CLAIMS

[Claim 1] An ultrafine bubble-containing liquid manufacturing apparatus, comprising:

(a) a storage unit configured to store liquid ~~in a position including a predetermined region~~; ~~and~~

(b) a heating unit configured to generate ultrafine bubbles with a diameter of less than 1.0 μm in the liquid by heating the liquid by heating the liquid ~~in the predetermined region~~ so as to cause film boiling in the liquid, wherein the heating includes:

(i) increasing a temperature of a surface of a heating portion provided inside the liquid to 300 degrees Celsius or more; and

(ii) generating bubbles on the surface of the heating portion;

(c) a control unit configured to heat the heating unit intermittently to cause the film boiling intermittently; and

(d) an injection port configured to inject gas into liquid stored in the storage unit,

(i) wherein the gas is selected from the group consisting of hydrogen, helium, oxygen, nitrogen, methane, fluorine, neon, carbon dioxide, ozone, argon, chlorine, ethane, propane, air, and gaseous mixtures thereof;~~characterized by~~ and

(ii) wherein the ultrafine bubbles are generated from the gas dissolved in the liquid.

~~a storage container which has a supply port for supplying liquid in which the ultrafine bubbles have been generated from the predetermined region into the storage container and a discharge port for discharging the liquid stored in the storage container.~~

[Claim 2] The ultrafine bubble-containing liquid manufacturing apparatus according to claim 1, wherein the heating unit includes a heating resistance portion.

~~[Claim 3] The ultrafine bubble-containing liquid manufacturing apparatus according to claim 1 or 2, further comprising a control unit configured to heat the heating unit intermittently to cause the film boiling intermittently.~~

[Claim ~~4~~3] The ultrafine bubble-containing liquid manufacturing apparatus according to ~~any one of~~ claim~~s~~ 1 or 2~~to 3~~, further comprising a channel in which liquid flows ~~through the predetermined region~~.

[Claim ~~5~~4] The ultrafine bubble-containing liquid manufacturing apparatus according to ~~any one of~~ claim~~s~~ 1 or 2~~to 3~~, further comprising a circulation channel configured to circulate liquid ~~through the predetermined region~~ by returning liquid stored in the storage container to the storage unit such that ultrafine bubbles can be generated again by heating the liquid returned to the storage unit ~~in the predetermined region~~.

~~[Claim 6] An ultrafine bubble-containing liquid manufacturing comprising:~~

~~a storage unit configured to store liquid in a position including a predetermined region; and~~

~~a heating unit configured to generate ultrafine bubbles with a diameter of less than 1.0 μm in the liquid by heating the liquid in the predetermined region so as to cause film boiling in the liquid;~~

~~a pressure chamber including at least part of the predetermined region;~~

a supply channel for supplying liquid to the pressure chamber; and

an ejection opening communicating with the pressure chamber, wherein liquid inside the pressure chamber is ejected from the ejection opening by energy of bubbles generated by film boiling in the liquid

characterized by

a first liquid collection container for collecting liquid ejected from the ejection opening, configured such that liquid collected in the first collection container can move to a sealable second liquid collection container which is attachable to and detachable from the ultrafine bubble-containing liquid manufacturing apparatus.

[Claim 7] The ultrafine bubble-containing liquid manufacturing apparatus according to claim 6, further comprising a filter for removing impurities other than the ultrafine bubbles, arranged so that liquid that moves from the first liquid collection container to the second liquid collection container moves through the filter.

[Claim 8] The ultrafine bubble-containing liquid manufacturing apparatus according to any one of claims 1 to 7, further comprising an injection port configured to inject gas into liquid stored in the storage unit.

[Claim 9] A method for generating an ultrafine bubble-containing liquid using the ultrafine bubble-containing liquid manufacturing apparatus as defined in any one of claims 1 to 8, comprising generating ultrafine bubbles with a diameter of less than 1.0 μm by causing film boiling in liquid.

~~[Claim 10] The method according to claim 9, comprising generating ultrafine bubbles, in liquid by increasing a temperature of a surface of the heating portion provided inside the liquid to 300°C or more and generating bubbles on the surface of the heating portion.~~

~~[Claim 11] The method according to claim 9 or 10, wherein the film boiling is caused intermittently.~~

~~[Claim 12] The method according to any one of claims 9 to 11, wherein the ultrafine bubbles are generated from gas dissolved in liquid.~~

~~[Claim 13] The method according to according to claim 9 or 10, wherein liquid contacts the heating portion in a shrinkage step after a growth process of the bubbles.~~

~~[Claim 14] The method according to claim 9 or 10, using the ultrafine bubble containing liquid manufacturing apparatus as defined in claim 6, comprising a step of ejecting liquid from the ejection opening by using energy of bubbles generated on the surface of the heating portion~~

~~[Claim 15] The method according to claim 9 or 10, wherein a period during which the liquid is heated by the heating portion is 100 μsec or less.~~

~~[Claim 16] The method according to claim 9 or 10, wherein an area of a surface of the heating portion in contact with the liquid is 25.0 mm^2 or less.~~

~~[Claim 17] The method according to claims 9 to 16, using the ultrafine bubble-containing liquid manufacturing apparatus as defined in claim 8, comprising a step of injecting gas into liquid in the storage unit through the injection port.~~

~~[Claim 18] The ultrafine bubble generating method according to claim 17, wherein the gas injected in the injecting step is a gas selected from the group consisting of hydrogen, helium, oxygen, nitrogen, methane, fluorine, neon, carbon dioxide, ozone, argon, chlorine, ethane, propane, air, and gaseous mixtures thereof.~~