than the optimum flow rate, stability of the concentration of ozonated water generated in the nozzle deteriorates.

[0007]

Embodiments of the invention seek to provide a gas-dissolved liquid producing apparatus capable of increasing a gas dissolution efficiency and also enhancing stability of the concentration of gas-dissolved liquid.

SUMMARY OF THE INVENTION

[0008]

A gas-dissolved liquid producing apparatus according to an aspect of the present invention includes: a gas supply unit that supplies gas serving as a raw material of gas-dissolved liquid; a liquid supply unit that supplies liquid serving as a raw material of the gas-dissolved liquid; and a gas-dissolved liquid generator that generates the gas-dissolved liquid by dissolving the gas supplied from the gas supply unit in the liquid supplied from the liquid supply unit, wherein the gas-dissolved liquid generator includes: a first gas dissolving unit having a first optimum flow rate, wherein the first gas dissolving unit generates the gas-dissolved liquid by dissolving the gas supplied from the gas supply unit in the liquid supplied from the liquid supply unit;

a second gas dissolving unit having a second optimum flow rate different from the first optimum flow rate, wherein the second gas dissolving unit generates the gas-dissolved liquid by dissolving the gas supplied from the gas supply unit in the liquid supplied from the liquid supply unit; a flow rate detector that detects a flow rate of the liquid supplied from the liquid supply unit; and a

rate of the second gas dissolving unit (the second optimum flow rate), gas is supplied to the second gas dissolving unit, and dissolution of the gas is performed in the second gas dissolving unit. As described above, dissolution of gas is performed in an appropriate gas dissolving unit corresponding to the flow rate of the liquid.

[0012]

In the gas-dissolved liquid producing apparatus of the present invention, two arrays each including the first gas dissolving unit and the second gas dissolving unit connected in series may be provided in parallel, wherein in each array: the first optimal flow rate may be smaller than the second optimum flow rate, and the first gas dissolving unit may be arranged on an upstream side closer to the liquid supply unit than the second gas dissolving unit.

[0013]

According to this configuration, the first gas dissolving unit having a smaller optimum flow rate out of the two gas dissolving units (the first gas dissolving unit and the second gas dissolving unit) connected in series is arranged on the upstream side, and the second gas dissolving unit having a larger optimum flow rate is arranged on the downstream side, so that the pressure loss when the gas-dissolved water is generated in the gas-dissolved water generator can be reduced.

[0014]

What is claimed is:

1. A gas-dissolved liquid producing apparatus comprising:

a gas supply unit that supplies gas serving as a raw material of gas-dissolved liquid;

a liquid supply unit that supplies liquid serving as a raw material of the gas-dissolved liquid; and

a gas-dissolved liquid generator that generates the gas-dissolved liquid by dissolving the gas supplied from the gas supply unit in the liquid supplied from the liquid supply unit, wherein the gas-dissolved liquid generator includes:

a first gas dissolving unit having a first optimum flow rate, wherein the first gas dissolving unit generates the gas-dissolved liquid by dissolving the gas supplied from the gas supply unit in the liquid supplied from the liquid supply unit;

a second gas dissolving unit having a second optimum flow rate different from the first optimum flow rate, wherein the second gas dissolving unit generates the gas-dissolved liquid by dissolving the gas supplied from the gas supply unit in the liquid supplied from the liquid supply unit;

a flow rate detector that detects a flow rate of the liquid supplied from the liquid supply unit; and

a controller that controls which one of the first gas dissolving unit and the second gas dissolving unit

should be supplied with the gas supplied from the gas supply unit based on the flow rate of the liquid detected by the flow rate detector.

2. The gas-dissolved liquid producing apparatus according to claim 1, wherein

the first gas dissolving unit and the second gas dissolving unit are connected in series, and

the controller

performs control to supply the first gas dissolving unit with the gas supplied from the gas supply unit when the flow rate detected by the flow rate detector is closer to the optimum flow rate of the first gas dissolving unit than the optimum flow rate of the second gas dissolving unit, and

performs control to supply the second gas dissolving unit with the gas supplied from the gas supply unit when the flow rate detected by the flow rate detector is closer to the optimum flow rate of the second gas dissolving unit than the optimum flow rate of the first gas dissolving unit.

3. The gas-dissolved liquid producing apparatus according to claim 2, wherein

two arrays each including the first gas dissolving unit and the second gas dissolving unit connected in series are provided in parallel,

wherein in each array:

the first optimal flow rate is smaller than the second optimum flow rate, and

the first gas dissolving unit is arranged on an upstream side closer to the liquid supply unit than the second gas dissolving unit.

4. The gas-dissolved liquid producing apparatus according to claim 1, wherein

the first gas dissolving unit and the second gas dissolving unit are connected in parallel, and

the controller

performs control to supply the first gas dissolving unit with the gas supplied from the gas supply unit and the liquid supplied from the liquid supply unit when the flow rate detected by the flow rate detector is closer to the first optimum flow rate than the second optimum flow rate, and

performs control to supply the second gas dissolving unit with the gas supplied from the gas supply unit and the liquid supplied from the liquid supply unit when the flow rate detected by the flow rate detector is closer to the second optimum flow rate than the first optimum flow rate.

5. The gas-dissolved liquid producing apparatus according to claim 4, wherein

the gas-dissolved liquid generator includes a third gas dissolving unit that is connected to the first gas dissolving unit and the second gas dissolving unit in parallel, and has a third optimum flow rate different from both of the first optimum flow rate and the second optimum flow rate, and

the controller

performs control to supply the first gas dissolving unit and the second gas dissolving unit with the gas supplied from the gas supply unit when the flow rate detected by the flow rate detector is closer to a total flow rate of the first optimum flow rate and the second optimum flow rate than the third optimum flow rate, and

performs control to supply the third gas dissolving unit with the gas supplied from the gas supply unit when the flow rate detected by the flow rate detector is closer to the third optimum flow rate than the total flow rate of the first optimum flow rate and the second optimum flow rate.

6. The gas-dissolved liquid producing apparatus according to claim 5, wherein the controller performs control to supply the first gas dissolving unit and the second gas dissolving unit with the gas supplied from the gas supply unit when the flow rate detected by the flow rate detector is close to an intermediate value between the total flow rate of the first optimum flow rate and

the second optimum flow rate and the third optimum flow rate.

7. The gas-dissolved liquid producing apparatus according to claim 5, wherein the controller performs control to supply the third gas dissolving unit with the gas supplied from the gas supply unit when the flow rate detected by the flow rate detector is close to an intermediate value between the total flow rate of the first optimum flow rate and the second optimum flow rate and the third optimum flow rate.