[0009]

Embodiments of the present invention seek to provide a gas-dissolved water production device capable of producing only a necessary quantity of ozone water for a use point, without requiring a countermeasure against increase in temperature of the ozone water or occurrence of contamination during circulation.

Solution to Problem

[0010]

An aspect of the present invention is a gas-dissolved water production device including a gas flow rate control unit that controls a flow rate of gas which is a raw material, a water flow rate measuring unit that is connected to a supply source of water which is a raw material and measures a flow rate of the water, a pump that is connected to the supply source of the water and increases a pressure of the water, a gas-dissolved water generating unit that has a mixer which generates gas-dissolved water by mixing the gas and the water and a gas-liquid separator tank in which exhaust gas is separated from the gas-dissolved water generated, and an air control type pressure relief valve that is configured to maintain a constant exhaust gas pressure, wherein the gas flow rate control unit controls the flow rate of the gas in

accordance with the flow rate of the water measured by the water flow rate measuring unit, the pump is disposed on the upstream side of the gas-dissolved water generating unit, and the gas-dissolved water generated by the mixer is supplied to a use point without circulation, through the gas-liquid separator tank.

[0011]

Another aspect of the present invention is a gas-dissolved water production method including a gas flow rate control step of controlling a flow rate of gas which is a raw material, a water flow rate measuring step of measuring a flow rate of water which is a raw material, a water pressure increasing step of increasing pressure of the water by a pump, a mixing step of mixing the gas and the water by a mixer to generate gas-dissolved water, a gas-liquid separating step of separating exhaust gas from the gas-dissolved water in a gas-liquid separator tank, a gas-dissolved water supplying step of supplying the gas-dissolved water generated by the mixer to a use point without circulation, through the gas-liquid separator tank, and a gas exhausting step of exhausting the exhaust gas, while a constant exhaust gas pressure is maintained by an air control type pressure relief valve, wherein in the gas flow rate control step, the flow rate of the gas is controlled in accordance with the flow rate of the water measured at the water flow rate measuring step.

[0012]

As described below, the present invention includes other aspects. Therefore, the disclosure of the invention is intended to provide some of the aspects, and not intended to limit the scope of the invention which is described and claimed here.

Claims

[Claim 1]

A gas-dissolved water production device comprising:

a gas flow rate control unit that controls a flow rate of gas which is a raw material;

a water flow rate measuring unit that is connected to a supply source of water which is a raw material and measures a flow rate of the water;

a pump that is connected to the supply source of the water and increases a pressure of the water;

a gas-dissolved water generating unit that has a mixer which generates gas-dissolved water by mixing the gas and the water and a gas-liquid separator tank in which exhaust gas is separated from the gas-dissolved water generated; and

an air control type pressure relief valve that is configured to maintain a constant exhaust gas pressure;

wherein

the gas flow rate control unit controls the flow rate of the gas in accordance with the flow rate of the water measured by the water flow rate measuring unit,

the pump is disposed on the upstream side of the gas-dissolved water generating unit, and

the gas-dissolved water generated by the mixer is supplied to a use point without circulation, through the gas-liquid separator tank.

[Claim 2]

The gas-dissolved water production device according to claim 1, comprising:

a concentration measuring unit that measures concentration of the gas-dissolved water; and

a control unit that controls, on the basis of the concentration of the gas-dissolved water measured by the concentration measuring unit, the flow rate of the gas so as to reduce a difference between a measured value of the concentration of the gas-dissolved water and a target value.

[Claim 3]

The gas-dissolved water production device according to claim 1, wherein

the pump controls the pressure of the water within a pressure range of 0.1 to 1 MPa.

[Claim 4]

The gas-dissolved water production device according to claim 1, wherein

the mixer mixes the gas and the water by using a Venturi effect.

[Claim 5]

The gas-dissolved water production device according to claim 1, comprising:

a degassing treatment unit that performs degassing treatment on the water which is to be supplied to the gas-dissolved water generating unit.

[Claim 6]

The gas-dissolved water production device according to claim 1, wherein

the gas which is a raw material is ozone gas and the gas-dissolved water is ozone water.

[Claim 7]

The gas-dissolved water production device according to claim 6, comprising:

an ozone gas generating unit that generates the ozone gas, wherein

the ozone gas generating unit includes an electrode for electric discharge to be used for generating the ozone gas, and

a holding member which holds the electrode uses stainless steel as the material thereof and has a thickness of 10 mm or greater.

[Claim 8]

The gas-dissolved water production device according to claim 7, comprising:

a first supply source that supplies oxygen gas to the ozone gas generating unit;

a second supply source that supplies carbon dioxide gas or nitrogen gas to the the ozone gas generating unit;

a first flow rate controller that controls a flow rate of the oxygen gas supplied from the first supply source;

a second flow rate controller that controls a flow rate of the carbon dioxide gas or the nitrogen gas supplied from the second supply source;

wherein

the ozone gas generating unit generates the ozone gas from (a) the oxygen gas and (b) the carbon dioxide gas or the nitrogen gas.

[Claim 9]

The gas-dissolved water production device according to claim 1, comprising:

a pressure measuring unit that measures pressure of the gas-dissolved water which is to be supplied to the use point,

wherein

the pump controls the pressure of the water such that the pressure of the gas-dissolved water measured by the pressure measuring unit is constant.

[Claim 10]

The gas-dissolved water production device according to claim 1, wherein a necessary quantity of gas-dissolved water for the use point is supplied to the use point.

[Claim 11]

A gas-dissolved water production method comprising:

a gas flow rate control step of controlling a flow rate of gas which is a raw material;

a water flow rate measuring step of measuring a flow rate of water which is a raw material;

a water pressure increasing step of increasing pressure of the water by a pump;

a mixing step of mixing the gas and the water by a mixer to generate gas-dissolved water;

a gas-liquid separating step of separating exhaust gas from the gas-dissolved water in a gas-liquid separator tank;

a gas-dissolved water supplying step of supplying the gas-dissolved water generated by the mixer to a use point without circulation, through the gas-liquid separator tank; and

a gas exhausting step of exhausting the exhaust gas, while a constant exhaust gas pressure is maintained by an air control type pressure relief valve;

wherein

in the gas flow rate control step, the flow rate of the gas is controlled in accordance with the flow rate of the water measured at the water flow rate measuring step.