

SPECIFICATION
HOT WATER SUPPLY APPARATUS

Technical Field

The present invention relates to a hot water supply apparatus, and more particularly, to a control technique of output of a heat source.

Background Technique There is a conventional hot water supply apparatus in which hot water heated by a heat source is spurted from a discharging portion of a showerhead and a user can enjoy taking a shower (see patent document 1 for example).

Patent Document [Patent Document 1] Japanese Patent Application Laid-open No.2008-309407

However, the conventional hot water supply apparatus has a problem that since the hot water supply apparatus merely spurts hot water of a given temperature from a showerhead, a user's body burns with heat of the hot water, and he or she gets sweaty after taking the shower, this deteriorates refreshing feeling in some cases, fatigue remains and comfort is deteriorated.

The present invention is for solving the conventional problem, and it is an object of the invention to provide a hot water supply apparatus capable of reducing a load on a heart, and enhancing the comfort.

Disclosure of the Invention

To solve the conventional problem, a hot water supply apparatus according to the present invention comprises a heat source which heats water, temperature detecting means which detects a temperature of hot water heated by the heat source, a temperature operating section which adjusts a temperature of hot water spurted from the heat source, a discharging portion through which hot water heated by the heat source is discharged, and a hot/cold switch which starts an operation action for alternately spurting two kinds of hot water having different

temperatures, and when the hot/cold switch is operated to start a hot/cold bathing operation, for first predetermined time, output of the heat source is adjusted such that a temperature detected by the temperature detecting means becomes equal to a temperature which is set by the temperature operating section and hot water is spurted from the discharging portion, and after the first predetermined time is elapsed, the two kinds of hot water having the different temperatures are alternately spurted.

According to this configuration, since a user can take a shower of two kinds of hot water having different temperatures alternately, it is possible to lower heart rates when taking the shower, to reduce the load on the heart and to enhance the comfort. Further, since hot water heated by the heat source is spurted for the first predetermined time before alternately spurring the two kinds of hot water having the different temperatures, the user does not take cold water straight away, and this can prevent the heart rates from being abruptly changed.

[Effect of the Invention]

The present invention can provide a hot water supply apparatus capable of reducing a load on a heart and enhancing the comfort.

Brief Description of the Drawings

Fig. 1 is a front view of an outward appearance of a hot water supply apparatus according to a first embodiment of the present invention;

Fig. 2 is a diagram of an outward appearance of an essential portion of the first embodiment;

Fig. 3 is a block diagram of the hot water supply apparatus of the first embodiment;

Fig. 4 is a diagram showing variation in a detected temperature of a temperature sensor at the time of a continuous bathing in the first embodiment;

Fig. 5 is a diagram of an outward appearance of an

essential portion of the first embodiment;

Fig. 6 is a diagram showing variation in a detected temperature of the temperature sensor at the time of a hot/cold bathing in the first embodiment;

Fig. 7 is a diagram of states of heart rates in the first embodiment;

Fig. 8 is a diagram of states of heart rates in the first embodiment;

Fig. 9(a) is a diagram of variation in heart rates in the first embodiment, and Fig. 9(b) is a diagram of variation in heart rates in the first embodiment;

Fig. 10 is a diagram showing variation in alpha waves in the first embodiment;

Fig. 11 is a diagram showing variation in alpha waves in the first embodiment;

Fig. 12 is a diagram showing variation in a detected temperature of a temperature sensor 31 at the time of the hot/cold shower bathing in the first embodiment;

Fig. 13 is a diagram showing variation in heart rates at the time of the hot/cold bathing in the first embodiment;

Fig. 14 is a diagram showing variation in heart rates when taking a hot/cold bathing after taking a continuous bathing in the first embodiment;

Fig. 15 is a block diagram of a hot water supply apparatus according to a second embodiment;

Fig. 16 is a block diagram of a hot water supply apparatus according to a third embodiment;

Fig. 17 is a diagram of an outward appearance of an essential portion of a hot water supply apparatus according to a fourth embodiment; and

Fig. 18 is a diagram showing variation in a detected temperature of a temperature sensor 31 at the time of the hot/cold bathing in a fifth embodiment.

Mode for Carrying Out the Invention

A first aspect of the present invention provides a hot

water supply apparatus comprising a heat source which heats water, temperature detecting means which detects a temperature of hot water heated by the heat source, a temperature operating section which adjusts a temperature of hot water spurted from the heat source, a discharging portion through which hot water heated by the heat source is discharged, and a hot/cold switch which starts an operation action for alternately spurring two kinds of hot water having different temperatures, wherein when the hot/cold switch is operated to start a hot/cold bathing operation, for first predetermined time, output of the heat source is adjusted such that a temperature detected by the temperature detecting means becomes equal to a temperature which is set by the temperature operating section and hot water is spurted from the discharging portion, and after the first predetermined time is elapsed, the two kinds of hot water having the different temperatures are alternately spurted.

According to this configuration, it is possible to take a shower bathing in which the two kinds of hot water having the different temperatures are alternately spurted, heart rates during the shower bathing can be reduced, a load on a heart can be reduced, and comfort can be enhanced. Before the two kinds of hot water having the different temperatures are alternately spurted, hot water heated by the heat source is spurted for the first predetermined time, a user does not take cold water straight away and it is possible to prevent the heart rates from being abruptly changed.

According to a second aspect of the invention, the hot water supply apparatus of the first aspect further comprises water temperature detecting means which detects water temperature before it is heated by the heat source, wherein a length of the first predetermined time is changed in accordance with a water temperature detected by the water temperature detecting means. According to this aspect, the first predetermined time is changed while seeing a water temperature which is changed in accordance with seasons, and a user's body can sufficiently be warmed. Since the hot/cold bathing

operation is started after the body is sufficiently warmed, it is possible to prevent heart rates from being abruptly changed.

According to a third aspect of the invention, the hot water supply apparatus of the first aspect further comprises outside air temperature detecting means which detects an outside air temperature, wherein a length of the first predetermined time is changed in accordance with the outside air temperature detected by the outside air temperature detecting means. According to this aspect, the first predetermined time is changed while seeing an outside air temperature which is changed in accordance with seasons, and a user's body can sufficiently be warmed. Since the hot/cold bathing operation is started after the body is sufficiently warmed, it is possible to prevent heart rates from being abruptly changed.

According to a fourth aspect of the invention, the hot water supply apparatus of the first aspect further comprises physical condition inputting means for selecting whether the first predetermined time should be provided in accordance with a physical condition. According to this aspect, when the physical condition is good, the hot/cold bathing operation can be started without providing the first predetermined time, and when the physical condition is not good, the first predetermined time is provided and the hot/cold bathing operation is started, thereby suppressing abrupt change of heart rates.

According to a fifth aspect of the invention, in the hot water supply apparatus of any one of the first to fourth aspects, at the time of the hot/cold bathing operation, when high temperature hot water is changed to low temperature hot water, hot water of medium temperature provided between the high temperature hot water and the low temperature hot water is spurted for second predetermined time and then, the low temperature hot water is spurted. According to this, after the high temperature hot water is once changed to the hot water in the medium temperature region, the hot water in the medium temperature region is changed to the low temperature hot water. Therefore, the temperature is not abruptly changed from the high

temperature hot water to the low temperature hot water, and it is possible to suppress the abrupt change of the user's heart rates.

Embodiments of the present invention will be described with reference to the drawings. The invention is not limited to the embodiments.

(First Embodiment)

Fig. 1 is a front view of an outward appearance of a hot water supply apparatus according to the first embodiment. Fig. 2 is a diagram of details of an essential portion. Fig. 3 is a block diagram of the hot water supply apparatus of the first embodiment. A configuration of the outward appearance of the hot water supply apparatus according to the first embodiment will be described using Figs. 1 to 3. As shown in Fig. 1, the hot water supply apparatus of the embodiment includes a case 1 constituting a contour of the apparatus, a hot water supply port 2 through which hot water spurts to outside from a hot water supply pipe 14 in the case 1, and a water supply port 3 through which water is supplied to a water supply pipe 15 in the case 1.

A shower hose 4 constituting a portion of a hot water supply path is connected to the hot water supply port 2, and an end of the shower hose 4 has a showerhead 5 which is a discharging portion. When the hot water supply apparatus is used, hot water is discharged from the showerhead 5.

A flow rate adjusting valve 6 which adjusts a supply amount of water is mounted on the water supply port 3, and a supply amount of water supplied from a water supply source to the water supply port 3 through a water pipe 7 is adjusted. Usually, the flow rate adjusting valve 6 is operated when the hot water supply apparatus is installed to set the supply amount of water, but even when the hot water supply apparatus is used, if a user operates the flow rate adjusting valve 6, it is possible to set the supply amount of water to the hot water supply apparatus.

A front surface of the case 1 has a hot water switch 8 for starting/stopping hot water from the showerhead 5. If a

user once pushes the hot water switch 8 when the hot water supply apparatus is at rest, hot water spurts from the showerhead 5, and if the user pushes the hot water switch 8 again, the hot water spurting from the showerhead 5 is stopped.

According to the hot water supply apparatus of the embodiment, a temperature of high temperature hot water and a temperature of low temperature hot water can be set. As shown in Fig. 2, a temperature setting screen is displayed on a display section 51 by operating an operating section 52. A temperature T_x of high temperature hot water and a temperature T_y of low temperature hot water are set by operating the operating section 52. In Fig. 2, the temperature of high temperature hot water is set to 42°C and the temperature of low temperature hot water is set to 35°C.

As shown in Figs. 1 and 2, the hot water supply apparatus includes a hot/cold switch 10 having an ON-button 10a and an OFF-button 10b, and a hot/cold lamp 11 which is lit when the ON-button 10a is pushed. That is, when the hot/cold switch 10 is ON, the hot/cold lamp 11 is lit, and a user knows that the hot/cold switch 10 is ON.

As shown in Fig. 3, a tank 12 in which a small amount of hot water is stored, and a heater 13 which is a heat source for heating water are disposed in the case 1. The heater 13 is disposed in the tank 12. The case 1 also includes the hot water supply pipe 14 for guiding hot water heated by the heater 13 to the hot water supply port 2, and the water supply pipe 15 for guiding water from the water supply port 3 into the tank 12. The water supply pipe 15 is connected to a bottom of the tank 12, an end of the hot water supply pipe 14 is embedded in the tank 12, and hot water in an upper portion of the tank 12 is supplied.

The water supply pipe 15 includes a flow rate sensor 16 which is flow rate detecting means for detecting an amount of water to be supplied, and a water stopper 17 which opens and closes a water flow path of the water supply pipe 15. If the water stopper 17 is opened, water is supplied to the tank 12,

and if the water stopper 17 is closed, the supply of water to the tank 12 is stopped. A flow rate adjusting valve 23 is provided outside the case 1. The flow rate adjusting valve 23 adjusts a flow rate of water to be supplied to the water supply port 3 by operating the flow rate adjusting valve 6.

The hot water supply apparatus includes a temperature sensor 31 which is temperature detecting means for detecting a temperature of hot water heated by the heater 13. When normally taking a shower bathing, a user sets the temperature Tx (high temperature) by operating the operating section 52, and output of the heater 13 is adjusted such that a temperature detected by the temperature sensor 31 becomes equal to a set temperature Tx. The temperature sensor 31 is disposed in the tank 12, and the temperature sensor 31 detects a temperature of hot water to be supplied to the hot water supply pipe 14.

The hot water supply apparatus includes a power supply controller 18 for controlling the heater 13. The power supply controller 18 controls electricity of the heater 13 through a heater energization control device 19. The hot water supply apparatus further includes a heat source controller 20 which controls output of the heater 13 such that output of the heater 13 becomes equal to output determined by a heat source adjusting volume, and a hot/cold water controller 21 which receives support from the hot/cold switch 10 and controls the heater 13.

The hot water supply apparatus includes a power supply switch 22 for supplying a power supply to various constituent parts from an external power supply, and the power supply switch 22 is turned ON and OFF by operating the hot water switch 8. Although three controllers, i.e., the power supply controller 18, the heat source controller 20 and the hot/cold water controller 21 are provided in the embodiment, they may integrally be formed as one controller. The controllers may be electronic components constituting a microcomputer and peripheral devices thereof.

Operation and effect of the hot water supply apparatus having the above-described configuration will be described.

When the hot water supply apparatus of the embodiment is used, a user first pushes the hot water switch 8 once. If the hot water switch 8 is pushed, the water stopper 17 is opened, the power supply switch 22 is turned ON, and supply of a power supply to the various constituent parts is started. Since the water stopper 17 is opened, supply of water to the water supply port 3 is started, and the flow rate sensor 16 detects a flow rate of supplied water. If the flow rate sensor 16 detects a predetermined flow rate (e.g., 1L per minute), the power supply controller 18 controls the electricity of the heater 13 through a heater energization control device (e.g. triac) 19.

First, a shower bathing at the time of a continuous bathing during which the hot/cold lamp 11 is put out will be described.

Fig. 4 is a diagram showing variation in a temperature detected by the temperature sensor 31 while hot water is spurted from the showerhead 5. As shown in Fig. 4, in the normal shower bathing during which the hot/cold lamp 11 is put out, the output of the heater 13 is controlled such that a temperature detected by the temperature sensor 31 becomes equal to a temperature Tx which is set by the operating section 52.

A user pushes the hot water switch 8 and hot water starts spurting from the showerhead 5. At that time, the power supply switch 22 is also turned ON, and a power supply is supplied to the various controllers. If the flow rate sensor 16 detects a predetermined flow rate, the energization of the heater 13 is started and the heating operation of water in the tank 12 is started. Although the energization of the heater 13 is started if a flow rate of 1L per minute is detected by the flow rate sensor in this embodiment, the predetermined flow rate is not limited to this.

The user operates the operating section 52 to set the temperature Tx of high temperature hot water. As a result, as shown in Fig. 4, even if the hot water switch 8 is pushed and the spurting operation of hot water from the showerhead 5 is started, if the hot/cold switch 10 is OFF, the output of the heater 13 is adjusted such that a temperature detected by the

temperature sensor 31 becomes equal to the temperature Tx of high temperature hot water which was set by the operating section 52.

If the user again pushes the hot water switch 8 and stops the hot water from the showerhead 5, the output from the heater 13 is also stopped, and the user finishes taking the shower bathing.

Next, shower bathing at the time of hot/cold bathing during which the hot/cold lamp 11 is lit will be described.

Fig. 5 is a diagram of an outward appearance of an essential portion of hot water supply apparatus of the first embodiment. As shown in Fig. 5, a time setting screen is displayed on the display section 51 by operating the operating section 52. The operating section 52 is operated to set the high temperature hot water spurting time La and the low temperature hot water spurting time Lb. In Fig. 5, the high temperature hot water spurting time is set to 30 seconds, and the low temperature hot water spurting time is also set to 30 seconds. Since the two kinds of hot water spurting time can be set in this manner, it is possible to meet various requirements of a user. Although the high temperature hot water spurting time La and the low temperature hot water spurting time Lb can be set in this embodiment, the present invention is not limited to this, and high temperature hot water and low temperature hot water may be repeated at predetermined intervals.

A user pushes the hot water switch 8 and starts spurting hot water from the showerhead 5. The temperature Tx of high temperature hot water and the temperature Ty of low temperature hot water are set, and the high temperature hot water spurting time La and the low temperature hot water spurting time Lb are set by operating the operating section 52. Before the ON-button 10a of the hot/cold switch 10 is pushed, hot water of the set temperature Tx is spurted from the showerhead 5. In this embodiment, the temperature Tx of high temperature hot water is set to 42°C, the temperature of low temperature hot water

is set to 35°C, and spurting time La and spurting time Lb are set to 30 seconds.

Next, the user pushes the ON-button 10a of the hot/cold switch 10. If the ON-button 10a is pushed, the bathing mode is shifted to a hot/cold bathing mode, and the hot/cold lamp 11 is lit. The hot/cold water controller 21 starts counting predetermined time after the ON-button 10a is pushed, and the output of the heater 13 is adjusted such that a temperature detected by the temperature sensor 31 becomes equal to the set temperature Tx until the predetermined time La which is first predetermined time is elapsed after the ON-button 10a is pushed.

Fig. 6 is a diagram showing variation in a detected temperature of the temperature sensor 31 at the time of the hot/cold bathing operation. If the predetermined time La is elapsed, the output of the heater 13 is adjusted such that the temperature detected by the temperature sensor 31 becomes equal to the set temperature Ty. After the output of the heater 13 is changed, the hot/cold water controller 21 starts counting the predetermined time Lb, and the output of the heater 13 is adjusted such that the temperature becomes equal to the set temperature Ty until the predetermined time Lb is elapsed. If the predetermined time Lb is elapsed, the output of the heater 13 is adjusted such that the temperature detected by the temperature sensor 31 becomes equal to the set temperature Tx, and the counting operation of the predetermined time La is started. Thereafter, the above operations are repeated.

Fig. 7 is a diagram of states of heart rates at the time of the continuous bathing in which the hot/cold switch 10 is turned OFF and at the time of hot/cold bathing in which the hot/cold switch 10 is turned ON. In an experiment shown in Fig. 7, shower bathing was carried out for 10 minutes, and heart rates during the shower bathing were measured. A line graph P shown in Fig. 7 shows variation in heart rates at the time of the continuous bathing (hot/cold switch 10 is OFF) and a line graph Q shows variation in heart rates at the time of the hot/cold bathing (hot/cold switch 10 is ON).

At the time of the continuous bathing, the temperature of shower was 38°C. At the time of the hot/cold bathing, a temperature of high temperature hot water of the shower was 38°C, a temperature of low temperature hot water was 25°C, and hot water of 38°C and hot water of 25°C were alternately spurted at intervals of 30 seconds. As a result, the average heart rates at the time of the continuous bathing were 92 bpm, and the average heart rates at the time of the hot/cold bathing were 80 bpm.

Fig. 8 is a diagram showing states of heart rates of the continuous bathing when the hot/cold switch 10 is OFF and of the hot/cold bathing when the hot/cold switch 10 is ON. Figs. 9(a) and (b) are diagrams showing average heart rates at the time of the continuous bathing and at the time of the hot/cold bathing mode. In experiments shown in Figs. 8 and 9, heart rates of healthy men when the hot/cold switch 10 was OFF and when the hot/cold switch 10 was ON were measured. More specifically, exercise was initially done for five minutes, and after one minute intermission, shower bathing was carried out for 10 minutes, and variation in heart rates during this series of actions was measured. In Fig. 8, a line graph X shows variation in heart rates at the time of the continuous bathing, and a line graph Y shows variation in heart rates at the time of the hot/cold bathing.

As shown in Figs. 8, 9(a) and (b), the average heart rates when the exercise was done both at the time of the continuous bathing and at the time of the hot/cold bathing were 140 bpm. The average heart rates at the time of the continuous bathing of shower bathing for 10 minutes after one minute intermission after the exercise were 115 bpm, but the average heart rates at the time of the hot/cold bathing mode were 98 bpm, and it is found that the heart rates are lowered as compared with the continuous bathing. Heart rates were measured under the condition that the temperature of hot water at the time of the continuous bathing was 38°C, the temperature of high temperature hot water at the time of the hot/cold bathing mode was 38°C, the temperature of low temperature hot water was 25°C, and the

predetermined time α was 30 seconds.

In this embodiment, energization of the heater 13 is turned ON and OFF every predetermined time, a user can take high temperature hot water and low temperature hot water alternately at regular intervals and this is extremely healthy. As shown in Figs. 7 to 9, the average heart rates can be lowered by taking the hot/cold bathing, a load on a user's heart can be reduced, and it is possible to take a comfortable shower bathing. Since the heart rates are low, this is effective for relieving fatigue.

In this embodiment, since the output of the heater 13 is switched every predetermined time L_a and predetermined time L_b , a user can take high temperature hot water and low temperature hot water alternately at regular intervals, and this is extremely healthy. Since the average heart rates can be lowered by taking the hot/cold bathing, a load on a user's heart can be reduced, and it is possible to take a comfortable shower bathing.

Further, since the output of the heater 13 is changed every predetermined time, it is possible to reduce power consumption. That is, the power consumption can be reduced by time during which the energization of the heater 13 is stopped.

Further, since the high temperature hot water spurting time L_a and the low temperature hot water spurting time L_b can be set in accordance with a user's preference, it is possible to enhance the usability.

Figs. 10 and 11 show alpha wave values at the time of the continuous bathing and at the time of the hot/cold bathing. Frequency of brain waves is analyzed, and the alpha waves are brain waves of frequency in a range of 8 to 13 Hz. Generally, when people feel comfortable, there is a tendency that more alpha waves appear.

As shown in Figs. 10 and 11, at the time of the continuous bathing, percentage of alpha waves content before taking a shower was 42.88%, but percentage of alpha waves content after taking the continuous bathing shower was 40.52%. At the time

of the hot/cold bathing, percentage of alpha waves content before taking a shower was 46.94%, but percentage of alpha waves content after taking the hot/cold bathing shower was 56.75%. It can be found that alpha waves are remarkably increased after the hot/cold bathing, and a user is relaxed.

According to the above-described hot/cold bathing operation, since a user alternately takes high temperature hot water and low temperature hot water, the user takes low temperature hot water even when his or her body is not sufficiently warmed, and heart rates are abruptly increased in some cases. Hence, in this embodiment, hot water of set temperature T_x is spurted for first predetermined time L_a' (e.g., three minutes) after the hot/cold bathing operation is started. There is a relation that predetermined time L_a is smaller than the first predetermined time L_a' .

Fig. 12 is a diagram showing variation in a detected temperature of a temperature sensor at the time of the hot/cold bathing operation. As shown in Fig. 12, if a user pushes the ON-button 10a and starts the hot/cold bathing operation, hot water is spurted such that the temperature of the hot water becomes equal to the set temperature T_x for the initial first predetermined time L_a' . During that time, user's body is warmed, and if the first predetermined time L_a' is elapsed, the output of the heater 13 is changed such that the temperature of the hot water becomes equal to the set temperature T_y of the low temperature hot water, and low temperature hot water is spurted.

Thereafter, if the predetermined time L_b which was set by the operating section 52 is elapsed, the output of the heater 13 is again changed such that a temperature detected by the temperature sensor 31 becomes equal to the set temperature T_x , the set temperature T_x is maintained for the predetermined time L_a , and the same operation is repeated thereafter. That is, in the embodiment, after the body is warmed by the continuous bathing for the first predetermined time L_a' , the hot/cold bathing operation is started to enhance the relaxing effect.

Fig. 13 is a diagram showing variation in heart rates when

hot/cold bathing is carried out straight away without carrying out the continuous bathing. Fig. 14 is a diagram showing variation in heart rates when the hot/cold bathing is carried out after the continuous bathing is carried out. When the hot/cold bathing was carried out straight away without carrying out the continuous bathing as shown in Fig. 13, the heart rates are abruptly varied immediately after the hot/cold bathing was started, and the heart rates were increased to 104.0 bpm. As a result of hot/cold bathing for 10 minutes, the average heart rates became 77.6 bpm.

As shown in Fig. 14, after the continuous bathing was carried out for three minutes, the hot/cold bathing was carried out for 10 minutes. As a result, the heart rates were increased and a peak value was 89.0 bpm immediately after the continuous bathing was changed to the hot/cold bathing, but in the first continuous bathing, the average heart rates were 78.3 bpm, and the average heart rates after the hot/cold bathing was started were 76.0 bpm.

As can be found from Figs. 13 and 14, if the continuous bathing is carried out to warm a body and then the hot/cold bathing is started, it is possible to suppress the abrupt variation in heart rates, and a load on a heart can be reduced.

Although the set temperature T_y of low temperature hot water can be set in the embodiment, the present invention is not limited to this, and the output of the heater 13 may be zero and the set temperature of the low temperature hot water may be water temperature before it is heated.

(Second Embodiment)

In the second embodiment, the water supply pipe 15 includes a temperature sensor 32 which is water temperature detecting means for detecting a water temperature, and the water temperature can be detected. The same elements as those of the first embodiment are designated with the same symbols, and explanation thereof will be omitted. Fig. 15 is a block diagram of the hot water supply apparatus according to the second embodiment.

In the first embodiment, the continuous bathing operation is carried out for a present first predetermined time La' (e.g., three minutes) when the hot/cold bathing operation is started, and after the first predetermined time La' is elapsed, the hot/cold bathing operation is started. In the second embodiment, a length of the first predetermined time La' can be changed based on the water temperature. This is because that when the water temperature is low in winter season, it is possible to suppress variation in heart rates if the hot/cold bathing is carried out after a body is sufficiently warmed.

That is, in this embodiment, when the water temperature detected by the temperature sensor 32 is higher than a predetermined temperature T_i (e.g., 30°C), preset time is used as the first predetermined time La' , and when the water temperature detected by the temperature sensor 32 is lower than the predetermined temperature T_i , the first predetermined time La' is extended, and the time of the continuous bathing operation is extended. The extended time width of the first predetermined time La' when the water temperature is lower than the predetermined temperature T_i may be uniformly determined, or a function of the water temperature and the extended time width may be preset and the first predetermined time La' may be extended by the extended time width corresponding to the water temperature.

(Third Embodiment)

In the third embodiment, a temperature sensor 33 which is outside air temperature detecting means for detecting an outside air temperature is provided in the case 1, and the outside air temperature can be detected. The same elements as those of the first and second embodiments are designated with the same symbols, and explanation thereof will be omitted. Fig. 16 is a block diagram of the hot water supply apparatus according to the third embodiment.

In the first embodiment, when the hot/cold bathing operation is to be started, the continuous bathing operation is carried out for the preset first predetermined time La' (e.g.,

three minutes), and after the first predetermined time La' is elapsed, the hot/cold bathing operation is started. In the third embodiment, the length of the first predetermined time La' can be changed based on the outside air temperature. This is because that when the outside air temperature is low in winter season, it is possible to suppress variation in heart rates if the hot/cold bathing is carried out after a body is sufficiently warmed.

That is, in the third embodiment, when the outside air temperature detected by the temperature sensor 33 is higher than a predetermined temperature Tg (e.g., 25°C), preset time is used as the first predetermined time La', and when the outside air temperature detected by the temperature sensor 33 is lower than the predetermined temperature Tg, the first predetermined time La' is extended, and the time of the continuous bathing operation is extended. The extended time width of the first predetermined time La' when the outside air temperature is lower than the predetermined temperature Tg may be uniformly determined, or a function of the outside air temperature and the extended time width may be preset and the first predetermined time La' may be extended by the extended time width corresponding to the outside air temperature.

(Fourth Embodiment)

Fig. 17 is a diagram of an outward appearance of an essential portion of the hot water supply apparatus according to the fourth embodiment. As shown in Fig. 17, a physical condition setting screen which is physical condition setting means is displayed on the display section 51 by operating the operating section 52. On the physical condition setting screen, a user can input a physical condition of that day. In this embodiment, the user can select from three kinds of options ("GOOD", "MID" AND "BAD"), and the physical condition is worse in this order.

The first predetermined time La' can be changed in accordance with a physical condition which was input by the user, and the continuous bathing time can be changed in accordance

with the physical condition of that day. As a result, it is possible to avoid such a case that a physical condition is not good and the user takes cold water before his or her body is sufficiently warmed, and heart rates are abruptly changed or the user feels bad.

If the user selects "GOOD", the preset time is used as the first predetermined time La' as it is, and the preset time is not extended. If the user selects "MID", the first predetermined time La' is extended little, and the continuous bathing operation is carried out. If the user selects "BAD", the first predetermined time La' is further extended and the continuous bathing operation is carried out. The worse the physical condition is, the longer the time of the continuous bathing is extended. According to this configuration, it is possible to suppress the abrupt variation in heart rates when the physical condition is not good.

(Fifth Embodiment)

According to the fifth embodiment, when set temperature T_x of high temperature hot water is changed to set temperature T_y of low temperature hot water at the time of the hot/cold bathing operation, hot water of medium set temperature T_z which is provided between the set temperature T_x and the set temperature T_y is first spurted for second predetermined time L_c and then, the temperature is changed toward the set temperature T_y . When the temperature is changed from the high temperature hot water to low temperature hot water, the temperature is not changed abruptly, and the hot water of medium temperature is spurted. According to this configuration, a load on a heart can further be reduced.

Fig. 18 is a diagram showing variation of a hot water temperature detected by a temperature sensor in the fifth embodiment. As shown in Fig. 18, if the hot/cold bathing operation is started, hot water having the set temperature T_x of high temperature hot water is spurted for the first predetermined time La' . After the first predetermined time La' is elapsed, the output of the heater 13 is adjusted such that

a temperature detected by the temperature sensor 31 becomes equal to the set temperature T_z between the set temperature T_x and the set temperature T_y . That is, if the temperature detected by the temperature sensor 31 is changed from the set temperature T_x to the set temperature T_z , the output of the heater 13 is fixed such that the temperature becomes equal to the set temperature T_z only for the second predetermined time L_c . Although the set temperature T_z is set to $(\text{set temperature } T_z + \text{set temperature } T_y) / 2$ in this embodiment, the calculation method of the set temperature T_z is not limited to this.

If the second predetermined time L_c is elapsed, the output of the heater 13 is adjusted such that the temperature detected by the temperature sensor 31 becomes equal to the set temperature T_y .

While the set temperature T_x of high temperature hot water is changed to the set temperature T_y of low temperature hot water, the temperature is once changed to the medium set temperature T_z only for the second predetermined time L_c and then, the temperature is changed to the set temperature T_y . According to this configuration, the user's body can gradually get used to the low temperature hot water, a load on a heart can be reduced, and it is possible to reduce the abrupt variation in heart rates. [Industrial Applicability]

As described above, according to the hot water supply apparatus of the present invention, when a user takes a shower bathing, two kinds of hot water having different temperatures are alternately spurted in addition to a normal shower bathing, and this can reduce a load on a heart and fatigue is relieved and a health is improved. Since the power consumption can be reduced as compared with a normal shower bathing, this hot water supply apparatus is very ecologically friendly. Although the hot water supply apparatus using the heater as the heat source are explained in the embodiments, the present invention can also be applied even if the heat source is a heat pump or a gas heat source.

CLAIMS

1. A hot water supply apparatus comprising a heat source which heats water, temperature detecting means which detects a temperature of hot water heated by the heat source, a temperature operating section which adjusts a temperature of hot water spurted from the heat source, a discharging portion through which hot water heated by the heat source is discharged, and a hot/cold switch which starts an operation action for alternately spurting two kinds of hot water having different temperatures, wherein when the hot/cold switch is operated to start a hot/cold bathing operation, for first predetermined time, output of the heat source is adjusted such that a temperature detected by the temperature detecting means becomes equal to a temperature which is set by the temperature operating section and hot water is spurted from the discharging portion, and after the first predetermined time is elapsed, the two kinds of hot water having the different temperatures are alternately spurted.

2. The hot water supply apparatus according to claim 1, further comprising water temperature detecting means which detects water temperature before it is heated by the heat source, wherein a length of the first predetermined time is changed in accordance with a water temperature detected by the water temperature detecting means.

2. The hot water supply apparatus according to claim 1, further comprising outside air temperature detecting means which detects an outside air temperature, wherein a length of the first predetermined time is changed in accordance with the outside air temperature detected by the outside air temperature detecting means.

4. The hot water supply apparatus according to claim 1, further comprising physical condition setting means for setting

a physical condition of a user, wherein a length of the first predetermined time is changed in accordance with the physical condition which was input through the physical condition setting means.

5. The hot water supply apparatus according to any one of claims 1 to 4, wherein at the time of the hot/cold bathing operation, when high temperature hot water is changed to low temperature hot water, hot water of medium temperature provided between the high temperature hot water and the low temperature hot water is spurted for second predetermined time and then, the low temperature hot water is spurted.