46, an operation indicator lamp 47, a temperature regulator 48, a temperature setting potentiometer 49 to be adjusted by the operating switch-cum-temperature setting controller 33, a power supply controller 50, a heater control means 51, a heater 52, a temperature detecting unit 53, a thermister 55, a feedback controller 56, and a flow-rate detection means 57. The flow-rate detection means 57 closes a circuit

when it detects a flow of water, and it cuts off electric supply to individual control units connected thereto when it does not detect a flow of water.

The heated/cold water supply apparatus has a heat exchanger built within its enclosure together with the air pump 44. The heat exchanger comprised of a canister of small capacity contains the heater 52 internally, and it is thereby capable of delivering heated water continuously by exchanging heat instantaneously with water flowing in the canister.

In the structure as described above, the heated-water supply switch 32 is provided with a function to shut-off water. First, when a user, intending to take a shower bath, turns the heated-water supply switch 32 on (step 60), the flow-rate detection means 57 detects a flow of water, and closes its switch contacts. Water is thus discharged from the showerhead 36 passing through the water inlet pipe 30 (step 61). If the overheating protective device 41 has not functioned at this moment (step 62), the power supply unit 42 steps down high A.C. voltage of the power source 42a into a low D.C. voltage (step 63).

When the operating switch 45 is subsequently turned on (step 68), the low voltage produced by the power supply unit 42 comes into an ON state. The lamp controller 46 lights up the operation indicator lamp 47 (step 69). The lighting tells the user that electric power begins to energize the heater 52 (step 72).

The temperature regulator 48 sets a temperature for heated-water supply according to the temperature setting potentiometer 49 adjusted by preference of the user (step 70), and the power supply controller 50 controls the heater control means 51 (step 71). This control operation determines an amount of electric power supplied from the power source 42a to the heater 52.

When the user turns off the heated-water supply switch 32 (the step 60 in

Fig. 3) to finish the shower bathing, the water shut-off function operates. The water stops discharging (step 75), and the lamp controller 46 turns off the operation indicator lamp 47 (step 76). The electric supply to the heater 52 is cut off at the same time the light goes off (step 77 in Fig. 3).

If the overheating protective device 41 functions as a result of an irregularity that takes place during use (step 62), the electric supply to the heater 52 is also interrupted, and the lamp controller 46 turns off the operation indicator lamp 47. Loss of the light tells the user that an abnormality has occurred.

The operation and configuration as described above enable the user to take a shower with heated water. The user can also use it for cold water shower by turning off the operating switch 45 to cut off the power supply to the heater 52.

When the pump switch 34 is operated while taking a shower bath (step 65), the pump controller 43 turns the air pump on or off in response to the operation (step 66 and step 67). At the same time, the indicator means 43a displays an operating condition of the air pump 44 synchronously with the operation of the pump switch 34. The pump 44 operates so as to mix air into the heated water in the showerhead 36 through the air hose 37.

The above operation and configuration enable the user to take a shower with heated water mixed with air. The user can also use it for taking a shower of cold water mixed with air by turning off the operating switch 45.

The temperature detecting unit 53 detects, by means of the thermister 55, a temperature of the heated water heated by the heater 52 (step 73). The feedback controller 56 carries out a feedback operation to the power supply controller 50 in order to minimize a difference between the temperature set with the temperature regulator 48 and the detected temperature (step 74).

Accordingly, electric power supplied to the heater 52 is controlled steplessly according to the temperature adjusted by the user at will. The apparatus is therefore able to maintain stable temperature of the heated water, even if fluctuations and the like occur in volume of the shower water, thereby enabling the user to enjoy pleasant feel of taking a shower.

The flow-rate detection means 57 operates to cut off the electric power to the heater 52 (step 64), if it detects an interruption of discharging the heated water due to an irregularity that takes place during use, even if the heated-water supply switch 32 is in its ON position. In other words, the electric power to the temperature regulator 48 and the power supply controller 50 is interrupted, and the heater 52 is deenergized by the heater control means 51. The lamp controller 46 turns off the operation indicator lamp 47 to indicate the user that an abnormality has occurred. Accordingly, this enables the user to enjoy the shower bathing more safely.

Furthermore, the flow-rate detection means 57 can also suspend the air pump 44, if it is arranged to interrupt the electric power to the pump controller 43. Such an arrangement can prolong a useful life of the motor as well as the pump.

In addition, when the pump switch 34 is operated (step 65), the air pump 44 having a built-in D.C. motor operable by a low D.C. voltage is controlled on and off by the pump controller 43 (step 66 and step 67) in response to the operation, without being influenced by on/off switching of the operating switch 45. Therefore, it provides a selection of starting air and stopping the air separately with the air pump 44. Accordingly, it allows the user to select any form of shower water from the showerhead 36 among heated water, cold water, heated water mixed with air, and cold water mixed with air.

Consequently, the heated/cold water supply apparatus of this exemplary embodiment provides the following advantages.

(a) Various forms of shower water from the heated-water discharge port can be selected readily with a manipulation of the switches.

(b) Sufficient washing effect can be attained by addition of air pressure even with a limited amount of heated-water supply, thereby conserving water.

(c) Addition of the air pressure gives a user to enjoy pleasant feel of taking a shower with anticipation of massage effect.

(d) The structure having the air pump capable of being operated independently irrespective of a manipulation of the switching means allows the user to select various forms of shower water from the heated-water discharge port, such as heated water only, cold water only, mixture of heated water with air, and mixture of cold water with air, for use in their proper ways according to intended purposes, thereby improving convenience substantially.

(e) Since amount of electric power supplied to the heater is controlled according to a difference between heated water temperature and a set temperature, it can keep a stable temperature of the heated water, even when fluctuations and the like occurs in flow of the shower water. Additionally, since the temperature can be set steplessly, it ensures the user to set a desired temperature of the heated water so as to enjoy pleasant feel of taking a shower.

(f) The flow-rate detection means interrupts electric power from the heater control means to the heater by cutting off the electric power to the power supply controller, if it detects no discharge flow of the heated water. The interruption of power to the heater before the overheating protective device operates, in the manner as described, can ensure further safety and prevent damages from

escalating.

Use of the low voltage D.C. motor for the air pump allows downsizing, weight reduction, and low-cost design, and thereby realizing a design of the heated/cold water supply apparatus having a main body of small size and light weight at low cost.

### **Second Exemplary Embodiment**

Fig. 4 is an electric circuit block diagram of a heated/cold water supply apparatus of a second exemplary embodiment of the of the present invention. Like components as those of the first exemplary embodiment are assigned like reference numerals, and their descriptions will be skipped.

General appearance of the heated/cold water supply apparatus of this exemplary embodiment is identical to the one shown in Fig. 1. Further, a pump controller, a pump switch, a first and a second power supply units, an operating switch, an indicator means, an air pump, a lamp controller, an operation indicator lamp, a temperature regulator, a temperature setting potentiometer, a power supply controller, a heater control means, a heater, a temperature detecting unit, a thermister, a feedback controller, and a flow-rate detection means, and so on are identical to those of the first exemplary embodiment. Therefore, a figure is not included to show them.

This exemplary embodiment is so constructed that electric power to the heater 52 is cut off directly by the flow-rate detection means 57 provided for detecting no discharge flow of heated water.

In Fig. 4, the flow-rate detection means 57 disposed next to the heater 52 at a side close to a power source disrupts the electric power to the heater 52, if

heated water stops flowing while the heated-water supply switch 32 stays on, i.e. in a position not to block the water flow.

In this way, the power supply to the heater 52 can be cut off directly, if a trouble occurs in the water shut-off function for any reason, thereby resulting in such a condition that prevents a user from taking a shower bath. In other words, it ensures more reliable termination of the electric power to the heater 52 than disrupting the power to the heater 52 with the heater control means 51 by cutting off power to the power supply controller 50. Accordingly, it ensures further safety for the user to enjoy shower bathing at ease.

### **Third Exemplary Embodiment**

Fig. 5 is a circuit block diagram of a heated/cold water supply apparatus of a third exemplary embodiment of the present invention, Fig. 6 is a flow chart, and Fig. 7A through 7C are diagrammatic representations illustrating operations of beat-shower control, cool-down control, and cyclic control. General appearance of the heated/cold water supply apparatus of this exemplary embodiment is identical to the one shown in Fig. 1.

With reference to Fig. 5, Fig. 6, and Fig. 7, description will be given in detail hereinafter.

The heated/cold water supply apparatus of this exemplary embodiment shown in Fig. 5 comprises power supply units 151 and 140, a beat-shower controller 152, a pump controller 153, a pump switch 154, an air pump 155, an operating switch 156, a lamp controller 157, an operation indicator lamp 158, a temperature regulator 159, a temperature setting potentiometer 160, a temperature controller setting unit 161, a cool-down controller 162, a cyclic

controller 163, a heat source controller (hereinafter referred to as power supply controller) 164, a heat source control means (hereinafter referred to as heater control means) 165, a temperature detecting unit 166, a thermister 167, a feedback controller 168, and a heater 169 defining a heat source.

In the above structure, the heated-water supply switch 32 is provided with a water shut-off function. First, when a user, intending to take a shower bath, turns the heated-water supply switch 32 on (step 175), water passing through the water inlet pipe 30 is discharged from a showerhead 36 (step 176). The power supply unit 151 steps down high A.C. voltage into low D.C. voltage (step 177).

When the operating switch 156 is subsequently turned on (step 181), the lamp controller 157 lights up the operation indicator lamp 158 (step 182). The lighting tells the user that electric power begins to energize the heater 169 (step 189).

The temperature regulator 159 sets a temperature for heated-water supply according to the temperature setting potentiometer 160 adjusted by preference of the user (step 183), and the power supply controller 164 controls the heater control means 165 (step 188). This control determines an amount of electric power supplied to the heater 169.

When the user turns off the heated-water supply switch 32 (the step 175) to finish the shower bathing, the water stops discharging (step 192). The lamp controller 157 then turns off the operation indicator lamp 158 (step 193). The electric supply to the heater 169 is cut off at the same time the light goes off (step 194).

The operation and configuration as described above enable the user to take a shower with heated water. The user can also use it for cold water shower by

turning off the operating switch 156.

When the user actuates the pump switch 154 while taking a shower bath (step 178), the air pump 155 having a built-in D.C. motor operable by a low D.C. voltage starts operating.

If the user selects a beat-shower function at this time with the beat-shower controller 152, a beat-shower operation begins, in which the air pump 155 repeats ON and OFF alternately as shown in Fig. 7A. When the user cancels the beat-shower operation, it resumes an ordinary continuous operation, and the operation stops if the pump switch 154 is turned off.

In this embodiment, the above-said beat-shower controller 152 is so configured that a pump-run time (T1) and a pump-pause time (T2) of the air pump 155 can be changed according to preference of the user. In addition, each of the pump-run time (T1) and the pump-pause time (T2) can be adjusted individually.

Furthermore, the user may choose a pattern of his choice among a plurality of patterns, each having a prearranged pump-run time (T1) and pump-pause time (T2).

The operation and configuration as described above makes it possible to vary the ON and OFF cycle of the air pump 155 continuously and periodically according to the preference of the user. The heated water mixed with air can thus give effective stimulation to skin of the user, to thereby allow the user to enjoy pleasant feel of taking shower.

In addition, the beat-shower controller 152 is provided in advance with a plurality of patterns with respect to the times T1 and T2, from which the user can choose any one of his choices. One of them is a 1/f fluctuation pattern, and another one is a chaos fluctuation pattern.

The  $1/f$  fluctuation pattern can be used by storing it in a memory of a microcomputer as a digit sequence having  $1/f$  fluctuation, and generating it repetitively as a  $1/f$  fluctuation pulse signal (or, a  $1/f$  fluctuation generating circuit similar to the one described in Japanese Patent Laid-open Publication, No. H08-195628, for instance, may be used).

For the chaos fluctuation pattern, the times T1 and T2 are obtained by the Bernoulli shift, or a function such as a logistic function and tent mapping, all featuring the baker's transform as a fundamental characteristic (as described in Japanese Patent Laid-open Publication, No. H07-120044, for instance). In the case of using a low power microcomputer not capable of performing chaos computation, this purpose can be attained by storing a portion of chaos time series signal in a memory of the microcomputer in advance as a chaos fluctuation pattern, and repetitively reading this pattern.

The times T1 and T2 determined according to the  $1/f$  fluctuation or the chaos fluctuation provide fluctuations compatible with living bodies, thereby giving the user more pleasant feel and tranquility in mind.

Moreover, the apparatus can be used as heat-shower using water mixed with air, when the operating switch 156 is turned off.

Furthermore, the temperature controller setting unit 161 allows the user to make a selection amongst cool-down control (step 184), cyclic control (step 186), and heated water shower at a constant temperature, once the heated-water supply temperature is set with the temperature regulator 159.

When the cool-down control is selected (step 185), temperature of the heated-water supply set by the temperature regulator 159 is controlled in a manner to vary continuously with time from an upper bound temperature B1 to a

lower bound temperature B2, as shown in Fig. 7B. That is, the cool-down controller 162 computes temperature of the heated-water supply, and the power supply controller 164 controls the heater control means 165 based on the computed result. In this operation, the user can adjust the lower bound temperature B2 down to a temperature of the incoming water from the water inlet pipe 30. The user can also adjust a decay time T3 given for the heated-water supply to get a change W1 in temperature down to the lower bound temperature B2.

On the other hand, when the cyclic control is selected (step 187), temperature of the heated-water supply is controlled in a manner to vary continuously and periodically with time between an upper bound temperature C1 and a lower bound temperature C2, as shown in Fig. 7C. In other words, the cyclic controller 163 computes temperature of the heated-water supply, and the power supply controller 164 controls the heater control means 165 based on the computed result. In this operation, the user can adjust the upper bound temperature C1 and the lower bound temperature C2. The user can also adjust the lower bound temperature C2 down to a temperature of the incoming water from the water inlet pipe 30. In addition, the user can arbitrarily adjust a cyclic duration T4 to be given for getting a variation W2 in temperature of the heated-water supply.

The temperature detecting element 166 detects a temperature of the hot water heated by the heater 169 by means of the thermister 167 (step 190). The feedback controller 168 performs a feedback operation to the power supply controller 164 in order to minimize a difference between any of the temperatures set with the temperature regulator 159, the cool-down controller 162 or the cyclic

controller 163 and the detected temperature (step 191). With the feedback operation as described above, electric power supplied to the heater 169 can be controlled steplessly. The apparatus is therefore capable of maintaining a stable temperature of the heated water, even if fluctuations and the like occur in volume of the shower water, thereby enabling the user to enjoy comfortably with the cool-down control and the cyclic control.

Consequently, the present exemplary embodiment is able to provide the following advantages, in addition to the same advantages as the first exemplary embodiment.

(a) It can provide effective stimulation to skin by varying a discharge pressure of the heated water according to a predetermined pattern, thereby allowing the user to enjoy pleasant feel of taking shower along with a massage effect.

(b) It prevents a sudden change in temperature of the discharging heated water, when the user desires to cool down his body of a glow at an end of the shower bathing. This can avoid a strain on a body of the user, and allow him to finish taking the shower bathing comfortably.

(c) It can vary temperature of the heated water continuously and periodically with time. It can therefore give stimulation due to variation of temperature on the skin of the user while taking shower bathing so as to allow him to enjoy a pleasant feel of the shower bathing.

**What is claimed is:****1. Heated/cold water supply apparatus comprising:**

a heated-water supply switch having a water shut-off function;

a heater for heating water;

a temperature regulator for setting a temperature of heated water heated by said heater;

a power supply controller for controlling amount of electric power supplied to said heater according to the set temperature;

an operating switch for controlling supply of electric power to said temperature regulator and said power supply controller;

an air pump;

a pump controller for controlling said air pump; and

a heated-water discharging unit,

wherein said temperature regulator and said power supply controller receive supply of electric power from a first power-supply unit according to an operation of said operating switch, and regulate temperature of the heated water discharged from said heated-water discharge port, and

said pump controller is composed to be operable independently of functioning of said operating switch, for driving said air pump to supply air to be mixed into the heated water before being discharged from said heated-water discharge port.

**2. The heated/cold water supply apparatus according to claim 1, further comprising:**

a canister therein containing said heater;



a heat exchanger capable of discharging heated water continuously by exchanging heat with water flowing in said canister;

a shower hose for leading the heated-exchanged water to said heated-water discharge port; and

an enclosure,

wherein at least said heater, said heat exchanger, and said air pump are disposed within said enclosure.

3. The heated/cold water supply apparatus according to claim 1, further comprising a second power supply unit, wherein:

said first power supply unit generates low voltage of a predetermined potential in response to operation of said heated-water supply switch;

said pump controller receives supply of electric power from said second power supply unit; and

said air pump is driven by said pump controller.



4. The heated/cold water supply apparatus according to claim 3, further comprising:

a pump switch disposed in said pump controller; and

an indicator means for indicating synchronously with operation of said pump switch.

5. The heated/cold water supply apparatus according to claim 1, wherein said power supply controller controls an amount of electric power to said heater based on a difference between a temperature of the heated water and a set

temperature.

6. The heated/cold water supply apparatus according to claim 1, further comprising a flow-rate detection means for interrupting electric power to said heater, when a flow of the heated water to be discharged from said heated-water discharge port is not detected.

7. The heated/cold water supply apparatus according to any one of claim 1 through claim 6, further comprising a beat-shower controller for driving said pump controller to repeat an ON and OFF operations alternately.

8. The heated/cold water supply apparatus according to claim 7, wherein said beat-shower controller is so configured that times of said ON and OFF operations are arbitrarily adjustable.



9. The heated/cold water supply apparatus according to claim 7, wherein said beat-shower controller is so configured that times of said ON and OFF operations can be selected amongst a plurality of predetermined patterns.

10. The heated/cold water supply apparatus according to claim 7, wherein said beat-shower controller is so configured that times of said ON and OFF operations are determined according to a 1/f fluctuation.

11. The heated/cold water supply apparatus according to claim 7, wherein said beat-shower controller is so configured that times of said ON and OFF

operations are determined according to a chaos fluctuation.

12. The heated/cold water supply apparatus according to any one of claim 1 through claim 6, further comprising a cool-down controller for operating according to an upper bound temperature and a lower bound temperature set for heated water heated by said heater, wherein said cool-down controller controls said power supply controller in a manner to vary with a lapse of time temperature of the heated water from the upper bound temperature to the lower bound temperature.

13. The heated/cold water supply apparatus according to claim 12, wherein said cool-down controller is so configured that the lower bound temperature of the heated water is adjustable.

14. The heated/cold water supply apparatus according to claim 12, wherein said cool-down controller is so configured that a speed of changing the temperature to the lower bound temperature is adjustable.



15. The heated/cold water supply apparatus according to any one of claim 1 through claim 6, further comprising a cyclic controller for setting an upper bound temperature and a lower bound temperature of the heated water to be heated by said heater, wherein said cyclic controller controls said power supply controller in a manner to periodically vary temperature of the heated water between the upper bound temperature and the lower bound temperature.

16. The heated/cold water supply apparatus according to claim 15, wherein said cyclic controller is so configured that said upper bound temperature and said lower bound temperature are adjustable.



17. The heated/cold water supply apparatus according to claim 15, wherein said cyclic controller is so configured that a cyclic duration is adjustable.