

DESCRIPTION

AERATION APPARATUS

Technical Field

[0001]

The present invention relates to treatment of effluent from an exhaust gas desulfurizer employed in an electric power plant, such as a coal-fired, crude oil-fired, or heavy oil-fired power plant, and particularly relates to an aeration apparatus employing aeration for decarbonating (aerating) effluent (used seawater) from an exhaust gas desulfurizer for desulfurization using a seawater method.

Background Art

[0002]

Conventionally, in an electric power plant using coal, crude oil, or the like as fuel, sulfur oxides (SO_x), such as sulfur dioxide (SO₂), are removed from combustion exhaust gas (hereinafter called "boiler exhaust gas") discharged from a boiler, and then the boiler exhaust gas is discharged into the atmosphere. Known examples of such desulfurization treatment with an exhaust gas desulfurizer include systems employing a limestone-plaster method, a spray dryer method, or a seawater method.

[0003]

An exhaust gas desulfurizer employing the seawater method (seawater desulfurizer) uses seawater as an absorbent. In this system, for example, seawater and boiler exhaust gas are supplied to the inside of a desulfurization tower (absorption tower) having a substantially cylindrical shape, such as a longitudinally disposed cylinder, to cause gas-liquid contact in a wet system, thereby removing sulfur oxides using the seawater as an absorbing solution.

As shown in Fig. 3, for example, when the seawater (used seawater) used as an absorbent for desulfurization in the aforementioned desulfurization tower flows in a seawater oxidation treatment system (SOTS) 1 to be drained away, the used seawater is decarbonated (aerated) by aeration with micro-air-bubbles 2 discharged from an aeration device 10 disposed on a bottom face 1a of the seawater oxidation treatment system 1.

[0004]

Figs. 4, 5A, and 5B show a conventional aeration apparatus 10. A header 12 is connected to an air-supplying pipe 11 and is disposed on a bottom face 1a of the seawater oxidation treatment system 1. The header 12 is provided with a large number of aeration nozzles 13 that are horizontally arranged approximately parallel to the bottom face 1a. The aeration nozzles 13 are each a rubber hose provided with a

large number of small cuts 14 and covering the outer face of a base material; they are generally called "diffuser nozzles". Such aeration nozzles 13 can discharge a large number of micro-air-bubbles having approximately the same size by opening the cuts 14 when the hose is expanded by the pressure of air supplied from the air-supplying pipe 11.

There is no technical literature that discloses the application of aeration nozzles to an aeration apparatus employing aeration for decarbonating (aerating) effluent (used seawater) from an exhaust gas desulfurizer for desulfurization using a seawater method.

Disclosure of Invention

[0005]

In the decarbonation by aeration, the decarbonation performance can be improved by increasing the amount of micro-air-bubbles by increasing the amount of air supplied. However, since the aeration nozzle 13, called a diffuser nozzle, has an optimum amount of supplied air for generating favorable micro-air-bubbles, it is necessary to increase the number of nozzles in order to increase the amount of micro-air-bubbles (the amount of air). That is, in the case where a plurality of the same type of aeration nozzles 13 is used, the number of nozzles per unit area disposed on a bottom face 1a of the seawater oxidation treatment system 1 is necessarily

increased.

[0006]

However, the conventional structure having horizontally arranged aeration nozzles 13 has a limitation in the number of nozzles that can be disposed per unit area of a bottom face 1a of the seawater oxidation treatment system 1. Consequently, this limitation restricts the amount of air supplied for generating micro-air-bubbles. That is, in a plan view of the seawater oxidation treatment system 1, since the area of the bottom face 1a covered by each horizontally disposed aeration nozzle 13 is large, the number of nozzles that can be disposed per unit area so as not to overlap each other in the vertical direction is limited.

The present invention has been made under the above-described circumstances, and it is an object of the present invention to provide an aeration apparatus in which the number of aeration nozzles that can be disposed per unit area of a bottom face of a seawater oxidation treatment system can be increased to improve the decarbonation performance by aeration with the aeration apparatus for decarbonating (aerating) seawater used for desulfurization.

[0007]

The present invention employs the following means for solving the above-mentioned problems.

The aeration apparatus according to the present invention

is installed in a seawater oxidation treatment system for draining used seawater discharged from a desulfurization tower of an exhaust gas desulfurizer using seawater as an absorbent and configured to conduct decarbonation by generating micro-air-bubbles in the used seawater. In the aeration apparatus, a header being in communication with an air-supplying pipe is installed on a bottom face of the seawater oxidation treatment system, and aeration nozzles are attached to the header so as to extend upward in the vertical direction. The vertically disposed aeration nozzles generate the micro-air-bubbles.

[0008]

In this aeration apparatus, the header communicating with the air-supplying pipe is installed on the bottom face of the seawater oxidation treatment system, and the vertically disposed aeration nozzles attached to the header so as to extend upward in the vertical direction generate micro-air-bubbles. Accordingly, the number of aeration nozzles that can be installed per unit area of the bottom face of the seawater oxidation treatment system can be increased, compared to that in conventional horizontally arranged nozzles. That is, in a plan view of the seawater oxidation treatment system, the area covered by each aeration nozzle vertically disposed on the bottom face can be notably decreased compared to that in the horizontally arranged nozzles. Accordingly, the number of nozzles that can be disposed per unit area is increased.

[0009]

According to the present invention described above, since the number of aeration nozzles that can be disposed per unit area of the bottom face of the seawater oxidation treatment system can be increased, the amount of air supplied for generating micro-air-bubbles is increased by an amount corresponding to the increased number of nozzles. As a result, a significant advantage is afforded in that the decarbonation performance by aeration with the aeration apparatus for decarbonating (aerating) seawater used for desulfurization is improved.

Furthermore, in the aeration apparatus whose decarbonation performance is improved, the length of the seawater oxidation treatment system necessary for performing a predetermined level of decarbonation can be decreased. Therefore, an advantage can also be realized in that the cost and the space for installing the seawater oxidation treatment system can be decreased.

Brief Description of Drawings

[0010]

[FIG. 1] FIG. 1 is a perspective view illustrating vertically arranged aeration nozzles as an embodiment of an aeration apparatus according to the present invention.

[FIG. 2A] FIG. 2A is a plan view illustrating the nozzle

installation structure of the vertically arranged aeration nozzles shown in FIG. 1.

[FIG. 2B] FIG. 2B is a side view illustrating the nozzle installation structure of the vertically arranged aeration nozzles shown in FIG. 1.

[FIG. 2C] FIG. 2C is a partial cross-sectional view illustrating the inner structure of a main portion of the vertically arranged aeration nozzles shown in FIG. 1.

[FIG. 3] FIG. 3 is a view schematically illustrating an aeration apparatus installed in a seawater oxidation treatment system.

[FIG. 4] FIG. 4 is a perspective view illustrating horizontally arranged aeration nozzles of a conventional aeration apparatus.

[FIG. 5A] FIG. 5A is a plan view illustrating the nozzle installation structure of the horizontally arranged aeration nozzles shown in FIG. 4.

[FIG. 5B] FIG. 5B is a side view illustrating the nozzle installation structure of the horizontally arranged aeration nozzles shown in FIG. 4.

[0011]

Explanation of Reference Signs:

- 1: seawater oxidation treatment system (SOTS)
- 1a: bottom face
- 2: micro-air-bubbles

10A: aeration apparatus

11: air-supplying pipe

12: header

13A: aeration nozzle (diffuser nozzle)

14: cut

Best Mode for Carrying Out the Invention

[0012]

An embodiment of an aeration apparatus according to the present invention will now be described with reference to the drawings.

An aeration apparatus 10A shown in FIGS. 1 and 2A to 2C is installed, for example, in the inside of a seawater oxidation treatment system (SOTS) 1 for draining seawater used for desulfurization (hereinafter, referred to as "used seawater") discharged from a desulfurization tower (not shown) of an exhaust gas desulfurizer using seawater as an absorbent into the surrounding sea area. In this aeration apparatus 10A, the decarbonation (aeration) is conducted by generating a large amount of micro-air-bubbles in the used seawater flowing in the seawater oxidation treatment system 1.

[0013]

The aeration apparatus 10A is connected to an air supply source (not shown) disposed at the outside of the seawater oxidation treatment system 1 through an air-supplying pipe 11.

The other end of the air-supplying pipe 11 is connected to a header 12 arranged along a bottom face 1a of the seawater oxidation treatment system 1.

The header 12 is branched in the flow direction and the width direction of the bottom face 1a. The upper face of the header 12 is provided with a large number of aeration nozzles 13A, called "diffuser nozzles", so as to extend upward in the vertical direction. That is, in the aeration apparatus 10A of this embodiment, the header 12 communicating with the air-supplying pipe 11 is installed on the bottom face 1a of the seawater oxidation treatment system 1, and the aeration nozzles 13A for generating a large amount of micro-air-bubbles from cuts 14 are attached to the upper face of the header 12 so as to extend upward in the vertical direction.

[0014]

The structure of the aeration nozzles 13A will now be briefly described.

As shown in FIGS. 2A to 2C, the aeration nozzles 13A are installed on the upper face of the header 12 via flanges 15. The air-supplying pipe 11 and the header 12, which are placed in used seawater, are resin pipes in view of corrosion resistance, for example.

As shown in FIG. 2C, the aeration nozzles 13A each have a structure composed of, for example, a base material 16 having an approximately cylindrical shape and made of a resin in view

of corrosion resistance against used seawater, a rubber hose 17 provided with a large number of cuts 14 and disposed so as to cover the outer circumference of this base material 16, and jointing members 18, such as wire or bands, for fixing the upper and lower ends of the hose 17 to the base material 16. The cuts 14 are closed when they are in a normal state where no pressure is applied thereto.

[0015]

One end of the base material 16 communicates with the inside of the header 12 via an air inlet 19 passing through the header 12 and the flange 15 in order to enable the introduction of air in the state that the base material 16 is attached to the header 12. The interior of the base material 16 is divided in the vertical direction by a partition plate 16a provided at the midpoint in the axial direction thereof. The flow of air is inhibited by this partition plate 16a. In addition, an air outlet 16b is provided in the side face of the base material 16, at a position on the header 12 side of the partition plate 16a. This air outlet 16b allows air to flow out between the inner circumferential surface of the hose 17 and the outer circumferential surface of the base material 16, that is, to flow out into a pressurization space 20, by applying a pressure to the hose 17 to expand it. Therefore, as indicated with the arrow A in the drawing, the air flowing in the aeration nozzle 13A from the header 12 flows into the

interior of the base material 16 from the air inlet 19 and then flows out into the pressurization space 20 from the air outlet 16b in the side face.

The jointing members 18 fix the hose 17 to the base material 16 and prevent air that flows in through the air outlet 16b from leaking out through the two ends.

[0016]

In the thus configured aeration nozzle 13A, the air flowing in from the header 12 through the air inlet 19 flows out into the pressurization space 20 through the air outlet 16b and stays in the pressurization space 20 to increase the internal pressure because of the cuts 14 being closed. As a result, the hose 17 is expanded by the increased internal pressure of the pressurization space 20 to open the cuts 14 provided in the hose 17, resulting in the outflow of micro-air-bubbles into the used seawater. Such generation of micro-air-bubbles is performed in all of the aeration nozzles 13A that are provided with air via the air-supplying pipe 11 and the header 12.

[0017]

The aeration nozzles 13A are vertically arranged on the upper face of the header 12 so as to extend upward in the vertical direction. In such vertical arrangement, in a plan view viewed from above the bottom face 1a of the seawater oxidation treatment system 1, the area occupied by each

aeration nozzle 13A can be decreased. That is, in the vertically arranged aeration nozzles 13A, the area of the bottom face 1a covered by one nozzle is notably decreased compared to that in horizontally arranged aeration nozzles. Consequently, the number of nozzles that can be disposed per unit area can be significantly increased.

Therefore, the header 12 can also be installed on the bottom face 1a in regions where the header 12 cannot normally be arranged because of the presence of the horizontally arranged aeration nozzles 13, and, thereby, the aeration nozzles 13A can be vertically arranged in these regions.

[0018]

In the aeration apparatus 10A configured such that the header 12 communicating with the air-supplying pipe 11 is installed on the bottom face 1a of the seawater oxidation treatment system 1 and the aeration nozzles 13A attached to the header 12 are vertically arranged so as to extend upward in the vertical direction and generate micro-air-bubbles, the number of aeration nozzles 13A that can be disposed per unit area of the bottom face of the seawater oxidation treatment system can be increased compared to that in conventional horizontally arranged aeration nozzles. Consequently, the amount of air supplied for generating the micro-air-bubbles can be increased by an amount corresponding to the increased number of the nozzles. As a result, the decarbonation

performance by aeration with the aeration apparatus 10A for decarbonating (aerating) seawater used for desulfurization can be significantly improved.

[0019]

Furthermore, by improving the decarbonation performance of the aeration apparatus 10A, the length of the seawater oxidation treatment system 1 necessary for conducting a predetermined level of decarbonation can be decreased. Therefore, the cost and the space for installing the seawater oxidation treatment system 1 can also be decreased.

The aeration nozzles 13A are preferably arranged at equal intervals in the flow direction and the width direction of the seawater oxidation treatment system 1.

The present invention is not limited to the above-described embodiment and can be variously modified within the scope of the present invention.

CLAIMS

1. An aeration apparatus being installed in a seawater oxidation treatment system for draining used seawater discharged from a desulfurization tower of an exhaust gas desulfurizer using seawater as an absorbent and configured to conduct decarbonation by generating micro-air-bubbles in the used seawater, wherein

a header being in communication with an air-supplying pipe is installed on the bottom face of the seawater oxidation treatment system, and micro-air-bubbles are generated from aeration nozzles attached to the header so as to extend upward in the vertical direction.