ground electrodes 1 via the support structure 4 and is commonly grounded.

To-be-treated water passes through the electric discharge D formed in a planar shape, which will be described later.

[0015] Moreover, the voltage receiving portion 21 of the high-voltage electrode unit 2 is fixed to an upper end portion, in the vertical direction, of each insulating member 5, and lower end portions of the support portions 22 are located above the support structure 4 which supports the ground electrodes 1.

Each insulating member 5 is, for example, formed in a columnar or rod shape, and a lower end portion, in the vertical direction, of each insulating member 5 is fixed to the support structure 4. The upper end portion of each insulating member 5 extends to above the water supply unit 3 and fixes the voltage receiving portion 21 of the high-voltage electrode unit 2 at the upper end thereof.

Since the ground electrodes 1 and the insulating members 5 are fixed to the support structure 4, and the high-voltage electrode unit 2 is fixed to the upper ends of the insulating members 5 fixed to the support structure 4, the intervals between the ground electrodes 1 and the counter electrode portions 23 of the high-voltage electrode unit 2 are accurately maintained.

[0033] The support structure 4 is formed from a conductive material, and a metal material having excellent corrosion resistance such as stainless steel or titanium is particularly preferably used. In Embodiment 1, the support structure 4 having a rectangular cross section is used. However, it is sufficient that the support structure 4 has mechanical strength capable of holding the ground electrodes 1, the high-voltage electrode unit 2, and the insulating members 5. For example, a member having a circular, H-shaped, I-shaped, or T-shaped cross-section, a hollow member, or the like can be used as appropriate as a frame material forming the support structure 4. The H shape and the like can achieve weight reduction while maintaining the mechanical strength, so that the manufacturing cost of the support structure 4 and the water treatment apparatus can be reduced.

[0034] The example in which the support structure 4 is fixed to the upper portion of the treated water tank 6 has been described above. However, the support structure 4 may be disposed above support legs (not shown) fixed to a bottom portion of the treated water tank 6 and be held above the treated water tank 6. In the case where the support structure 4 is mounted to the treated water tank 6, the number of components of the water treatment apparatus is smaller than in the case where support legs are used. Thus,

FIG. 5 is a cross-sectional view showing the configuration of still another water treatment apparatus according to Embodiment 1. FIG. 5 shows that an upper end portion 5a and a lower end portion 5b of each insulating member 5 in the configuration of FIG. 1 are made thinner than the other portion of each insulating member 5. Not only the insulation distance is ensured directly at the portion of the upper end portion connected to the high-voltage electrode unit 2 as described above, but also the insulation distance can be increased by providing recesses and projections on the entire surface of each insulating member 5 or on at least a part of the surface of each insulating member 5, that is, by changing the cross-sectional area of each insulating member 5 between the lower end portion and the upper end portion.

[0039] Embodiment 2

In Embodiment 1, decomposition of the organic matter remaining in the to-be-treated water 30 having dropped through the electric discharge D is promoted by extending the residence time, in the treated water tank 6, of the to-be-treated water 30 having passed through the electric discharge D or stirring the to-be-treated water 30. In Embodiment 2, a circulation pipe is provided so as to return the to-be-treated water 30 retained in the treated water tank 6 to the water supply pipe 32 of the water supply unit 3 in order to

bring the to-be-treated water 30 into contact with the electric discharge D again.

FIG. 6A is a cross-sectional view showing the configuration of a water treatment apparatus according to Embodiment 2. In the drawing, one end of a circulation pipe 35 is connected to a wall surface, of the treated water tank 6, opposing the drainage pipe 61, and the other end of the circulation pipe 35 is connected to the water supply pipe 32 of the water supply unit 3. Decomposition of the organic matter can be promoted by sending the to-be-treated water 30 retained in the treated water tank 6 to the water supply unit 3 again with use of the pump 34 provided on the circulation pipe 35, and repeatedly bringing the to-be-treated water 30 into contact with the electric discharge D.

[0040] FIG. 6B, FIG. 6C, and FIG. 6D each show the configuration of a water treatment apparatus in which a part of the circulation pipe in FIG. 6A is changed.

Although the one end of the circulation pipe 35 is connected to the wall surface, of the treated water tank 6, opposing the drainage pipe 61 in FIG. 6A, the one end of the circulation pipe 35 may be connected to the drainage pipe 61 as shown in FIG. 6B. In this case, for example, a valve 37 may be provided, and whether to circulate, drain, or retain the water may be selected by the valve 37.

similarly, the materials or the configurations of the ground electrodes 1, the high-voltage electrode unit 2, the support structure 4, the insulating members 5, and the treated water tank 6 can be selected and can be changed.

[0043] As described above, with the configuration of Embodiment 2, the same advantageous effects as the embodiment 1 are achieved. Specifically, the intervals between the ground electrodes 1 and the high-voltage electrode unit 2 can be accurately maintained, and electric leak between the ground electrodes 1 and the high-voltage electrode unit 2 is inhibited, so that it is possible to treat to-be-treated water with high efficiency by stable electric discharge.

Furthermore, since to-be-treated water is repeatedly brought into contact with electric discharged by the circulation pipe 35, this repeated contact contributes to high-efficiency treatment of to-be-treated water.

[0044] Also, in FIG. 6A, FIG. 6B, FIG. 6C, and FIG. 6D, the water-repellent portion 52 covering a part of the surface of each insulating member 5 and the shielding plate 36 around the water supply unit 3 may be provided, or the upper end portion 5a and the lower end portion 5b of each insulating member 5 may be made thinner than the other portion of each insulating member 5.

FIG. 7 is a cross-sectional view showing the configuration of another water treatment apparatus according

seen in a line C-C direction, and FIG. 11 is a cross-sectional view of FIG. 9 as seen in a line D-D direction.

The water treatment apparatus of Embodiment 3 has the same basic configuration as that of Embodiment 1, and specifically includes ground electrodes 1, a high-voltage electrode unit 2, a water supply unit 3, a support structure 4, insulating members 5, and a treated water tank 6. Hereinafter, the differences from Embodiment 1 will be described.

[0046] The plurality of ground electrodes 1 are each a flat-plate-shaped conductive member, and are arranged at predetermined intervals in a horizontal direction so as to be parallel to each other, and the upper ends thereof in the vertical direction are fixed to the support structure 4. One ground electrode 1 has a shape having a recess-like hollow part 1a for letting the water supply unit 3, the water supply pipe 32, and the high-voltage electrode unit 2 to pass therethrough, and portions 1b, fixed to the support structure 4, at both ends of the hollow part 1a.

Each insulating member 5 is, for example, a columnar member, an upper end portion of the insulating member 5 is located above the water supply unit 3, the support structure 4 is fixed to the upper end portion of the insulating member 5, and the voltage receiving portion 21 of