side face of the treatment tank 1 corresponding to the high voltage electrode 11 of each unit 20, because of which the guide 22 of the fourth embodiment (refer to Fig. 6) can be omitted, and the internal configuration of the treatment tank 1 can be simplified more than in the fourth embodiment.

[0096]

Sixth Embodiment

Fig. 8 is a sectional view schematically showing a main configuration of a water treatment device according to a sixth embodiment of the invention. The water treatment device according to the sixth embodiment is such that the positions of the discharge ports 24 of the water treatment device according to the fifth embodiment are partially changed, so that the discharge ports 24A and 24C and the oppositely oriented discharge ports 27B and 27D are all provided in the right side face of the treatment tank 1. The circulation pipe 25 branches into four systems, and is connected to each of the discharge ports 24A and 24C and the oppositely oriented discharge ports 27B and 27D. As other configurations, an operation, a water treatment principle, and the like of the water treatment device according to the sixth embodiment are the same as in the first embodiment or the fifth embodiment, a description will be omitted.

[0097]

As shown in Fig. 8, the water treatment device according

is blown against the high voltage electrode 11 through the discharge port 24, because of which water droplets adhering to the high voltage electrode 11 are blown away by the gas flow pressure. That is, even when water droplets adhere to the high voltage electrode 11 in accompaniment to the formation of the minute water droplets 66, the water droplets are swiftly removed, because of which a spark discharge can be restricted.

[0118]

The minute water droplet supply means 61 not being particularly limited provided that the treatment target water 6 can be formed into minute water droplets thereby, various methods are applicable. For example, a shower nozzle, a single-fluid nozzle, a two-fluid nozzle, an ultrasonic oscillator, an ultrasonic homogenizer, a splashing mechanism that mechanically splashes the treatment target water 6 to form water droplets, a recoil mechanism that drops the treatment target water 6, or causes the treatment target water 6 to collide with a wall face, to form water droplets, or the like, is applicable. A diameter of the minute water droplet 66 is preferably 100μm or less, as the minute water droplets 66 are then diffused together with gas over a wide range of the treatment tank 1.

[0119]

Also, in the eighth embodiment, the minute water droplet supply means 61 is provided on the exterior of the treatment

CLAIMS

[Claim 1]

A water treatment device, comprising:

a unit having a grounding electrode having a planar flowing water portion that causes treatment target water to flow in a flow direction and a multiple of high voltage electrodes provided parallel with the flowing water portion in a position distanced from the flowing water portion of the grounding electrode and so as to extend in a direction intersecting the flow direction;

a frame having a gas supply port that supplies a gas that generates a radical owing to an electrical discharge between the grounding electrode and the high voltage electrode, and a supply port and a discharge port of the treatment target water, and housing the unit; and

blowing means disposed in a position opposing a downstream side end portion in the flow direction of the unit, wherein

the blowing means forms a gas flow with respect to an electrical discharge region from the high voltage electrode to a surface of the treatment target water on the flowing water portion, the gas flow intersects an extension direction of the high voltage electrode and intersects with extension direction of the electrical discharge which formed from the high voltage electrode to the surface of the treatment target water on the

flowing water portion, in an interior of the frame.

[Claim 2]

A water treatment device, comprising:

a unit having a grounding electrode having a planar flowing water portion that causes treatment target water to flow in a flow direction and a multiple of high voltage electrodes provided parallel with the flowing water portion in a position distanced from the flowing water portion of the grounding electrode and so as to extend in a direction intersecting the flow direction;

a frame having a gas supply port that supplies a gas that generates a radical owing to an electrical discharge between the grounding electrode and the high voltage electrode, and a supply port and a discharge port of the treatment target water, and housing the unit; and

blowing means disposed in a position opposing an upstream side end portion in the flow direction of the unit, wherein

the blowing means forms a gas flow with respect to an electrical discharge region from the high voltage electrode to a surface of the treatment target water on the flowing water portion, the gas flow intersects an extension direction of the high voltage electrode and intersects with extension direction of the electrical discharge which formed from the high voltage electrode to the surface of the treatment target water on the flowing water portion, in an interior of the frame.

[Claim 3]

A water treatment device, comprising:

a unit having a grounding electrode having a planar flowing water portion that causes treatment target water to flow in a flow direction and a multiple of high voltage electrodes provided parallel with the flowing water portion in a position distanced from the flowing water portion of the grounding electrode and so as to extend in a direction intersecting the flow direction;

a frame housing a multiple of the unit stacked in a vertical direction, and having a gas supply port that supplies a gas that generates a radical owing to an electrical discharge between the grounding electrode and the high voltage electrode, and a supply port and a discharge port of the treatment target water; and

blowing means disposed in a position opposing a downstream side end portion in the flow direction of the unit on a lowermost level, wherein

the blowing means forms a gas flow with respect to an electrical discharge region from the high voltage electrode to a surface of the treatment target water on the flowing water portion, the gas flow intersects an extension direction of the high voltage electrode and intersects with extension direction of the electrical discharge which formed from the high voltage electrode to the surface of the treatment target water on the

flowing water portion, in an interior of the frame.

[Claim 4]

The water treatment device according to claim 1 or claim 2, wherein a multiple of the unit are stacked in a vertical direction, and the blowing means is provided in each of the units.

[Claim 5]

The water treatment device according to claim 3 or claim 4, wherein each of the units has a gas guiding member provided parallel to the grounding electrode on a side of the high voltage electrode opposite to that of the grounding electrode.

[Claim 6]

The water treatment device according to any one of claim 1 to claim 5, wherein the blowing means is provided in a side face of the frame.

[Claim 7]

The water treatment device according to claim 4, wherein one portion of a multiple of the blowing means is provided in a side face of the frame opposing a downstream side end portion in the flow direction of one portion of the units, a gas flow of a direction opposite to the flow direction is formed, another one portion of the multiple of the blowing means is provided in a side face of the frame opposing an upstream side end portion in the flow direction of another one portion of the units, and a gas flow of a direction the same as the flow direction is

formed.

[Claim 8]

The water treatment device according to any one of claim 1 to claim 7, wherein the gas flow formed by the blowing means is a gas flow formed of a circulating gas.

[Claim 9]

The water treatment device according to any one of claim 1 to claim 8, wherein the blowing means is a blowing device having a blowing fan, or a propeller unit having a fin rotated by a motor.

[Claim 10]

The water treatment device according to any one of claim 1 to claim 8, wherein the blowing means is a circulating gas discharge port, and the blowing means further includes a circulation passage that connects the circulating gas discharge port provided in the frame and a circulating gas exit on an exterior of the frame, and a blower disposed partway along the circulation passage.

[Claim 11]

The water treatment device according to claim 3 or claim 4, wherein the flow directions of the units neighboring in the vertical direction are opposite directions.

[Claim 12]

The water treatment device according to claim 4, wherein the flow directions of the units neighboring in the vertical

direction are the same direction.

[Claim 13]

The water treatment device according to any one of claim 1 to claim 12, wherein the grounding electrode has a multiple of minute holes in the flowing water portion, and a layer of minute water droplets of the treatment target water is formed above the flowing water portion by a gas flow biased by the blower or other blowing means being fed from a back face side of the grounding electrode.

[Claim 14]

The water treatment device according to any one of claim 1 to claim 13, wherein the interior of the frame includes minute water droplet supply means that supplies water droplets formed by the treatment target water being atomized to a gas flow formed by the blowing means.

[Claim 15]

The water treatment device according to claim 10, wherein the circulation passage includes minute water droplet supply means that supplies water droplets formed by the treatment target water being atomized to a gas flow formed by the blower.

[Claim 16]

The water treatment device according to any one of claim 1 to claim 15, wherein the flowing water portion of the grounding electrode is inclined so as to become lower with respect to a horizontal plane toward a downstream side of the

flow direction.

[Claim 17]

A water treatment method whereby treatment target water and a gas that generates a radical owing to an electrical discharge are supplied to an interior of a frame in which a unit having a grounding electrode and a multiple of high voltage electrode are housed, an electrical discharge is generated between the grounding electrode and the high voltage electrode, and organic matter in the treatment target water is degraded and removed by a radical generated by the electrical discharge, the water treatment method comprising:

a step of causing the treatment target water to flow in a flow direction over a planar flowing water portion of the grounding electrode;

a step of applying a voltage to a multiple of the high voltage electrode provided parallel with the flowing water portion in a position distanced from the flowing water portion of the grounding electrode and so as to extend in a direction intersecting the flow direction, thereby generating the electrical discharge between the grounding electrode and the multiple of the high voltage electrode; and

a step of forming a gas flow with respect to an electrical discharge region from the high voltage electrode to a surface of the treatment target water on the flowing water portion, the gas flow intersects an extension direction of the high

voltage electrode and intersects with extension direction of the electrical discharge which formed from the high voltage electrode to the surface of the treatment target water on the flowing water portion, using blowing means disposed in a position opposing a downstream side end portion or an upstream side end portion in the flow direction of the unit.