ELECTRIC TANKLESS WATER HEATER AND CONTROL METHOD FOR ELECTRIC TANKLESS WATER HEATER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application is filed based on and claims priority to Chinese Patent Application No. 202111495278.7 filed on December 08, 2021, the entire contents of which are incorporated herein by reference.

FIELD

[0002] The present disclosure relates to the field of household electrical appliances technologies, and more particularly, to an electric tankless water heater and a control method for an electric tankless water heater.

BACKGROUND

[0003] In the related art, micro-nano bubble water refers to water in which a large number of tiny bubbles with a diameter of 0.1μm to 50 μm is dissolved. The micro-nano bubble water is now more widely used in industrial water treatment and water pollution treatment, and is also gradually applied in daily life and beauty products.

[0004] Currently, generated micro-nano bubble water is applied in an electric tankless water heater. However, the generated micro-nano bubble water has unstable quality. As a water pressure of the electric tankless water heater is unstable, the stable water pressure cannot be ensured. As a result, the hot water is not instant.

[0005] The quality of the micro-nano bubble water output through a water outlet when the electric tankless water heater is just turned on is be lower than the quality of the micro-nano bubble water output from the water outlet when the electric tankless water heater steadily operates.

SUMMARY

[0006] The present disclosure aims to solve at least one of the technical problems in the related art. To this end, embodiments of the present disclosure provide an electric tankless water heater with a simple and compact overall structure, fast heating speed, which can provide a stable water pressure while ensuring an immediate and stable supply of hot water.

[0007] The present disclosure further provides a control method for an electric tankless water heater.

[0008] An electric tankless water heater according to a first aspect of the present disclosure includes a dissolved air vessel having a dissolved air chamber, an air pump in communication with the air inlet, a water pump, and a heating device. The dissolved air vessel has an air inlet, a water inlet, and a bubble water outlet that are in communication with the dissolved air chamber. The water pump has an outlet connected to the water inlet and an inlet connected to a water inlet pipe of the electric tankless water heater. The heating device includes a heat exchanger pipe and a heating element. The heat exchanger pipe has an inlet end in communication with the bubble water outlet and an outlet end in communication with a water outlet pipe of the electric tankless water heater, and the heating element is adjacent to the heat exchanger pipe and configured to heat the heat exchanger pipe.

[0009] According to the electric tankless water heater of the present disclosure, by arranging the air pump at the air inlet of the dissolved air vessel, quality and production efficiency of micro-nano bubble water can be improved. In addition, by arranging the water pump at the water inlet of the dissolved air vessel, a water inflow pressure can be ensured. Therefore, the electric tankless water heater has a simple and compact overall structure, a fast heating speed, and can provide stable water pressure while ensuring an instant and stable supply of hot water.

[0010] According to an example of the present disclosure, the electric tankless water heater further includes a housing having an accommodation chamber. Each of the dissolved air vessel, the heating device, the water pump, and the air pump are disposed in the accommodation chamber. The water pump is arranged at a lower side of the dissolved air vessel. The heating device and the dissolved air vessel are horizontally arranged in parallel to each other. The air

pump is arranged at a side of the dissolved air vessel facing away from the heating device.

[0011] According to an example of the present disclosure, an upper end of the water inlet pipe extends into the accommodation chamber through a bottom of the housing, and a lower end of the outlet pipe extends out of the accommodation chamber from the bottom of the housing.

[0012] According to an example of the present disclosure, the electric tankless water heater further includes a power supply board disposed in the accommodation chamber and located above the dissolved air vessel and the heating device, and/or a display panel disposed on a front side of the housing.

[0013] According to an example of the present disclosure, a top of the air pump is lower than a top of the dissolved air vessel.

[0014] According to an example of the present disclosure, the dissolved air vessel is vertically arranged and includes a tank body and a water flowing pipe. A lower end of the water flowing pipe is connected to the outlet of the water pump. An upper end of the water flowing pipe extends into the tank body through a bottom of the tank body and extends upwards until the upper end is adjacent to a top of the tank body. A water outlet end of the water flowing pipe is formed as the water inlet of the dissolved air vessel.

[0015] According to an example of the present disclosure, the tank body includes a tubular body extending in an up-down direction and having an open top, and a top cover covering the top of the tubular body. An outlet end of an air inlet pipe communicating with the air pump extends into the dissolved air vessel through the top cover and is fixed on the top cover.

[0016] According to an example of the present disclosure, the water outlet end of the water flowing pipe is opposite to the outlet end of the air inlet pipe in the up-down direction.

[0017] According to an example of the present disclosure, the top cover is provided with a plurality of reinforcement structures protruding upwardly or downwardly.

[0018] According to an example of the present disclosure, the bubble water outlet is formed at a lower part or a bottom of the dissolved air vessel.

[0019] According to an example of the present disclosure, a check valve is disposed between the air pump and the air inlet.

[0020] According to an example of the present disclosure, the electric tankless water heater

further includes a solenoid valve disposed between the water inlet pipe and the inlet of the water pump.

[0021] According to an example of the present disclosure, the water pump is a booster water pump.

[0022] According to an example of the present disclosure, the heating element is arranged around the heat exchanger pipe and extends spirally in an axis direction of the heat exchanger pipe.

[0023] According to an example of the present disclosure, the water outlet pipe is provided with a flow sensor and/or a temperature sensor, and both the flow sensor and the temperature sensor are in communication with the heating element.

[0024] According to an example of the present disclosure, the electric tankless water heater further includes a micro-nano bubble generator communicating with the water outlet pipe.

[0025] A control method for an electric tankless water heater according to a second aspect of the present disclosure is provided. The electric tankless water heater is the electric tankless water heater according to the first aspect of the present disclosure. The electric tankless water heater further includes a solenoid valve disposed upstream of the water pump in a water flow direction. The control method includes: step S1 of detecting whether a water flow signal is present at the outlet end of the heat exchanger pipe; step S2 of opening, based on a determination that a water flow signal exists at the outlet end of the heat exchanger pipe, the solenoid valve to inject water into the dissolved air vessel for a first predetermined time period, and closing the solenoid valve after the first predetermined time period; and step S3 of switching on the air pump to supply air into the dissolved air vessel for a second predetermined time period, and after the second predetermined time period, switching off the air pump and opening the solenoid valve.

[0026] In the control method for the electric tankless water heater, every time the electric tankless water heater is started, water in the dissolved air vessel is fully mixed with injected gas to generate stable micro-nano bubble water.

[0027] According to an example of the present disclosure, the first predetermined time period ranges from 50 seconds to 90 seconds, and the second predetermined time period ranges from 1 second to 5 seconds.

[0028] According to an example of the present disclosure the water pump of the electric tankless water heater is a booster water pump. The booster water pump is configured to be switched on when there is a water flow signal at the outlet end of the heat exchanger pipe, the solenoid valve is opened, and the air pump is switched off.

[0029] According to an example of the present disclosure, the control method further includes step S4 of determining whether the dissolved air vessel satisfies a predetermined air supply condition, and switching on the air pump in response to the predetermined air supply condition being satisfied, and switching off the air pump when an air pressure in the dissolved air vessel reaches a predetermined pressure or air has been supplied by the air pump for a predetermined time period.

[0030] According to an example of the present disclosure, the control method further includes: switching off the heating device in a third predetermined time period prior to switching on the air pump; and switching on the heating device again when the air pump is switched on.

[0031] According to an example of the present disclosure, the third predetermined time period ranges from 2 seconds to 10 seconds.

[0032] Additional aspects and advantages of the present disclosure will be given at least in part in the following description, or become apparent at least in part from the following description, or can be learned from practicing of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] FIG. 1 is a schematic view of an electric tankless water heater according to an embodiment of the present disclosure.

[0034] FIG. 2 is a schematic view of the electric tankless water heater illustrated in FIG. 1 in another direction.

[0035] FIG. 3 is a schematic view of the electric tankless water heater illustrated in FIG. 1 in another direction.

[0036] FIG. 4 is an external view of the electric tankless water heater illustrated in FIG. 1.

[0037] FIG. 5 is a front view of the electric tankless water heater illustrated in FIG. 1.

[0038] FIG. 6 is a front view of the electric tankless water heater illustrated in FIG. 1, with a display panel, a power supply board, a wire fastener, and a wiring terminal being separated from each other.

[0039] FIG. 7 is an exploded view of the electric tankless water heater illustrated in FIG. 1.

[0040] FIG. 8 is an exploded view of a dissolved air vessel and an air pump illustrated in FIG. 1.

[0041] FIG. 9 is a cross-sectional view of the dissolved air vessel and the air pump illustrated in FIG. 1.

[0042] FIG. 10 is an exploded view of the dissolved air vessel and the air pump illustrated in FIG. 8 in another direction.

[0043] FIG. 11 is an exploded view of the dissolved air vessel and the air pump illustrated in FIG. 8 in another direction.

[0044] FIG. 12 is a cross-sectional view of the dissolved air vessel and the air pump illustrated in FIG. 10.

[0045] FIG. 13 is a schematic view of a heating device illustrated in FIG. 1.

[0046] FIG. 14 is a schematic principle diagram of a circuit connection of the electric tankless water heater illustrated in FIG. 1.

[0047] FIG. 15 is an electrical signal connection diagram of the electric tankless water heater illustrated in FIG. 1.

[0048] FIG. 16 is a structural connection diagram of the electric tankless water heater illustrated in FIG. 1.

[0049] FIG. 17 is a material energy transfer diagram of the electric tankless water heater illustrated in FIG. 1.

[0050] FIG. 18 is a bubble water function control diagram of the electric tankless water heater illustrated in FIG. 1.

[0051] FIG. 19 is a control logic diagram of a solenoid valve, an air pump, and a heating device of the electric tankless water heater illustrated in FIG. 1.

[0052] Reference numerals

[0053] 100, electric tankless water heater;

[0054] 110, dissolved air vessel; 111, dissolved air chamber; 112, air inlet; 113, water inlet;

114, bubble water outlet; 115, tank body; 1151, tubular body; 1152, top cover; 116, water flowing pipe;

[0055] 120, air pump; 121, air inlet pipe; 122, air pump fixing sleeve;

[0056] 130, water pump; 131 water inlet pipe; 132, controllable silicon;

[0057] 140, heating device; 141, heat exchanger pipe; 142, heating element; 143, water outlet pipe; 1431, flow sensor; 144, temperature limiter;

[0058] 150, housing; 151, accommodation chamber; 152, wire fastener; 153, wiring terminal;

[0059] 160, power supply board; 170, display panel; 180, check valve; 190, solenoid valve.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0060] Embodiments of the present disclosure will be described in detail below with reference to examples thereof as illustrated in the accompanying drawings, throughout which same or similar elements are denoted by same or similar reference numerals. The embodiments described below with reference to the drawings are illustrative only, and are intended to explain, rather than limiting, the present disclosure.

[0061] An electric tankless water heater 100 according to an embodiment in a first aspect of the present disclosure will be described below with reference to FIGS. 1 to 12.

[0062] As illustrated in FIG. 1, the electric tankless water heater 100 according to the embodiment in the first aspect of the present disclosure includes a dissolved air vessel 110, an air pump 120, a water pump 130, and a heating device 140.

[0063] Specifically, the dissolved air vessel 110 has a dissolved air chamber 111, in which water and air are mixed together. The dissolved air vessel 110 has a water inlet 113, a bubble water outlet 114, and an air inlet 112. The bubble water outlet 114, the water inlet 113, and the air inlet 112 are in communication with the dissolved air chamber 111. The air pump 120 is in communication with the air inlet 112. The air pump 120 is configured to pump air into the dissolved air chamber 111 to allow for sufficient mixing and dissolving of the air with the water in the dissolved air chamber 111. The water pump 130 has an outlet connected to the water inlet 113 and an inlet connected to a water inlet pipe 131 of the electric tankless water heater 100.

The heating device 140 includes a heat exchanger pipe 141 and a heating element 142. An inlet end of the heat exchanger pipe 141 is in communication with the bubble water outlet 114, and an outlet end of the heat exchanger pipe 141 is in communication with a water outlet pipe 143 of the electric tankless water heater 100. The heating element 142 is adjacent to the heat exchanger pipe 141, and is configured to heat the heat exchanger pipe 141. In this way, micro-nano bubble water through the bubble water outlet 114 of the dissolved air vessel 110 can be heated quickly to meet the user's usage demands. Therefore, it is possible to ensure instantaneous and stable supply of hot water.

[0064] For example, as illustrated in FIG. 1, the dissolved air vessel 110 has the water inlet 113, the air inlet 112, and the bubble water outlet 114 that are in communication with the dissolved air chamber 111. Water is pumped into dissolved air vessel 110 through the water inlet 113 by the water pump 130. Air is pumped into the dissolved air vessel 110 through the air inlet 112 by the air pump 120. The water and the air are mixed and dissolved in the dissolved air vessel 110 to generate micro-nano bubble water with high quality. The micro-nano bubble water with the high quality can be mixed with the water more fully to generate super micro bubbles. As a result, better user's bathing experience can be provided, and thus healthy bathing and clean skin care are also better. The micro-nano bubble water flows to the heat exchanger pipe 141 of the heating device 140 through a water bubble outlet. The heating element 142 can heat the heat exchanger pipe 141, which enables the micro-nano bubble water flowing through the heating device 140 to be heated quickly. As a result, the user's demands for a temperature and instantaneous heating of the micro-nano bubble water can be satisfied. Therefore, user's experience can be improved.

[0065] In the electric tankless water heater 100 of the present disclosure, by arranging the air pump 120 at the air inlet 112 of the dissolved air vessel 110, the quality and production efficiency of the micro-nano bubble water can be improved. In addition, by arranging the water pump 130 at the water inlet 113 of the dissolved air vessel 110, a water inflow pressure can be ensured. Therefore, the electric tankless water heater 100 has a simple and compact overall structure, a fast heating speed, and can provide stable water pressure while ensuring an instantaneous and stable supply of hot water.

[0066] In some embodiments of the present disclosure, as shown in FIG. 1, the electric

tankless water heater 100 may further include a housing 150 having an accommodation chamber 151. The dissolved air vessel 110, the air pump 120, the water pump 130, and the heating device 140 are disposed in the accommodation chamber 151. In this way, internal components of the electric tankless water heater 100 can be separated from an external environment by the housing 150, to avoid safety hazards caused by contact between the internal components and the external environment. At the same time, the accommodation chamber 151 in the housing 150 can provides a mounting space for the internal components of the electric tankless water heater 100.

[0067] As illustrated in FIG. 1, the water pump 130 is arranged at a lower side of the dissolved air vessel 110. The heating device 140 and the dissolved air vessel 110 are horizontally arranged in parallel to each other. The air pump 120 is arranged at a side of the dissolved air vessel 110 facing away from the heating device 140. In this way, the air pump 120 is spaced apart from the heating device 140, which can avoid any influence on a normal operation of the air pump 120 due to a high temperature during the heating of the heating device 140.

[0068] Further, as illustrated in FIG. 5, the housing 150 is further provided with an air pump fixing sleeve 122, a wire fastener 152, and a wiring terminal 153. The air pump 120 is fixed to the housing 150 by the air pump fixing sleeve 122. The wire fastener 152 is configured to fix wires in the housing 150 to ensure a neat and beautiful appearance of the housing 150 while avoiding safety problems due to misplaced wires. The wiring terminal 153 is configured for wiring.

[0069] In some embodiments of the present disclosure, as illustrated in FIG. 12, an upper end of the water inlet pipe 131 extends into the accommodation chamber 151 through a bottom of the housing 150, and a lower end of the water outlet pipe 143 extends out of the accommodation chamber 151 from the bottom of the housing 150. The water inlet pipe 131 is configured to supply the water to the electric tankless water heater 100, and the water outlet pipe 143 is configured to output the micro-nano bubble water to the electric tankless water heater 100.

[0070] For example, after flowing into the electric tankless water heater 100 through the inlet pipe 131, the water is formed into micro-nano bubble water in the electric tankless water

heater 100 to satisfy user's temperature requirements, and then is discharged out of the electric tankless water heater 100 through the water outlet pipe 143.

[0071] In some embodiments of the present disclosure, as illustrated in FIG. 7, the electric tankless water heater 100 may further include a power supply board 160 and a display panel 170. The power supply board 160 is disposed in the accommodation chamber 151 and located above the dissolved air vessel 110 and the heating device 140. It should be noted that the dissolved air vessel 110 will be ageing during using of the electric tankless water heater 100, and thus leakage of the water would occur. In this case, the leaked water flow downwards due to gravity. By arranging the power supply board 160 above the dissolved air vessel 110 and the heating device 140, it is possible to avoid safety problems such as short-circuiting of the power supply board 160 due to the leakage of the water from the dissolved air vessel 110. The display panel 170 is disposed on a front side of the housing 150, which is convenient for the user to visually observe a temperature of the micro-nano bubble water.

[0072] Further, as illustrated in FIG. 6, the power supply board 160 is located at an upper part of the housing 150, and is configured to control and regulate operations of the air pump 120, the water pump 130, and the heating device 140. It should be noted that in the long-term use of the electric tankless water heater 100, the dissolved air vessel 110 and the heating device 140 may have slight leakage due to the aging of the components. By arranging the power supply board 160 at the upper part of the housing 150, it is possible to avoid the short-circuiting of the power supply board 160 due to the water dripping onto the power supply board 160 from the dissolved air vessel 110 and the water heater.

[0073] For example, as illustrated in FIG. 5, the electric tankless water heater 100 may have both the power supply board 160 and the display panel 170. In this case, the power supply board 160 is located on the housing 150. Further, the power supply board 160 is located above the heating device 140 and the dissolved air vessel 110. The display panel 170 is located on the front side of the housing 150. Further, the display panel 170 is partly located inside the housing 150 and partly located outside the housing 150. In this way, it is easy for the user to visually observe information such as the temperature of the micro-nano bubble water and the connection of the power supply.

[0074] In some embodiments of the present disclosure, as illustrated in FIG. 3, a top of the

air pump 120 is lower than a top of the dissolved air vessel 110. It should be noted that the top of the air pump 120 is connected to the air inlet pipe 121. By positioning the the top of the air pump 120 lower than the top of the dissolved air vessel 110, it is possible to reduce an overall height of the air pump 120 and the dissolved air vessel 110 in an an up-down direction of the electric tankless water heater 100, which allows for more compact arrangement of the components in the housing 150. Therefore, the volume of the electric tankless water heater 100 can be reduced.

[0075] For example, as illustrated in FIG. 1, the air pump 120 is located at a right side of the dissolved air vessel 110, and the top of the dissolved air vessel 110 is higher than the top of the air pump 120. In this way, a space at the right side of the dissolved air vessel 110 is reasonably utilized. Meanwhile, the overall height of the air pump 120 and the dissolved air vessel 110 in the up-down direction of the electric tankless water heater 100 can be reduced, which allows for more compact arrangement of the components in the housing 150. Therefore, the space in the housing 150 can be saved.

[0076] In some embodiments of the present disclosure, as illustrated in FIG. 1, the dissolved air vessel 110 is vertically arranged. The the dissolved air vessel 110 may include a water flowing pipe 116 and a tank body 115. A lower end of the water flowing pipe 116 is connected to the outlet of the water pump 130, an upper end of the water flowing pipe 116 extends into the tank body 115 through a bottom of the tank body 115 and then extends upwards until the upper end is adjacent to a top of the tank body 115. In addition, a water outlet end of the water flowing pipe 116 is formed as the water inlet 113 of the dissolved air vessel 110. In this way, water entering into the dissolved air vessel 110 first flows out from the upper end of the dissolved air vessel 110, and then flow downwards due to the gravity, which prolongs a duration of the water in the dissolved air vessel 110 and facilitates a full mixing of the water and the air in the dissolved air vessel 110, thereby contributing to the generating micro-nano bubbly water with high quality and improving the user experience.

[0077] For example, as illustrated in FIG. 9, the upper end of the water flowing pipe 116 extends upwards to the top of the dissolved air vessel 110. The water first flows along the water flowing pipe 116 to the top of the dissolved air vessel 110, and then flows to the bottom from the top of the dissolved air vessel 110. During the flowing, the water can fully mix with the air

filling the dissolved air vessel 110 to generate the micro-nano bubble water.

[0078] In some embodiments of the present disclosure, as illustrated in FIG. 8, the tank body 115 includes a tubular body 1151 and a top cover 1152. The tubular body 1151 extends in an up-down direction and has an open top. The top cover 1152 covers the top of the tubular body 1151. An outlet end of an air inlet pipe 121 communicating with the air pump 120 extends into the dissolved air vessel 110 through the top cover 1152. The air inlet pipe 121 is fixed to the top cover 1152. By designing the tank body 115 to include the tubular body 1151 and the top cover 1152, it is possible to facilitate internal cleaning and maintenance of the dissolved air vessel 110 at a later stage of use.

[0079] For example, during the using of the electric tankless water heater 100 for a long time, the water flowing pipe 116 in the dissolved air vessel 110 may become aging, which will need to be replaced. In the present disclosure, it is only necessary to open the top cover 1152 of the tank body 115 and replace the water flowing pipe 116 without replacing the dissolved air vessel 110, thereby reducing cost of later maintenance and workload of a maintenance personnel.

[0080] In some embodiments of the present disclosure, as illustrated in FIG. 9, the outlet end of the water flowing pipe 116 is opposite to the outlet end of the air inlet pipe 121 in the up-down direction. In this way, it is possible to facilitate sufficient contact between the water discharged from the water flowing pipe 116 and the air discharged from the air inlet pipe 121, which in turn facilitates the generation of the micro-nano bubble water with high quality in the dissolved air vessel 110.

[0081] In some embodiments of the present disclosure, as illustrated in FIG. 11, the top cover 1152 is provided with a plurality of reinforcement structures protruding upwardly or downwardly. In this way, it is possible to facilitate enhancing a structural strength of the top cover 1152 and extends a service life of the dissolved air vessel 110. Meanwhile, tightness of of the dissolved air vessel 110 can be improved.

[0082] It should be noted that the water and the air entering the dissolved air vessel 110 are pressurized by the water pump 130 and the air pump 120 respectively, which leads to a relatively high pressure inside the dissolved air vessel 110. By additionally providing the reinforcement structures on the top cover 1152, it is possible to avoid loosening of the top cover 1152 and poor

tightness of the dissolved air vessel 110 due to the excessive pressure inside the dissolved air vessel 110.

[0083] In some embodiments of the present disclosure, as illustrated in FIG. 12, the bubble water outlet 114 is formed at a bottom or a lower part of the dissolved air vessel 110. In this way, it is beneficial to increase a pressure at which the micro-nano bubble water is discharged from the bubble water outlet 114, which in turn increases a pressure at which the micro-nano bubble water is discharged from the electric tankless water heater 100. Therefore, the user experience can be enhanced, and the cleaning ability of the micro-nano bubble water can be improved.

[0084] For example, as illustrated in FIG. 12, the bubble water outlet 114 is formed at the bottom of the dissolved air vessel 110. During an operation of the electric tankless water heater 100, a predetermined amount of micro-nano bubble water is always present in the dissolved air vessel 110, and the bottom of the dissolved air vessel 110 has a maximal pressure. Thus, the micro-nano bubble water discharged from the bubble water outlet 114 has a maximal pressure, which ensures that the discharged micro-nano bubble water is in good spraying state to satisfy the user's demands.

[0085] In some embodiments of the present disclosure, as illustrated in FIG. 9, a check valve 180 is disposed between the air pump 120 and the air inlet 112. The check valve 180 is configured to control the air pumped by the air pump 120 to flow only to the gas inlet 112 without flowing back to the air pump 120 from the gas inlet 112. Therefore, the backflow of air can be avoid, which in turn ensures that the air pumped by the air pump 120 every time can enter the dissolved air vessel 110, ensuring that there is sufficient air mixed with water in the dissolved air vessel 110 to generate the micro-nano bubble water with high quality.

[0086] For example, as illustrated in FIG. 9, the air pump 120 is connected upstream of the check valve 180, and the air inlet is connected to downstream of the check valve 180. When the air pump 120 starts working, the air pumped by the air pump 120 flows to the air inlet 112 through the check valve 180, and enters the dissolved air vessel 110 through the air inlet 112 to mix with the water in the dissolved air vessel 110. When the air pump 120 stops working, the air will flow black, at which case the air flows to the check valve 180 through the air inlet 112, and the air cannot pass through the check valve 180, thereby ensuring that all the air pumped

by the air pump 120 can be utilized to generate the micro-nano bubbly water. As a result, the quality and generation efficiency of the micro-nano bubbly water can be improved.

[0087] As illustrated in FIG. 9, an air inlet pipe 121 is connected between the air pump 120 and the air inlet 112. The air inlet pipe 121 is connected to a bending joint. A position of the bending joint may be determined based on a specific installation position of the air pump 120, which improves an adaptability to an installation space when the air pump 120 is installed. Meanwhile, the bending joint can increase the pressure of the flowing air compared to a direct joint, which facilitates the sufficient mixing of the air and the water in the dissolved air vessel 110 to generate the micro-nano bubble water with the high quality.

[0088] In some embodiments of the present disclosure, as illustrated in FIG. 5, the electric tankless water heater 100 further includes a solenoid valve 190 disposed between the inlet of the water pump 130 and the water inlet pipe 131. The solenoid valve 190 is configured to control the booster water pump 130 to be switched on or switched off.

[0089] In some embodiments, the solenoid valve 190 is a normal open solenoid valve 190 for controlling the booster water pump 130 to be switched on to pressurize water flowing into the dissolved air vessel 110. Upon energizing the solenoid valve 190, the solenoid valve 190 is closed, and the booster water pump 130 stops working, and the water is continuously feed into the dissolved air vessel 110.

[0090] In some embodiments of the present disclosure, as illustrated in FIG. 1, the water pump 130 is a booster water pump 130. The booster water pump 130 is configured to increase the pressure of the water entering into the dissolved air vessel 110. In this way, it is possible to contribute to the mixing of the air and the liquid in the dissolved air vessel 110 to generate the micro-nano bubble water with high quality in the dissolved air vessel 110, which in turn enhances the user experience.

[0091] Referring to FIG. 1, the water pump 130 is selected to be the booster water pump 130. When the water enters the dissolved air vessel 110 by the booster water pump 130, the pressure of the water entering the dissolved air vessel 110 can be significantly increased by the booster water pump 130. As a result, the high pressure water and the high pressure air are mixed with each other in the dissolved air vessel 110 to generate a greater pressure in the dissolved air vessel 110, which enables the water and the air in the dissolved air vessel 110 to be quickly and

fully mixed with each other. In this way, the micro-nano bubble water generated in the dissolved air vessel 110 is finer, thereby improving the user experience in the using process and increasing market competitiveness.

[0092] In some embodiments of the present disclosure, as illustrated in FIG. 1, the heating element 142 is arranged around the heat exchanger pipe 141 and extends spirally in an axis direction of the heat exchanger pipe 141. In this way, the heating element 142 surrounds the heat exchanger pipe 141 and can provide sufficient heating to the micro-nano bubble water flowing through the heat exchanger pipe 141, thereby allowing the micro-nano bubble water flowing through the heat exchanger pipe 141 to be heated sufficiently to meet the user's demands, which in turn satisfies instant heating requirement for the electric tankless water heater 100.

[0093] For example, as illustrated in FIG. 1, the heating element 142 spirally extends to surround the heat exchanger pipe 141, which ensures that the heating element 142 can heat the water flowing into the heat exchanger pipe 141 during the flowing of the water through the heat exchanger pipe 141. In this way, the heating element 142 can heat the micro-nano bubble water in the heat exchanger pipe 141 when the micro-nano bubble water flows into the heat exchanger pipe 141 from the dissolved air vessel 110, thereby meeting the user's demands for a temperature of the micro-nano bubble water.

[0094] Furthermore, as illustrated in FIG. 13, the heating device 140 may also be provided with a temperature limiter 144 on a top thereof. The temperature limiter 144 is configured to limit a temperature of the water flowing in the heat exchanger pipe 141 to prevent the user from being harmed due to the too high temperature in the heat exchanger pipe 141. When the temperature of the water flowing in the heat exchanger pipe 141 is greater than a predetermined temperature, the temperature limiter 144 can control the heating element 142 to stop heating.

[0095] In some embodiments of the present disclosure, as illustrated in FIG. 13, the water outlet pipe 143 is provided with a flow sensor 1431. In this way, it is possible to detect whether the water flows out of the water outlet in real time. In addition, the water outlet pipe 143 may further provided with a temperature sensor. In this way, it is possible to detect the temperature of the micro-nano bubble water flowing out of the water outlet pipe 143 in real time. Both the flow sensor 1431 and the temperature sensor are in communication with the heating element

142. In this way, the heating member 142 can heat or stop heating based on data fed back from the temperature sensor and the flow sensor 1431.

[0096] In some embodiments of the present disclosure, as illustrated in FIG. 1, the air inlet 112 is formed at the top, bottom or sidewall of the dissolved air vessel 110. The water inlet 113 is formed at the top or upper part of the dissolved air vessel 110. The bubble water outlet 114 is formed at the lower part or bottom of the dissolved air vessel 110. In this way, it is possible to ensure an air inlet function, a water inlet function, and a micro-nano bubble water discharging function of the dissolved air vessel 110.

[0097] For example, as illustrated in FIG. 1, the air inlet 112 is formed at the top of the dissolved air vessel 110. The water inlet 113 is formed at the upper part of the dissolved air vessel 110. The air inlet 112 is opposite to the water inlet 113 in the up-down direction. The bubble water outlet 114 is formed at the lower part of the dissolved air vessel 110. In this way, the air inlet 112 and the water inlet 113 can supply the air and the water to the dissolved air vessel 110 respectively to generate the micro-nano bubble water in the dissolved air vessel 110, and the micro-nano bubble water can flows out of the dissolved air vessel 110 through the bubble water outlet 114.

[0098] In some embodiments of the present disclosure, as illustrated in FIG. 1, the electric tankless water heater 100 further includes a micro-nano bubble generator communicating with the water outlet pipe 143, thereby further ensuring that the the micro-nano bubble water with high quality is output from the electric tankless water heater 100.

[0099] For example, as illustrated in FIG. 1, the micro-nano bubble generator has an end connected to the water outlet pipe 143 and the other end connecter to a high pressure shower head. The micro-nano bubble water discharged from the water outlet pipe 143 flows through the micro-nano bubble generator to be further treated by the micro-nano bubble generator. Therefore, it is possible to ensure that the micro-nano bubble water discharged from the high pressure shower is finer and more stable.

A control method for an electric tankless water heater according to an embodiment in a second aspect of the present disclosure is provided. The electric tankless water heater includes the electric tankless water heater 100 according to the embodiments in the first aspect of the present disclosure. The electric tankless water heater 100 further includes a solenoid valve 190.

The solenoid valve 190 is disposed upstream of the water pump 130 in a water flow direction. The control method includes: step S1 of detecting whether a water flow signal is generated at the outlet end of the heat exchanger pipe 141; step S2 of opening, based on a determination that a water flow signal exists at the outlet end of the heat exchanger pipe, the solenoid valve 190 to inject water into the dissolved air vessel 110 for a first predetermined time period, and closing the solenoid valve 190 after the first predetermined time period; and step S3 of switching on the air pump 120 to supply air into the dissolved air vessel 110 for a second predetermined time period, and and after the second predetermined time period, switching off the air pump 120 and opening the solenoid valve 190.

[00100] It should be noted that the control process is implemented each time the electric tankless water heater 100 is started. In some embodiments, as illustrated in FIG. 18, when the flow sensor 1431 located at the outlet end of the heat exchanger pipe 141 has detected a water flow signal, the flow sensor transmits the signal to the power supply board 160. Further, the power supply board 160 transmits a signal for opening the solenoid valve 190 to the solenoid valve 190. The water enters into the dissolved air vessel 110 through the water inlet 113 for the first predetermined time period. After the first predetermined time period, the power supply board 160 transmits a signal for closing the solenoid valve 190 to the solenoid valve 190, enabling the water pump 130 stop supplying water to the dissolved air vessel 110 for the second predetermined time period. At the same time, the power supply board 160 transmits a signal for switching on the air pump 120 to the air pump 120. The air pump 120 pumps air into the dissolved air vessel 110 from the air inlet for the second predetermined time period. After the second predetermined time period, the power supply board 160 transmits a signal for opening the solenoid valve 190 to the solenoid valve 190. The solenoid valve 190 is opened to continuously inject water into the dissolved air vessel 110. At the same time, the power supply board 160 transmits a signal for switching off the air pump 120 to the air pump 120. The air pump 120 is switched off to stop pumping air into the dissolved air vessel 110.

[00101] It should be noted that when each time the electric tankless water heater 100 is restarted, there will be liquid remaining in the dissolved air vessel 110 from the last time. In this case, if the water is directly and continuously injected into the dissolved air vessel 110 and the air is pumped into the dissolved air vessel 110 periodically, the air and the water in the

micro-nano bubble water discharged at the beginning of the discharging stage are not sufficiently mixed with each other. With supplying the air without supplying the water at the beginning stage, it is possible to allow the water in the dissolved air vessel 110 to be fully mixed with the injected air. Therefore, a stable generation of the micro-nano bubble water can be ensured.

[00102] The water pump 130 may also be provided with a controllable silicon 132, which is a high-power electrical component and also known as a thyristor. The thyristor has advantages of small size, high efficiency and long life. In an automatic control system, the thyristor may be used as a high-power driver device to achieve control of a high-power device with a small power controller.

[00103] In the control method for the electric tankless water heater 100 according to the present disclosure, each time the electric tankless water heater 100 is started, the water in the dissolved air vessel 110 can be sufficiently mixed with the injected air to generate the stable micro-nano bubble water.

[00104] In some embodiments of the present disclosure, as illustrated in FIG. 18, the first predetermined time period ranges from 50 seconds to 90 seconds. In an example, the first preset time period may be set as 50 seconds, 55 second, 60 seconds, 65 seconds, 70 seconds, 75 seconds, 80 seconds, 85 seconds, and 90 seconds based on as desired. The second predetermined time period ranges from 1 second to 5 seconds. In an example, the second preset time period may be set as 1 second, 1.5 seconds, 2 seconds, 2.5 seconds, 3 seconds, 3.5 seconds, 4 seconds, 4.5 seconds, and 5 seconds.

[00105] For example, in an example, the first predetermined time period may be set as 60 seconds, and the second predetermined time period may be set as 1.5 seconds. In this way, a ratio of the water to the air in the dissolved air vessel 110 can be ensured to meet requirements, which is more conducive to the generation of fine and smooth micro-nano bubble water.

[00106] In some embodiments of the present disclosure, as illustrated in FIG. 1, the water pump 130 of the electric tankless water heater 100 is a booster water pump 130. In this way, the pressure of the water entering the dissolved air vessel 110 can be increased, enabling the water to be mixed with the air in the dissolved air vessel 110 to generate the micro-nano bubble water. The booster water pump 130 is configured to be switched on when the water flow signal

is detected at the outlet end of the heat exchanger pipe 141, the solenoid valve 190 is opened, and the air pump 120 is closed.

[00107] In some embodiments of the present disclosure, as illustrated in FIG. 18, the control method further includes step S4 of determining whether the dissolved air vessel 110 satisfies a predetermined air supply condition, and switching on the air pump 120 in response to the predetermined air supply condition being satisfied, and switching off the air pump 120 when an air pressure in the dissolved air vessel 110 reaches a predetermined pressure or air has been supplied by the air pump 120 for a predetermined time period. In this way, it is possible to ensure that the dissolved air vessel 110 always has appropriate amounts of the air and the water, which in turn ensures that the electric tankless water heater 100 can continuously generate the micro-nano bubble water.

[00108] For example, during the using of the electric tankless water heater 100, the dissolved air vessel 110 is provided with a pressure sensor therein. When the air pressure in the dissolved air vessel 110 is lower than a predetermined pressure value, the pressure sensor will transmit a signal to the power board 160. The power supply board 160 will transmit a signal for switching on the air pump 120 to the air pump 120. Then, the air pump 120 is switched on to supply the air into the dissolved air vessel 110. When the air pressure in the dissolved air vessel 110 reaches a predetermined pressure, the pressure sensor will transmit a signal to the power supply board 160. Then, the power supply board 160 will transmit a signal for switching off the air pump 120 to the air pump 120. Then, the air pump 120 is switched off to stop the supply of the air into the dissolved air vessel 110. Cycling is performed in this way to ensure that the electric tankless water heater 100 can stably generate micro-nano bubble water with high quality.

[00109] For another example, a predetermined time period for each air supply by the air pump 120 is set, and a time interval between each adjacent air supply is also set for a predetermined time period. Thus, during the practical using of the electric tankless water heater 100, when the water is injected into the dissolved air vessel 110 for a predetermined time period, the power supply board 160 will transmit a signal for switching on the air pump 122 to the air pump 120. Then, the air pump 120 is switched on supply the air to the dissolved air vessel 110. After the air has been supplied for the predetermined time period, the air pump 120 is automatically switched off. The water is always is injected into the dissolved air vessel 110

during the entire cycle, and cycling is performed in this way to ensure that the electric tankless water heater 100 can stably generate stable micro-nano bubble water with high quality.

[00110] In some embodiments of the present disclosure, the control method further includes: switching off the heating device 140 in a third predetermined time period prior to switching on the air pump 120; and switching on the heating device 140 again when the air pump 120 is switched on. It should be noted that the higher a content of the air in the micro-nano bubble water, the less heat required for heating the water to a same temperature. The air pump 120 is switched on during the air supply into the dissolved air vessel 110, the content of the air in the micro-nano bubble water will increase sharply. As a result, less heat is required. By switching off the heating device 140 in the third predetermined time period prior to switching on the air pump 120, it is possible to ensure that the electric tankless water heater 100 can produce stable and fine micro-nano bubble water. Meanwhile, energy can be saved.

[00111] In some embodiments of the present disclosure, the third predetermined time period ranges from 2 seconds to 10 seconds. That is, in an example, the third predetermined time may be set as 2 seconds, 3 seconds, 4 seconds, 5 seconds, 6 seconds, 7 seconds, 8 seconds, 9 seconds, and 10 seconds.

[00112] For example, as illustrated in FIG. 18, the third predetermined time period is set as 4 seconds. As a result, the heating element 142 can provide sufficient heat to heat the micro-nano bubble water flowing through the heat exchanger pipe 141 to a temperature required for user's cleaning operation while saving the energy.

[00113] An electric tankless water heater 100 according to an exemplary embodiment of the present disclosure will be described below with reference to FIGS. 1 to 3.

[00114] In a first embodiment, the electric tankless water heater 100 according to the exemplary embodiment of the present disclosure may include a dissolved air vessel 110, an air pump 120, a water pump 130, a heating device 140, a housing 150, a power supply board 160, a display panel 170, a solenoid valve 190, and a micro-nano bubble generator.

[00115] The dissolved air vessel 110 has a dissolved air chamber 111 defined therein. The dissolved air vessel 110 has a bubble water outlet 114, an air inlet 112, and a water inlet 113 formed on the dissolved air vessel 110. The dissolved air vessel 110 is vertically arranged. The dissolved air vessel 110 includes a water flowing pipe 116 and a tank body 115. A lower end

of the water flowing pipe 116 is connected to an outlet of the water pump 130, and an upper end of the water flowing pipe 116 extends into the tank body 115 through a bottom of the tank body 115 and then extends upwards until the upper end is adjacent to a top of the tank body 115. A water outlet end of the water flowing pipe 116 is formed as the water inlet 113 of the dissolved air vessel 110. The bubble water outlet 114 is located at the bottom of the dissolved air vessel 110.

[00116] The tank body 115 includes a tubular body 1151 and a top cover 1152. The tubular body 1151 extends in an up-down direction and has an open top. The top cover 1152 covers a top of the tubular body 1151. An outlet end of an air inlet pipe 121 communicating with the air pump 120 extends into the dissolved air vessel 110 through the top cover 1152 and is fixed to the top cover 1152. The top cover 1152 is provided with a plurality of reinforcement structures protruding upwardly or downwardly.

[00117] The air pump 120 is connected to the dissolved air vessel 110 by the air inlet 112. The top of the air pump 120 is lower than the top of the dissolved air vessel 110. A check valve 180 is disposed between the air pump 120 and the air inlet 112.

[00118] The water pump 130 is a booster water pump 130. An outlet of the water pump 130 is connected to the water inlet pipe 113, and an inlet of the water pump 130 is connected to the water inlet pipe 131. An outlet end of the air inlet pipe 121 is opposite to the outlet end of the water inlet pipe 116 in the up-down direction.

[00119] The heating device 140 includes a heating element 142 and a heat exchanger pipe 141. An inlet end of the heat exchanger pipe 141 is in communication with the bubble water outlet 114, and an outlet end of the heat exchanger pipe 141 is in communication with a water outlet pipe 143. The heating element 142 is arranged around the heat exchanger pipe 141. Further, the heating element 142 extends spirally in an axis direction of the heat exchanger pipe 141. The water outlet pipe 143 is provided with a flow sensor 1431 and a temperature sensor, and both the flow sensor 1431 and the temperature sensor are in communication with the heating element 142.

[00120] The housing 150 has an accommodation chamber 151. Each of the dissolved air vessel 110, the air pump 120, the water pump 130, and the heating device 140 is disposed in the accommodation chamber 151. The water pump 130 is arranged at a lower side of the

dissolved air vessel 110. The heating device 140 and the dissolved air vessel 110 are horizontally arranged in parallel to each other. The air pump 120 is arranged at a side of the dissolved air vessel 110 facing away from the heating device 140.

[00121] The power supply board 160 is disposed in the accommodation chamber 151. The power supply board 160 is located above the dissolved air vessel 110 and the heating device 140.

[00122] The display panel 170 is disposed on a front side of the housing 150.

[00123] The solenoid valve 190 is disposed between the water inlet pipe 131 and the inlet of the water pump 130.

[00124] The micro-nano bubble generator communicates with the water outlet pipe 143.

[00125] In an exemplary embodiments, as illustrated in FIG. 1, when the electric tankless water heater 100 is in operation, water enters the inlet of the water pump 130 from the water inlet pipe 131, and then enters the dissolved air vessel 110 after pressurized by the water pump 130. Air is generated by the air pump 120 and enters the dissolved air vessel 110 through the air inlet pipe 121 and the check valve 180. The air is pumped into the dissolved air vessel 110. The air is mixed with the water in the dissolved air vessel 110 to generate micro-nano bubble water. Then, the micro-nano bubble water passes through the bubble water outlet 114 and enters the heat exchanger pipe 141 of the heating device 140, where the heating element 142 in the heating device 140 heats the heat exchanger pipe 141. The water is then discharged out of the electric tankless water heater 100 through the water outlet pipe 143, flows to the booster shower through the micro-nano bubble generator. Finally, the micro-nano bubble water can be discharged.

[00126] According to the electric tankless water heater 100 of the present disclosure, by providing the air pump 120 at the air inlet 112 of the dissolved air vessel 110, it is possible to improve the quality and the generation efficiency of the micro-nano bubble water. In addition, by providing the water pump 130 at the water inlet 113 of the dissolved air vessel 110, the pressure of the inflowing water can be ensured. Therefore, the electric tankless water heater 100 has a simple and compact overall structure and a fast heating speed, and thus can provide a stable water pressure while ensuring instant and stable supply of hot water.

[00127] In the description of the present disclosure, it is to be understood that, terms such as

“center”, “longitudinal”, “lateral”, “length”, “width”, “thickness”, “over”, “below”, “front”, “back”, “left”, “right”, “vertical”, “horizontal”, “top”, “bottom”, “in”, “out”, “clockwise”, “anti-clockwise”, “axial”, “radial” and “circumference” refer to the directions and location relations which are the directions and location relations shown in the drawings, and for describing the present disclosure and for describing in simple, and which are not intended to indicate or imply that the device or the elements are disposed to locate at the specific directions or are structured and performed in the specific directions, which could not to be understood to the limitation of the present disclosure.

[00128] In addition, terms such as “first” and “second” are used herein for purposes of description and are not intended to indicate or imply relative importance or significance. Furthermore, the feature defined with “first” and “second” may include one or more this feature distinctly or implicitly. In the description of the present disclosure, “a plurality of” means two or more than two, unless specified otherwise.

[00129] In the present disclosure, unless specified or limited otherwise, the terms “mounted,” “connected,” “coupled” and “fixed” are understood broadly, such as fixed, detachable mountings, connections and couplings or integrated, and can be mechanical or electrical mountings, connections and couplings, and also can be direct and via media indirect mountings, connections, and couplings, and further can be inner mountings, connections and couplings of two components or interaction relations between two components, which can be understood by those of ordinary skill in the art according to the detail embodiment of the present disclosure.

[00130] In the description of the present disclosure, reference throughout this specification to “an embodiment,” “some embodiments,” “an example,” “a specific example,” or “some examples,” means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present disclosure. Thus, the appearances of the phrases in various places throughout this specification are not necessarily referring to the same embodiment or example of the present disclosure. Furthermore, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples. Without a contradiction, the different embodiments or examples and the features of the different embodiments or examples can be combined by those skilled in the art.

[00131] Although embodiments of the present disclosure have been illustrated and described, it is conceivable for those of ordinary skill in the art that various changes, modifications, replacements, and variations can be made to these embodiments without departing from the principles and spirit of the present disclosure. The scope of the present disclosure shall be defined by the claims as appended and their equivalents.

CLAIMS

What is claimed is:

1. An electric tankless water heater, comprising:

a dissolved air vessel having a dissolved air chamber, the dissolved air vessel having an air inlet, a water inlet, and a bubble water outlet that are in communication with the dissolved air chamber;

an air pump in communication with the air inlet;

a water pump having an outlet connected to the water inlet and an inlet connected to a water inlet pipe of the electric tankless water heater; and

a heating device comprising a heat exchanger pipe and a heating element, the heat exchanger pipe having an inlet end in communication with the bubble water outlet and an outlet end in communication with a water outlet pipe of the electric tankless water heater, and the heating element being adjacent to the heat exchanger pipe and configured to heat the heat exchanger pipe.

2. The electric tankless water heater according to claim 1, further comprising a housing having an accommodation chamber, each of the dissolved air vessel, the heating device, the water pump, and the air pump being disposed in the accommodation chamber, wherein:

the water pump is arranged at a lower side of the dissolved air vessel;

the heating device and the dissolved air vessel are horizontally arranged in parallel to each other; and

the air pump is arranged at a side of the dissolved air vessel facing away from the heating device.

3. The electric tankless water heater according to claim 2, wherein an upper end of the water inlet pipe extends into the accommodation chamber through a bottom of the housing, and a lower end of the outlet pipe extends out of the accommodation chamber through the bottom of the housing.

4. The electric tankless water heater according to claim 2 or 3, further comprising:

a power supply board disposed in the accommodation chamber and located above the

dissolved air vessel and the heating device; and/or

a display panel disposed on a front side of the housing.

5. The electric tankless water heater according to any one of claims 2 to 4, wherein a top of the air pump is lower than a top of the dissolved air vessel.

6. The electric tankless water heater according to any one of claims 1 to 5, wherein the dissolved air vessel is vertically arranged and comprises a tank body and a water flowing pipe, a lower end of the water flowing pipe being connected to the outlet of the water pump, an upper end of the water flowing pipe extending into the tank body through a bottom of the tank body and extending upwards until the upper end is adjacent to a top of the tank body, and a water outlet end of the water flowing pipe being formed as the water inlet of the dissolved air vessel.

7. The electric tankless water heater according to claim 6, wherein the tank body comprises:

a tubular body extending in an up-down direction and having an open top; and

a top cover covering the top of the tubular body,

wherein an outlet end of an air inlet pipe communicating with the air pump extends into the dissolved air vessel through the top cover and is fixed on the top cover.

8. The electric tankless water heater according to claim 7, wherein the water outlet end of the water flowing pipe is opposite to the outlet end of the air inlet pipe in the up-down direction.

9. The electric tankless water heater according to claim 7 or 8, wherein the top cover is provided with a plurality of reinforcement structures protruding upwardly or downwardly.

10. The electric tankless water heater according to any one of claims 1 to 9, wherein the bubble water outlet is formed at a lower part or a bottom of the dissolved air vessel.

11. The electric tankless water heater according to any one of claims 1 to 10, wherein a check valve is disposed between the air pump and the air inlet.

12. The electric tankless water heater according to any one of claims 1 to 11, further comprising a solenoid valve disposed between the water inlet pipe and the inlet of the water pump.

13. The electric tankless water heater according to any one of claims 1 to 12, wherein the water pump is a booster water pump.

14. The electric tankless water heater according to any one of claims 1 to 13, wherein the heating element is arranged around the heat exchanger pipe and extends spirally in an axis

direction of the heat exchanger pipe.

15. The electric tankless water heater according to any one of claims 1 to 14, wherein the water outlet pipe is provided with a flow sensor and/or a temperature sensor, both the flow sensor and the temperature sensor being in communication with the heating element.

16. The electric tankless water heater according to any one of claims 1 to 15, further comprising a micro-nano bubble generator communicating with the water outlet pipe.

17. A control method for an electric tankless water heater, wherein the electric tankless water heater is the electric tankless water heater according to any one of claims 1 to 16, the electric tankless water heater further comprising a solenoid valve disposed upstream of the water pump in a water flow direction, the control method comprising:

step S1 of detecting whether a water flow signal is present at the outlet end of the heat exchanger pipe;

step S2 of opening, based on a determination that a water flow signal exists at the outlet end of the heat exchanger pipe, the solenoid valve to inject water into the dissolved air vessel for a first predetermined time period, and closing the solenoid valve after the first predetermined time period; and

step S3 of switching on the air pump to supply air into the dissolved air vessel for a second predetermined time period, and after the second predetermined time period, switching off the air pump and opening the solenoid valve.

18. The control method according to claim 17, wherein the first predetermined time period ranges from 50 seconds to 90 seconds, and the second predetermined time period ranges from 1 second to 5 seconds.

19. The control method according to claim 17 or 18, wherein the water pump of the electric tankless water heater is a booster water pump, the booster water pump being configured to be switched on when there is a water flow signal at the outlet end of the heat exchanger pipe, the solenoid valve is opened, and the air pump is switched off.

20. The control method according to any one of claims 17 to 19, further comprising:

step S4 of determining whether the dissolved air vessel satisfies a predetermined air supply condition, and switching on the air pump in response to the predetermined air supply condition being satisfied, and switching off the air pump when an air pressure in the dissolved air vessel

reaches a predetermined pressure or air has been supplied by the air pump for a predetermined time period.

21. The control method according to any one of claims 17 to 20, further comprising:

switching off the heating device in a third predetermined time period prior to switching on the air pump; and

switching on the heating device again when the air pump is switched on.

22. The control method according to claim 21, wherein the third predetermined time period ranges from 2 seconds to 10 seconds.