

[NAME OF DOCUMENT] SPECIFICATION  
[TITLE OF THE INVENTION] ELECTRIC INSTANTANEOUS WATER  
HEATER

[TECHNICAL FIELD]  
[0001]

The present invention relates to an electric instantaneous water heater which is especially used for shower.

[BACKGROUND TECHNIQUE]  
[0002]

There is conventionally proposed an electric instantaneous water heater which is especially suitable for shower (patent document 1 for example). The electric instantaneous water heater according to patent document 1 includes a chassis configuring an outline, a tank placed in the chassis, a heater placed in the tank, a water supply pipe for supplying water to the tank, and a hot water supply pipe for serving hot water from the tank.

[PRIOR ART DOCUMENT]  
[PATENT DOCUMENT]  
[0003]

[Patent Document 1] Japanese Patent Application Laid-open No.2012-172947

[SUMMARY OF THE INVENTION]  
[PROBLEM TO BE SOLVED BY THE INVENTION]  
[0004]

The tank according to patent document 1 is laterally long, and the electric instantaneous water heater is longer in its height direction than its width direction. It is difficult in some cases to install such a conventional electric instantaneous water heater at a place, such as a lower space of a sink, where a space in the height direction is limited.

[0005]

Hence, it is an object of the present invention to provide an electric instantaneous water heater which can reduce a height of its chassis.

[MEANS FOR SOLVING THE PROBLEM]  
[0006]

In the invention according to claim 1, there is provided an electric instantaneous water heater including:

a chassis 10 configuring an outline; a tank 20 placed in the chassis 10; a heater 30 placed in the tank 20; a water supply pipe 40 for supplying water to the tank 20; and a hot water supply pipe 50 for deriving hot water from

the tank 20, in which the tank 20 is formed of a cylindrical torso 21 and a pair of end surfaces 22 and 23 which close both ends of the cylindrical torso 21, wherein a longitudinal direction length 21L of the cylindrical torso 21 is set longer than diameters 22D of the end surfaces 22 and 23, the cylindrical torso 21 is placed such that its longitudinal direction is equal to a width direction of the chassis 10, and a width direction length of the chassis 10 is set longer than a height direction length of the chassis 10.

According to the invention of claim 2, in the electric instantaneous water heater of claim 1, a tank water supply connection port 41 of the water supply pipe 40 is connected to the one end surface 22, a tank hot water supply connection port 51 of the hot water supply pipe 50 is connected to an upper portion of the cylindrical torso 21 on a side of the other end surface 23, and at least a portion of the hot water supply pipe 50 is placed at a position higher than a virtual tank center line 20C of the cylindrical torso 21 and lateral to the cylindrical torso 21.

According to the invention of claim 3, in the electric instantaneous water heater of claim 2, coil heaters 30A and 30B are used as the heater 30, a virtual coil center line 30C of the coil heaters 30A and 30B is parallel to the virtual tank center line 20C, and the heater 30 is placed in the tank 20 such that the virtual coil center line 30C of the coil heaters 30A and 30B is located lower than the virtual tank center line 20C.

According to the invention of claim 4, in the electric instantaneous water heater of claim 2 or 3, the tank water supply connection port 41 is located lower than the virtual tank center line 20C.

According to the invention of claim 5, in the electric instantaneous water heater of claim 3, the tank water supply connection port 41 is located at a position which does not coincide with the virtual coil center line.

According to the invention of claim 6, in the electric instantaneous water heater of claim 3, the tank water supply connection port 41 is located lower than the virtual coil center line.

According to the invention of claim 7, in the electric instantaneous water heater according to any one of claims 1 to 6, an electrical substrate 60 on which an

electronic component is mounted is placed on a lower surface of a resin cover 70, and the resin cover 70 is placed below the tank 20 such that a predetermined space is secured from the tank 20.

According to the invention of claim 8, in the electric instantaneous water heater of claim 7, the resin cover 70 is placed such that it inclines from a horizontal plane.

According to the invention of claim 9, in the electric instantaneous water heater of claim 7 or 8, an upward wall standing up from the resin cover 70 is provided around the resin cover 70, and a dew condensation water discharging section is formed in the upward wall or the resin cover 70.

According to the invention of claim 10, in the electric instantaneous water heater according to any one of claims 7 to 9, a downward wall which is suspended from the resin cover 70 is provided around the resin cover 70.

[EFFECT OF THE INVENTION]

[0007]

According to the present invention, by laterally placing the cylindrical tank such that the longitudinal direction of the tank is directed to the width direction of the chassis, the height of the chassis can be lowered, and the water heater is easily placed in a lower space of a sink for example.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0008]

Fig. 1 is a partially sectional front view showing an interior of a chassis of an electric instantaneous water heater according to an embodiment of the present invention; and

Figs. 2 are configuration diagrams of essential portions of the electric instantaneous water heater.

[MODE FOR CARRYING OUT THE INVENTION]

[0009]

In the electric instantaneous water heater according to the first embodiment of the present invention, a longitudinal direction length of the cylindrical torso is set longer than diameters of the end surfaces, the cylindrical torso is placed such that its longitudinal direction is equal to a width direction of the chassis, and a width direction length of the chassis is set longer than a height direction length of the chassis. According to

first embodiment, by laterally placing the cylindrical tank such that the longitudinal direction of the tank is directed to the width direction of the chassis, the height of the chassis can be lowered, and the water heater is easily placed in a lower space of a sink for example.

[0010]

According to the second embodiment of the invention, in the electric instantaneous water heater of the first embodiment, a tank water supply connection port of the water supply pipe is connected to the one end surface, a tank hot water supply connection port of the hot water supply pipe is connected to an upper portion of the cylindrical torso on a side of the other end surface, and at least a portion of the hot water supply pipe is placed at a position higher than a virtual tank center line of the cylindrical torso and lateral to the cylindrical torso. According to the second embodiment, flow speed of water which is introduced from the water supply pipe into the tank becomes slow, flow of the water is disturbed by the heaters, the water is heated while the water flows from one end surface toward the other end surface, and the water reliably becomes hot water in the vicinity of a the tank hot water supply connection port. If the hot water supply pipe is overlapped with the tank, a width direction of the chassis can be made short.

[0011]

According to the third embodiment of the invention, in the electric instantaneous water heater of the second embodiment, coil heaters are used as the heater, a virtual coil center line of the coil heaters is parallel to the virtual tank center line, and the heater is placed in the tank such that the virtual coil center line of the coil heaters is located lower than the virtual tank center line. According to the third embodiment, it is easy to heat water in a lower portion in the tank, hot water which is further heated by the heaters is introduced into an upper portion in the tank, and the water reliably becomes hot water in the vicinity of the tank hot water supply connection port.

[0012]

According to the fourth embodiment of the invention, in the electric instantaneous water heater of the second or third embodiment, the tank water supply connection port is located lower than the virtual tank center line. According to the fourth embodiment, it is possible to prevent water

which flows in from the tank water supply connection port from being mixed with hot water existing in the upper portion in the tank.

[0013]

According to the fifth embodiment of the invention, in the electric instantaneous water heater of the third embodiment, the tank water supply connection port is located at a position which does not coincide with the virtual coil center line. According to the fifth embodiment, flow of water which flows in from the tank water supply connection port can be disturbed, and it becomes easy to heat water.

[0014]

According to the sixth embodiment of the invention, in the electric instantaneous water heater of the third embodiment, the tank water supply connection port is located lower than the virtual coil center line. According to the sixth embodiment, since it is easy to introduced hot water heated by the heaters to the upper portion in the tank, the water reliably becomes hot water in the vicinity of the tank hot water supply connection port.

[0015]

According to the seventh embodiment of the invention, in the electric instantaneous water heater of any one of the first to sixth embodiments, an electrical substrate on which an electronic component is mounted is placed on a lower surface of a resin cover, and the resin cover is placed below the tank such that a predetermined space is secured from the tank. According to the seventh embodiment, influence of heat from the tank is not easily exerted on the electronic components, and it is possible to protect the electronic components from dew condensation water which drops from the tank.

[0016]

According to the eighth embodiment of the invention, in the electric instantaneous water heater of the seventh embodiment, the resin cover is placed such that it inclines from a horizontal plane. According to the eighth embodiment, by flowing dew condensation water which drops on the resin cover along this inclination, it is possible to protect the electronic components from the dew condensation water.

[0017]

According to the ninth embodiment of the invention, in the electric instantaneous water heater of the seventh or eighth embodiment, an upward wall standing up from the resin cover is provided around the resin cover, and a dew condensation water discharging section is formed in the upward wall or the resin cover. According to the ninth embodiment, it is possible to prevent dew condensation water which drops on the resin cover from reaching the electronic components by the upward wall, and it is possible to reliably discharge the dew condensation water from the dew condensation water discharging section.  
[0018]

According to the tenth embodiment of the invention, in the electric instantaneous water heater of any one of the seventh to ninth embodiments, a downward wall which is suspended from the resin cover is provided around the resin cover. According to the tenth embodiment, since dew condensation water which drops on the resin cover drops along the downward wall, the dew condensation water does not flow toward the electrical substrate.  
[Embodiment]  
[0019]

An embodiment of the present invention will be described below with reference to the drawings.

Fig. 1 is a partially sectional front view showing an interior of a chassis of an electric instantaneous water heater according to the embodiment. Fig. 1 shows a state where a front surface cover of the chassis is detached, and shows placement of component members in the chassis.

The electric instantaneous water heater of the embodiment includes the chassis 10 configuring an outline, a tank 20 placed in the chassis 10, heaters 30 placed in the tank 20, a water supply pipe 40 for supplying water to the tank 20, a hot water supply pipe 50 for deriving hot water from the tank 20, and resin cover 70 where an electrical substrate 60 is placed. Electronic components 61 are attached to the electrical substrate 60.

The tank 20 is formed of a cylindrical torso 21 and a pair of end surfaces 22 and 23 which close both ends of the cylindrical torso 21. A longitudinal direction length 21L of the cylindrical torso 21 is set longer than diameters 22D of the end surfaces 22 and 23, and a longitudinal direction of the cylindrical torso 21 is directed to a width direction of the chassis 10.

[0020]

The chassis 10 is formed of a wall surface-mounting plate 11 on which the tank 20 and the resin cover 70 are mounted, one side plate 12 located on the side of one end surface 22 of the tank 20, the other side plate 13 located on the side of the other end surface 23 of the tank 20, a top plate 14 located above the tank 20, a bottom plate 15 located below the tank 20, and a front surface plate (not shown) which is opposed to the wall surface-mounting plate 11 for covering the entire surface thereof.

A width direction length of the chassis 10, i.e., lengths of the top plate 14 and the bottom plate 15 are set longer than a height direction length of the chassis 10, i.e., lengths of the side plates 12 and 13.

By placing the tank 20 such that a longitudinal direction of the cylindrical tank 20 is directed to a width direction of the chassis 10, a height of the chassis 10 can be made low, and it is easy to place the water heater in a lower space of a sink for example.

[0021]

Electric power is supplied to the heaters 30 through an electric power control element 31. The electric power control element 31 controls electric power which is supplied to the heaters 30. An electric power supply line for supplying electric power to the heaters 30 is provided with an earth leakage breaker 32.

[0022]

The water supply pipe 40 connects a tank water supply connection port 41 to the one end surface 22 of the tank 20. The water supply pipe 40 is provided with a flow rate sensor unit 42 and a filter 43. The water supply pipe 40 is connected to a water supply port 44.

The flow rate sensor unit 42 detects an amount of water which is supplied to the water supply pipe 40. The filter 43 removes dirt or garbage included in water supplied to the water supply pipe 40. The water supply port 44 is connected to a water source.

Water supplied from the water supply port 44 passes through the filter 43 and the flow rate sensor unit 42, and the water flows from the tank water supply connection port 41 into the tank 20.

[0023]

A tank hot water supply connection port 51 of the hot water supply pipe 50 is connected to an upper portion of

the cylindrical torso 21 of the tank 20 on the side of the other end surface 23. The hot water supply pipe 50 is provided with thermostats 52, 53 and 54 and a temperature sensor 55. The hot water supply pipe 50 is connected to a hot water supply port 56.

The thermostats 52 and 53 are safety devices for preventing no-water heating of the tank 20. The thermostat 54 is a safety device to preventing hot water temperature from exceeding an upper limit. The temperature sensor 55 detects temperature of hot water derived from the hot water supply pipe 50. A user can set the set temperature by operating an operating section 81, and the hot water temperature control section controls the electric power control element 31 such that temperature detected by the temperature sensor 55 becomes equal to the set temperature. Portions of the electronic components 61 configure the hot water temperature control section.

[0024]

According to the embodiment, the tank water supply connection port 41 of the water supply pipe 40 is connected to the one end surface 22 of the tank 20, and the tank hot water supply connection port 51 of the hot water supply pipe 50 is connected to the upper portion of the cylindrical torso 21 on the side of the other end surface 23. According to this, flow speed of water which is introduced from the water supply pipe 40 into the tank 20 is lowered, flow of the water is disturbed by the heaters 30, the water is heated while the water flows from the one end surface 22 toward the other end surface 23, and the water reliably becomes hot water in the vicinity of the tank hot water supply connection port 51.

[0025]

The electrical substrate 60 is placed on lower surface of the resin cover 70. The resin cover 70 is placed such that predetermined spaces are secured from the tank 20. Therefore, influence of heat from the tank 20 is less prone to be exerted on the electronic components 61, and it is possible to protect the electronic components 61 from dew condensation water which drops from the tank 20.

The resin cover 70 inclines from a horizontal plane by  $\theta$ . Here, the horizontal plane is surfaces of the top plate 14 and the bottom plate 15. Therefore, dew condensation water which drops onto the resin cover 70

flows along this inclination, and the electronic components 61 can be protected from the dew condensation water.

Downward walls which are suspended from the resin cover 70 are provided around the resin cover 70. Here, the downward walls extend lower than the electrical substrate 60. Therefore, since dew condensation water which drops onto the resin cover 70 drops along the downward wall, the dew condensation water does not flow toward the electrical substrate 60.

Upward walls standing up from the resin cover 70 are provided around the resin cover 70, and dew condensation water discharging sections are formed in the upward walls or the resin cover 70. According to this, it is possible to prevent dew condensation water which drops onto the resin cover 70 from reaching the electronic components 61 by the upward wall, and it is possible to reliably discharge dew condensation water from the dew condensation water discharging section.

[0026]

Figs. 2 are configuration diagrams of essential portions of the electric instantaneous water heater. Fig. 2(a) is a front view and Fig. 2(b) is a right side view.

A partial hot water supply pipe 50X of the hot water supply pipe 50 is placed higher than a virtual tank center line 20C of the cylindrical torso 21, and a partial hot water supply pipe 50Y of the hot water supply pipe 50 is placed lateral to the cylindrical torso 21. By overlapping the hot water supply pipes 50X and 50Y with the tank 20 in this manner, a width direction length of the chassis 10 can be made short.

Coil heaters are used as the heaters 30. In this embodiment, two coil heaters 30A and 30B are used. Diameters of coil portions of the two coil heaters 30A and 30B are the same, and the coil portion of the coil heater 30B is annexed to an end of the coil portion of the coil heater 30A.

The heaters 30 are placed in the tank 20 such that a virtual coil center line 30C of the coil heaters 30A and 30B is set parallel to the virtual tank center line 20C and the virtual coil center line 30C of the coil heaters 30A and 30B is located lower than the virtual tank center line 20C.

By placing the heaters 30 in the tank 20 such that the virtual coil center line 30C of the coil heaters 30A

and 30B is located lower than the virtual tank center line 20C in this manner, it becomes easy to heat water existing at a lower position in the tank 20, and it is easy to introduce the hot water heated by the heaters 30 to an upper position in the tank 20. Therefore, water reliably becomes hot water in the vicinity of the tank hot water supply connection port 51.

[0027]

The tank water supply connection port 41 is located lower than the virtual tank center line 20C. By locating the tank water supply connection port 41 lower than the virtual tank center line 20C in this manner, it is possible to prevent water which flows from the tank water supply connection port 41 from being mixed with hot water existing at an upper position in the tank 20.

The tank water supply connection port 41 is located at a position which does not coincide with the virtual coil center line 30C. By locating the tank water supply connection port 41 at the position which does not coincide with the virtual coil center line 30C in this manner, it is possible to disturb flow of water which flows in from the tank water supply connection port 41, and it becomes easy to heat water.

The tank water supply connection port 41 is located lower than the virtual coil center line 30C. By locating the tank water supply connection port 41 lower than the virtual coil center line 30C in this manner, it becomes easy to introduce hot water heated by the heaters 30 to an upper position in the tank 20. Therefore, water reliably becomes hot water in the vicinity of the tank hot water supply connection port 51.

[INDUSTRIAL APPLICABILITY]

[0028]

According to the present invention, it is possible to downsize the electric instantaneous water heater, and it becomes easy to install the electric instantaneous water heater in a lower space of a sink.

[EXPLANATION OF SYMBOLS]

[0029]

- |    |                             |
|----|-----------------------------|
| 10 | chassis                     |
| 11 | wall surface-mounting plate |
| 12 | one side plate              |
| 13 | other side plate            |
| 14 | top plate                   |

|            |                                       |
|------------|---------------------------------------|
| 15         | bottom plate                          |
| 20         | tank                                  |
| 20C        | virtual tank center line              |
| 21         | cylindrical torso                     |
| 21L        | longitudinal direction length         |
| 22, 23     | end surface                           |
| 22D        | diameter                              |
| 30         | heater                                |
| 30A, 30B   | coil heater                           |
| 30C        | virtual coil center line              |
| 31         | electric power control element        |
| 32         | earth leakage breaker                 |
| 40         | water supply pipe                     |
| 41         | tank water supply connection port     |
| 42         | flow rate sensor unit                 |
| 43         | filter                                |
| 44         | water supply port                     |
| 50         | hot water supply pipe                 |
| 50X, 50Y   | partial hot water supply pipe         |
| 51         | tank hot water supply connection port |
| 52, 53, 54 | thermostat                            |
| 55         | temperature sensor                    |
| 56         | hot water supply port                 |
| 60         | electrical substrate                  |
| 61         | electronic component                  |
| 70         | resin cover                           |
| 81         | operating section                     |

[NAME OF DOCUMENT]

CLAIMS

[Claim 1]

An electric instantaneous water heater comprising:  
a chassis configuring an outline;  
a tank placed in the chassis;  
a heater placed in the tank;  
a water supply pipe for supplying water to the tank;

and

a hot water supply pipe for deriving hot water from the tank, in which

the tank is formed of a cylindrical torso and a pair of end surfaces which close both ends of the cylindrical torso, wherein

a longitudinal direction length of the cylindrical torso is set longer than diameters of the end surfaces,  
the cylindrical torso is placed such that its longitudinal direction is equal to a width direction of the chassis, and

a width direction length of the chassis is set longer than a height direction length of the chassis.

[Claim 2]

The electric instantaneous water heater according to claim 1, wherein

a tank water supply connection port of the water supply pipe is connected to the one end surface,

a tank hot water supply connection port of the hot water supply pipe is connected to an upper portion of the cylindrical torso on a side of the other end surface, and

at least a portion of the hot water supply pipe is placed at a position higher than a virtual tank center line of the cylindrical torso and lateral to the cylindrical torso.

[Claim 3]

The electric instantaneous water heater according to claim 2, wherein

coil heaters are used as the heater,

a virtual coil center line of the coil heaters is parallel to the virtual tank center line, and

the heater is placed in the tank such that the virtual coil center line of the coil heaters is located lower than the virtual tank center line.

[Claim 4]

The electric instantaneous water heater according to claim 2 or 3, wherein

the tank water supply connection port is located lower than the virtual tank center line.

[Claim 5]

The electric instantaneous water heater according to claim 3, wherein

the tank water supply connection port is located at a position which does not coincide with the virtual coil center line.

[Claim 6]

The electric instantaneous water heater according to claim 3, wherein

the tank water supply connection port is located lower than the virtual coil center line.

[Claim 7]

The electric instantaneous water heater according to any one of claims 1 to 6, wherein

an electrical substrate on which an electronic component is mounted is placed on a lower surface of a resin cover, and

the resin cover is placed below the tank such that a predetermined space is secured from the tank.

[Claim 8]

The electric instantaneous water heater according to claim 7, wherein

the resin cover is placed such that it inclines from a horizontal plane.

[Claim 9]

The electric instantaneous water heater according to claim 7 or 8, wherein

an upward wall standing up from the resin cover is provided around the resin cover, and

a dew condensation water discharging section is formed in the upward wall or the resin cover.

[Claim 10]

The electric instantaneous water heater according to any one of claims 7 to 9, wherein

a downward wall which is suspended from the resin cover is provided around the resin cover.