DESCRIPTION

EXHAUST GAS DESULFURIZER

Technical Field

[0001]

The present invention relates to 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 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, combustion exhaust gas (hereinafter called "boiler exhaust gas") discharged from a boiler is desulfurized to remove sulfur oxides (SOx), such as sulfur dioxide (SO_2), and is then 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]

Among these systems, an exhaust gas desulfurizer

employing the seawater method (hereinafter called "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 vertically disposed cylinder, to cause gas-liquid contact in a wet system, thereby removing sulfur oxides using the seawater as an absorbing solution.

In the above-mentioned seawater desulfurizer, in general, the seawater that was used as an absorbent in the desulfurization tower flows in a seawater treatment system (SWTS) and is drained into the surrounding sea area. The used seawater flowing in the seawater treatment system is subjected to decarbonation (aeration), for example.

[0004]

Here, a conventional seawater desulfurizer will be briefly described with reference to Fig. 4 showing an example thereof.

In the seawater desulfurizer 1 shown in the drawing, seawater is supplied to the desulfurization tower 2 from the upper portion and freely falls, and boiler exhaust gas is supplied to the desulfurization tower 2 from the lower portion and rises up. Accordingly, gas-liquid contact occurs between the rising boiler exhaust gas and the falling seawater. The desulfurization tower 2 includes a plurality of perforated

panels 3 arranged at predetermined intervals in the vertical direction of the desulfurization tower 2 as a wet system, and the gas-liquid contact between the seawater and the boiler exhaust gas is achieved by means of the seawater and the boiler exhaust gas passing through a large number of holes 4 provided in the perforated panels 3.

In the drawing, reference numeral 5 denotes a seawater-supplying pipe, reference numeral 6 denotes a used seawater outlet for draining seawater after being used for desulfurization, reference numeral 7 denotes a boiler exhaust gas supply port, and reference numeral 8 denotes a boiler exhaust gas exhaust port for discharging desulfurized boiler exhaust gas (refer to, for example, Patent Citation 1 and Patent Citation 2).

[0005]

In some cases using the seawater desulfurizer 1, the desulfurization tower 2 is arranged above a seawater treatment system (SWTS) 9, and used seawater after desulfurization is drained away by falling directly into the seawater treatment system 9 from the used seawater outlet 6 formed at the lower end of the desulfurization tower 2. That is, the used seawater is mixed and diluted with diluting seawater while falling from the desulfurization tower 2 into the diluting seawater flowing in the seawater treatment system 9 and is then drained away.

The seawater treatment system 9 through which the used seawater flows is provided with gas-sealing barrier walls 10 extending into the seawater for preventing the boiler exhaust gas in the desulfurization tower 2 from flowing into the seawater treatment system 9. Accordingly, the boiler exhaust gas supplied to the desulfurization tower 2 is sealed with the barrier walls 10 and the seawater surface and does not leak to the empty space formed above the seawater surface in the seawater treatment system 9.

Patent Citation 1: Japanese Unexamined Patent Applications, Publication No. HEI-11-290643

Patent Citation 2: Japanese Unexamined Patent Applications, Publication No. 2001-129352

Disclosure of Invention

[0006]

In the seawater desulfurizer 1 described above, used seawater flowing in the seawater treatment system 9 is decarbonated by aeration before being drained into the surrounding sea area. In this decarbonation treatment, insufficient mixing of used seawater with diluting seawater causes a decrease in decarbonation performance. That is, incomplete mixing and dilution of the used seawater with the diluting seawater, resulting in uneven concentration, causes a problem in that the performance of decarbonation conducted

when the diluted used seawater flows in the seawater treatment system 9 is decreased. In particular, diluting seawater flowing in the seawater treatment system 9 tends to stagnate in a region near the water surface (shown in Fig. 4 as region A) directly below the desulfurization tower 2 due to the influence of the barrier walls 10 provided for gas sealing. This tends to cause insufficient mixing of the diluted used seawater.

The present invention has been made under these circumstances, and an object of the present invention is to prevent or inhibit a decrease in decarbonation performance when diluted used seawater is decarbonated in an exhaust gas desulfurizer using a seawater method by accelerating mixing and dilution of the used seawater with diluting seawater.

[0007]

The present invention employs the following solutions for solving the aforementioned problems.

The present invention provides an exhaust gas desulfurizer in which seawater used for desulfurization falls into diluting seawater flowing in a seawater treatment system and the resulting diluted used seawater obtained by mixing the used seawater and the diluting seawater is decarbonated while flowing in the seawater treatment system. The exhaust gas desulfurizer includes a mixing-accelerating part that accelerates the mixing of the used seawater and the diluting

seawater in the seawater treatment system.

[0008]

In such an exhaust gas desulfurizer, since the mixing-accelerating part for accelerating the mixing and dilution of used seawater with diluting seawater is provided in the seawater treatment system, the mixing and dilution of used seawater with diluting seawater is accelerated to solve the problem of insufficient mixing.

In this case, the mixing-accelerating part is preferably a turbulence-generating device such as a static mixer that makes the seawater flow turbulent, an aeration nozzle that generates micro air bubbles from the bottom of the seawater treatment system, or a combination of the turbulence-generating device and the aeration nozzle.

[0009]

According to the present invention described above, the mixing and dilution of used seawater with diluting seawater is accelerated by providing the mixing-accelerating part that accelerates the mixing in the seawater treatment system. Therefore, the problem of insufficient mixing of used seawater and diluting seawater is solved to achieve a noticeable improvement in the performance of decarbonation treatment of diluted used seawater, which is conducted when the diluted used seawater flows in the seawater treatment system.

Brief Description of Drawings

[0010]

[FIG. 1] Fig. 1 is a diagram illustrating the configuration of an exhaust gas desulfurizer according to a first embodiment of the present invention.

[FIG. 2] Fig. 2 is a diagram illustrating the configuration of an exhaust gas desulfurizer according to a second embodiment of the present invention.

[FIG. 3] Fig. 3 is a diagram illustrating the configuration of an exhaust gas desulfurizer according to a third embodiment of the present invention.

[FIG. 4] Fig. 4 is a diagram illustrating the configuration of a conventional exhaust gas desulfurizer.

Explanation of Reference:

1: exhaust gas desulfurizer (seawater desulfurizer)

2: desulfurization tower

3: perforated panels

5: seawater-supplying pipe

6: used seawater outlet

7: boiler exhaust gas supply port

8: boiler exhaust gas exhaust port

9: seawater treatment system (SWTS)

20: turbulence-generating device (mixing-accelerating part)

30: aeration nozzles (mixing-accelerating part)

Best Mode for Carrying Out the Invention

[0012]

Embodiments of an exhaust gas desulfurizer according to the present invention will now be described with reference to the drawings.

A first embodiment shown in Fig. 1 shows an exhaust gas desulfurizer (hereinafter called "seawater desulfurizer") 1 employing a desulfurization system called a seawater method that uses seawater as an absorbent.

In this seawater desulfurizer 1, boiler exhaust gas and seawater are supplied to a desulfurization tower 2 having an approximately cylindrical shape. By doing so, desulfurization is performed by causing gas-liquid contact between the boiler exhaust gas which rises up from the lower portion and the seawater, serving as an absorbent solution, which freely falls from the upper portion, by means of perforated panels 3 serving as a wet system.

[0013]

Inside the desulfurization tower 2, a plurality of (three in the example shown in the drawing) the perforated panels 3 are horizontally arranged at prescribed intervals in the vertical direction of the desulfurization tower 2. Each perforated panel 3 is provided with a large number of holes 4 serving as passages of boiler exhaust gas and seawater.

The seawater serving as an absorbent is introduced to the

upper portion of the desulfurization tower 2 through a seawater-supplying pipe 5. This seawater is discharged from a large number of seawater nozzles 5a approximately uniformly arranged in a plane at an upper portion of the desulfurization tower 2 toward the perforated panels 3 disposed at the lower portion thereof. The bottom of the desulfurization tower 2 is open to serve as a used seawater outlet 6 so that the used seawater after desulfurization, by passing through the perforated panels 3, falls directly on the surface of the seawater in a seawater treatment system (SWTS) 9, described below.

[0014]

The boiler exhaust gas is supplied to the inside of the desulfurization tower 2 from a boiler exhaust gas supply port 7 communicating with the desulfurization tower 2 at a portion lower than the positions of the perforated panels 3, passes through the perforated panels 3, and is then discharged from a boiler exhaust gas exhaust port 8 formed at the upper portion of the desulfurization tower 2.

That is, gas-liquid contact of the seawater freely falling from the upper portion and the boiler exhaust gas rising up from the lower portion occurs when they pass through the holes 4 perforated in each of the perforated panels 3, and thereby the seawater absorbs sulfur oxides in the boiler exhaust gas, thus performing desulfurization.

[0015]

In the aforementioned desulfurization tower 2, the used seawater outlet 6 communicates with an opening above the seawater treatment system 9, which introduces diluting seawater and allows it to flow. This seawater treatment system 9 is a channel not only for introducing diluting seawater and letting it flow but also for diluting used seawater falling from the used seawater outlet 6 of the desulfurization tower 2 into the flow and further subjecting the diluted used seawater to decarbonation and draining the decarbonated used seawater away. In general, a culvert is used as the seawater treatment system 9. Used seawater and diluting seawater are combined and mixed together to give diluted used seawater. This diluted used seawater is subjected to decarbonation treatment by aeration while flowing in the seawater treatment system 9 and is then drained into the surrounding sea area by being guided by the seawater treatment system 9.

Furthermore, gas-sealing barrier walls 10 are provided in the seawater treatment system 9 below an opening where the desulfurization tower 2 is installed. The barrier walls 10 extend to positions under the surface of the flowing diluting seawater, in other words, to positions in the seawater. Since the barrier walls 10 are formed so as to surround the circumference of the opening of the used seawater outlet 6,

boiler exhaust gas supplied to the desulfurization tower 2 from the boiler exhaust gas supply port 7 is sealed by the barrier walls 10 and the seawater surface and is prevented from leaking to the empty space formed above the seawater surface in the seawater treatment system 9.

[0016]

Furthermore, a turbulence-generating device 20 that makes the diluting seawater flow turbulent is disposed in the seawater treatment system 9 as a mixing-accelerating part for accelerating the mixing of the used seawater with the diluting seawater.

The turbulence-generating device 20 shown in Fig. 1 is disposed at a position further towards the upstream side with respect to the position of the desulfurization tower 2, in the flow direction of the diluting seawater flowing in the seawater treatment system 9. As this turbulence-generating device 20, it is effective to use a device that generates turbulence, such as swirls, by agitating the flow of the diluting seawater, for example, a static mixer. However, the turbulence-generating device 20 is not limited to the static mixer described above and may be a mesh member in a plate or basket shape that is arranged at a position below the barrier walls 10 and allows diluting seawater to pass through. The turbulence-generating device 20 may be disposed at any position at the upstream side with respect to the position

where decarbonation treatment is performed in the seawater treatment system 9 as long as the diluted used seawater to be decarbonated is sufficiently mixed; it is preferably located near the desulfurization tower 2.

[0017]

By installing this turbulence-generating device 20, the diluting seawater introduced under the desulfurization tower 2 through the seawater treatment system 9 is provided with turbulence such as swirls by the operation of the turbulence-generating device 20, shown by the arrow a in the drawing. Therefore, the used seawater that falls from the used seawater outlet 6 of the desulfurization tower 2 into the flow of the diluting seawater is agitated by the turbulence such as the swirls, thus accelerating the mixing thereof.

Therefore, the diluted used seawater flowing in the seawater treatment system 9 is sufficiently agitated and mixed, and the used seawater thus flows with an approximately uniform concentration and is subjected to decarbonation by aeration, improving the decarbonation performance of the seawater treatment system (SWTS) 9.

[0018]

Next, a second embodiment of the present invention, shown in Fig. 2, will be described. The same portions as those in the above-described first embodiment are denoted by the same reference numerals, and a detailed description thereof is not

repeated.

In this embodiment, the mixing-accelerating part for accelerating the mixing of used seawater and diluting seawater is different from that in the first embodiment: aeration nozzles 30 generating micro air bubbles b are disposed on the bottom face of the seawater treatment system 9, instead of the aforementioned turbulence-generating device 20. In the example shown in the drawing, the aeration nozzles 30 are arranged at a position below the desulfurization tower 2 and generate micro air bubbles b in a region where the used seawater falls from the used seawater outlet 6 into the diluting seawater.

Therefore, the diluted used seawater flowing in the seawater treatment system 9 is sufficiently agitated and mixed, and therefore the used seawater flows with an approximately uniformed concentration and is subjected to decarbonation by aeration, thus improving the decarbonation performance of the seawater treatment system (SWTS) 9.

[0019]

Next, a third embodiment of the present invention, shown in Fig. 3, will be described. The same portions as those in the above-described embodiments are denoted by the same reference numerals, and a detailed description thereof is not repeated.

In this embodiment, the mixing-accelerating part for

accelerating the mixing of used seawater and diluting seawater is a combination of the aforementioned turbulence-generating device 20 and the aeration nozzles 30. That is, the diluted used seawater flowing in the seawater treatment system 9 is further sufficiently agitated and mixed by generating turbulence such as swirls with the turbulence-generating device 20 and generating micro air bubbles b with the aeration nozzles 30. Therefore, the diluted used seawater flows with a more uniform concentration and is subjected to decarbonation by aeration, thus improving the decarbonation performance of the seawater treatment system (SWTS) 9.

[0020]

Thus, in the present invention, since a mixing-accelerating part for accelerating the mixing of used seawater and diluting seawater is disposed in the seawater treatment system 9, the mixing and dilution are accelerated to solve the problem of insufficient mixing of the used seawater and the diluting seawater. Consequently, the performance of decarbonation of diluted used seawater, which is performed when it flows in the seawater treatment system 9, is improved, and therefore deleterious effects of the diluted used water on the environment of the surrounding sea area into which the diluted used seawater is drained can be decreased.

The present invention is not limited to the above-described embodiments and can be variously modified within the

scope of the present invention.

CLAIMS

1. An exhaust gas desulfurizer in which used seawater after desulfurization falls into diluting seawater flowing in a seawater treatment system and the resulting diluted used seawater obtained by mixing the used seawater and the diluting seawater is decarbonated while flowing in the seawater treatment system, the exhaust gas desulfurizer comprising:

a mixing-accelerating part for accelerating the mixing of the used seawater and the diluting seawater in the seawater treatment system.