

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 referred to as "boiler exhaust gas") discharged from a boiler is desulfurized to remove sulfur oxides (SO_x), such as sulfur dioxide (SO_2) which is included in boiler exhaust gas, 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 referred to as "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. Known examples of such seawater spray systems using the seawater desulfurizer, in which desulfurization is carried out by gas-liquid contact between the seawater falling from the upper portion of the desulfurization tower and the combustion exhaust gas rising up from the lower portion of the desulfurization tower, include systems employing a leaking plate system, a packing system, a spray system, or a liquid column system.

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

[0004]

Here, as an example of a conventional seawater

desulfurizer, the configuration of a leaking plate system will be briefly described with reference to Fig. 10. 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 Fig. 10, reference numeral 5 denotes a seawater-supplying pipe, 5a denotes a seawater nozzle, 6 denotes a used seawater outlet for discharging desulfurized seawater, 7 denotes a boiler-exhaust-gas supply port, and 8 denotes a boiler-exhaust-gas exhaust port for discharging desulfurized boiler exhaust gas (for example, see Patent Documents 1 and 2).

[0005]

In some cases using the seawater desulfurizer 1, the desulfurization tower 2 is arranged above a seawater oxidation treatment system (SOTS) 9, and used seawater after

desulfurization is made to directly fall into the seawater oxidation treatment system 9 from the used seawater outlet 6 formed at the lower end of the desulfurization tower 2, and is then drained away. That is, the used seawater is mixed and diluted with diluting seawater when falling from the desulfurization tower 2 into the diluting seawater flowing in the seawater oxidation treatment system 9 and is then drained away. The seawater oxidation 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 oxidation treatment system 9. Accordingly, the boiler exhaust gas supplied to the desulfurization tower 2 is sealed by the barrier walls 10 and the seawater surface and does not leak from the empty space formed above the seawater surface in the seawater oxidation treatment system 9.

In a seawater desulfurizer using another seawater spray system (a packing system, etc.), the basic configuration is the same: desulfurization is carried out by gas-liquid contact between the seawater falling from the upper portion of the desulfurization tower 2 and the combustion exhaust gas rising up from the lower portion of the desulfurization tower 2.

Patent Document 1: Japanese Unexamined Patent
Application, Publication No. HEI-11-290643

Patent Document 2: Japanese Unexamined Patent

Application, Publication No. 2001-129352

Disclosure of Invention

[0006]

With the above-described seawater desulfurizer 1, because the used seawater is made to fall from the desulfurization tower 2 into the seawater surface of the diluting seawater flowing in the seawater oxidation treatment system (SOTS) 9, where it is mixed and diluted, when the used seawater plunges into the seawater surface of the diluting seawater, the boiler exhaust gas in the desulfurization tower 2 may be entrained therein due to strong turbulence at the seawater surface. The boiler exhaust gas entrained in the used seawater in this way becomes air bubbles which flow in the flow of the diluting seawater and pass through the barrier walls 10 to be discharged. Accordingly, a part of the boiler exhaust gas leaks, together with the diluting seawater, from the desulfurization tower 2 to the surrounding area, which is undesirable.

[0007]

Thus, with the exhaust gas desulfurizer (seawater desulfurizer) using the seawater method, it is desirable to overcome the problem of the boiler exhaust gas, which is entrained when the used seawater plunges into the seawater surface of the diluting seawater, leaking from the

desulfurization tower to the surrounding area due to the flow of the diluting seawater.

The present invention has been conceived in light of the circumstances described above, and an object thereof is to prevent or minimize the leakage of the combustion exhaust gas in an exhaust gas desulfurizer using a seawater method by preventing or reducing entrainment of the combustion exhaust gas (boiler exhaust gas) generated when the used seawater plunges into the seawater surface of the diluting seawater.

[0008]

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

In an exhaust gas desulfurizer according to one aspect of the present invention employing a seawater method in which desulfurization is conducted by causing gas-liquid contact between seawater falling from the upper portion of a desulfurization tower and combustion exhaust gas rising up from the lower portion of the desulfurization tower, used seawater after desulfurization falls from the desulfurization tower into diluting seawater flowing in a seawater oxidation treatment system and is mixed and diluted therewith, and an impact-force damping device for damping an impact force, which is generated when the used seawater falls down and plunges into the diluting seawater, is provided at a position below an inflow position of the combustion exhaust gas in the

desulfurization tower.

[0009]

According to such an exhaust gas desulfurizer, desulfurized used seawater falls from the desulfurization tower into the diluting seawater flowing in the seawater oxidation treatment system and is mixed and diluted therewith, and the impact-force damping device for damping the impact force, which is generated when the used seawater falls down and plunges into the diluting seawater, is provided at the position below the inflow position of the combustion exhaust gas in the desulfurization tower. Accordingly, the used seawater falling from the desulfurization tower passes through the impact-force damping device before plunging into the diluting seawater or when plunging into the diluting seawater, thus reducing the penetration force on the seawater surface. In other words, the impact-force damping device disperses the flow (seawater mass) of the used seawater falling from the desulfurization tower onto the surface of the diluting seawater or reduces the flow velocity in the direction plunging into the diluting seawater, thus reducing the penetration force of the used seawater plunging into the seawater surface.

[0010]

The impact-force damping device in this case may be a funnel with an impact-force receiving plate or a grid-shaped

member, such as a grid, a perforated plate, a grating, and so forth, disposed above the diluting seawater (in combustion exhaust gas) or below (including the one extending from above the seawater into the seawater) the surface of the diluting seawater.

In the above aspect, the seawater spray system for implementing gas-liquid contact may be realized by any of a leaking plate system, a packing system, a spray system, and a liquid column system.

[0011]

According to the present invention described above, when the desulfurized used seawater is made to fall from the desulfurization tower into the diluting seawater in the seawater oxidation treatment system to mix and dilute it, because the used seawater falling from the desulfurization tower passes through the impact-force damping device, the penetration force of the used seawater falling and plunging into the diluting seawater is reduced. Accordingly, it is possible to prevent or reduce entrainment of the combustion exhaust gas in the desulfurization tower in the flow of the used seawater. Because the boiler exhaust gas entrained in the diluting seawater is discharged together with the flow of the diluting seawater, the exhaust gas desulfurizer can prevent the leakage of the boiler exhaust gas into the surrounding area from the desulfurization tower. In other

words, with the exhaust gas desulfurizer using the seawater method, in which the desulfurized used seawater is treated by being made to fall into the diluted seawater, the penetration force of the used seawater is reduced, thus reducing the turbulence generated at the surface of the diluting seawater. Accordingly, it is possible to prevent or reduce entrainment of the combustion exhaust gas generated when the used seawater plunges into the seawater surface of the diluting seawater; therefore, a notable advantage is afforded in that it is possible to prevent or minimize the leakage of the combustion exhaust gas outside of the desulfurization tower.

Brief Description of Drawings

[0012]

[FIG. 1] Fig. 1 is a sectional view showing a first embodiment of a seawater desulfurizer of the present invention.

[FIG. 2] Fig. 2 is a sectional view of the seawater desulfurizer showing a first modification in Fig. 1.

[FIG. 3] Fig. 3 is a sectional view of the seawater desulfurizer showing a second modification in Fig. 1.

[FIG. 4] Fig. 4 is a perspective view showing a single layered grid as a grid-shaped member of a damping device.

[FIG. 5] Fig. 5 is a perspective view showing grids with a layered structure as the grid-shaped member of the damping

device.

[FIG. 6] Fig. 6 is a perspective view showing a perforated plate as a modification of the grid-shaped member of the damping device.

[FIG. 7] Fig. 7 is a sectional view showing a second embodiment of a seawater desulfurizer of the present invention.

[FIG. 8] Fig. 8 is a perspective view of principal parts, showing a damping device of a funnel with an impact-force receiving plate shown in Fig. 7.

[FIG. 9] Fig. 9 is a sectional view of the seawater desulfurizer showing a modification of Fig. 7.

[FIG. 10] Fig. 10 is a sectional view showing a conventional structure of a seawater desulfurizer.

Explanation of Reference Signs:

[0013]

1A, 1B, 1C, 1D, and 1E: seawater desulfurizer

2: desulfurization tower

6: used seawater outlet

7: boiler-exhaust-gas supply port

9: seawater oxidation treatment system (SOTS)

10: barrier walls

20, 20A, 20B, 30, and 30A: impact-force damping device
(damping device)

31: funnel portion

- 32: impact-force receiving plate
- 33: outlet channel
- 34: horizontal channel portion

Best Mode for Carrying Out the Invention

[0014]

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

A desulfurization tower 2 of a seawater desulfurizer 1A shown in Fig. 1 is a device for removing, using a seawater method, sulfur oxides (SO_x), such as sulfur dioxide (SO₂), contained in combustion exhaust gas (hereinafter referred to as "boiler exhaust gas") discharged from a boiler, for example, of an electric power plant using coal, crude oil, or the like as fuel, before discharging the boiler exhaust gas into the atmosphere. The seawater desulfurizer 1A employing this desulfurization system, called the seawater method, uses seawater as an absorbent.

[0015]

The seawater desulfurizer 1A shown in the drawing removes sulfur oxides by causing gas-liquid contact in a wet system, using seawater as an absorbent, by supplying seawater and boiler exhaust gas to the inside of the desulfurization tower 2 which has a substantially cylindrical shape and which is

vertically disposed. The seawater supplied to the desulfurization tower 2 is discharged from an upper portion in the desulfurization tower 2 and thereby freely falls in the interior. On the other hand, the boiler exhaust gas is introduced into the desulfurization tower 2 from a lower portion and rises up in the desulfurization tower 2.

The desulfurization tower 2 includes a plurality of perforated panels 3 arranged at predetermined intervals in the vertical direction in the inside thereof. These perforated panels 3 are perforated plates not having weirs or narrow flow passages, and gas-liquid contact between the falling seawater and the rising boiler exhaust gas is brought about when they pass through a large number of holes 4 provided in the perforated panels 3. This type of seawater spraying method is called, for example, "a leaking plate system" or the like.

[0016]

That is, the perforated panels 3 function as a wet system by causing gas-liquid contact of the seawater (absorbent) introduced via a seawater-supplying pipe 5 and the boiler exhaust gas introduced from a boiler exhaust gas supply port 7. By causing this gas-liquid contact, sulfur oxides in the boiler exhaust gas are absorbed by the seawater functioning as an absorbent solution and are removed.

The seawater functioning 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. After the gas-liquid contact achieved by passing through the perforated panels 3, in other words, after desulfurization by absorbing and removing sulfur oxides in the boiler exhaust gas, this seawater becomes used seawater and directly falls from a used seawater outlet 6 formed at a bottom face portion of the desulfurization tower 2 onto the seawater surface of the diluting seawater flowing in a seawater oxidation treatment system (SOTS) 9, described later, and is mixed and diluted therein. The boiler exhaust gas desulfurized by means of the gas-liquid contact is discharged outside the desulfurization tower from a boiler-exhaust-gas exhaust port 8 formed at the upper portion of the desulfurization tower 2.

[0017]

In order to dilute the used seawater used as an absorbent in the desulfurization tower 2, the above-described seawater desulfurizer 1A is provided above the seawater oxidation treatment system 9 where the diluting seawater flows. Specifically, in the desulfurization tower 2 provided in such a manner as to extend over the seawater oxidation treatment system 9, because the used seawater outlet 6 formed at the

lower portion is positioned directly above the seawater oxidation treatment system 9, the used seawater falling from the desulfurization tower 2 onto the surface of the diluting seawater is mixed and diluted by the diluting seawater and becomes diluted used seawater. This diluted used seawater is subjected to treatment, for example, decarbonation (aeration) and so forth while flowing from a position where the seawater desulfurizer 1A is provided, through the seawater oxidation treatment system 9 at the downstream side.

The seawater oxidation treatment system 9, through which the used seawater flows, is provided with gas-sealing barrier walls 10 extending into the diluting seawater for preventing the boiler exhaust gas in the desulfurization tower 2 from flowing into the seawater oxidation treatment system 9. The portion below the used seawater outlet 6 is thus sealed by the barrier walls 10 and the seawater surface; therefore, the boiler exhaust gas supplied to the desulfurization tower 2 does not leak to the empty space formed above the seawater surface in the seawater oxidation treatment system 9.

[0018]

First Embodiment

A first embodiment of an impact-force damping device (hereinafter, referred to as "damping device") according to the present invention will be described below with reference to Figs. 1 to 6.

As shown in Fig. 1, inside the above-described desulfurization tower 2, a damping device 20 for damping an impact force, which is generated when the used seawater falls down and plunges into the seawater surface of the diluting seawater, is provided at the position below an opening that communicates with a boiler exhaust gas supply port 7. This damping device 20 is securely supported by the desulfurization tower 2 at a position below the inflow position of the boiler exhaust gas, as well as at the position above the surface of the diluting seawater flowing in the seawater oxidation treatment system 9. In addition, the damping device 20 is provided in such a manner as to cover the entire region where the used seawater outlet 6 is formed.

Because the used seawater flowing down toward the seawater surface of the diluting seawater contacts or passes through the damping device 20, it disperses the flow of the used seawater or the flow mass to reduce the flow velocity in the plunging direction into the seawater surface of the diluting seawater, thus decreasing a penetration force of the used seawater plunging into the seawater surface.

[0019]

The damping device 20 shown in Fig. 1 is, for example, a grid-shaped member formed in such a manner that the used seawater can pass therethrough. For example, a flat plate-shaped grid 21 can be used for the grid-shaped member in this

case, as shown in Figs. 4 and 5. A single-layered grid 21 shown in Fig. 4, or as shown in Fig. 5, a multi-layered structure in which a plurality of grids 21 are vertically stacked, may also be used. In addition, when using the layered structure, it is preferable to stack the layered grids 21 so that openings 21a thereof are staggered.

In addition, as a modification of the grid-shaped member, for example, as shown in Fig. 6, a perforated plate 22, in which a large number of pores 22a are provided in a circular plate, may be used. When using this type of perforated plate 22, a single-layered or a multi-layered structure can be used. In addition, when using the multi-layered structure, it is preferable to stack the layered perforated plates 22 so that pores 22a are staggered.

[0020]

By providing such a damping device 20, the used seawater falling down in the desulfurization tower 2 passes through the grid-shaped member, such as the grid 21 or the perforated plate 22. At this time, since the used seawater passes through the openings 21a of the grid 21 or the pores 22a of the perforated plate 22, the flow (flow mass) thereof is dispersed, and a pressure loss is generated by a channel resistance, caused by a falling channel being narrowed by the openings 21a and the pores 22a. Accordingly, the used seawater falling from the desulfurization tower 2 onto the

seawater surface of the diluting seawater reduces its penetration force on the seawater surface due to dispersion of the flow or a reduction in flow velocity before plunging into the diluting seawater. Therefore, turbulence generated at the surface of the diluting seawater is reduced below the used seawater outlet 6, thus preventing or reducing entrainment of the boiler exhaust gas in the desulfurization tower 2 in the diluting seawater.

Besides the grid 21 or the perforated plate 22, it is also possible to use, for example, a grating (not shown) for the grid-shaped member constituting the damping device 20.

[0021]

With a seawater desulfurizer 1B of a first modification shown in Fig. 2, a damping device 20A having effectively the same configuration as the above-described damping device 20 is provided in the diluting seawater flowing in the seawater oxidation treatment system 9. The damping device 20A in this case is securely supported by the barrier walls 10 extending into the diluting seawater in such a manner as to cover the entire region enclosed by the barrier walls 10. In addition, the damping device 20A shown in the figure has a certain thickness in the vertical direction and is provided in the seawater to substantially the same depth as that of lower ends of the barrier walls 10; however, it is not limited thereto. In other words, suitable modifications can be made; for

example, when providing the single grid 21 to function as the damping device 20A, it can be placed at substantially the same position as the seawater surface or placed in the seawater at an appropriate depth.

[0022]

After the used seawater plunges into the diluting seawater, the damping device 20A having the above-described structure can also reduce the penetration force of the used seawater plunging into the seawater surface by dispersing the flow (seawater mass) of the used seawater falling from the desulfurization tower 2 onto the seawater surface of the diluting seawater or reducing the flow velocity in the direction plunging into the diluting seawater. Specifically, because the damping device 20A reduces the penetration force on the seawater surface by dispersing the flow of the used seawater or reducing the flow velocity thereof, turbulence generated at the surface of the diluting seawater in the region enclosed by the barrier walls 10 is reduced below the used seawater outlet 6. Accordingly, the seawater desulfurizer 1B having the damping device 20A can prevent or reduce entrainment of the boiler exhaust gas in the desulfurization tower 2 in the diluting seawater.

[0023]

With a seawater desulfurizer 1C according to a second modification shown Fig. 3, a damping device 20B having

effectively the same configuration as the above-described damping device 20A is disposed in the seawater in such a manner that the height thereof is substantially the same as the depth of the diluting seawater flowing in the seawater oxidation treatment system 9. The damping device 20B in this case is securely supported by the barrier walls 10 extending in the diluting seawater and covers the entire region enclosed by the barrier walls 10.

The damping device 20B having the above-described structure can also reduce the penetration force on the seawater surface by dispersing the flow of the used seawater or reducing the flow velocity thereof after the used seawater plunges into the diluting seawater; therefore, turbulence generated at the surface of the diluting seawater in the region enclosed by the barrier walls 10 is reduced below the used seawater outlet 6. Accordingly, the seawater desulfurizer 1C having the damping device 20B can prevent or reduce entrainment of the boiler exhaust gas in the desulfurization tower 2 in the diluting seawater.

[0024]

The damping devices 20, 20A, and 20B described above are provided above or below the surface of the diluting seawater flowing in the seawater oxidation treatment system 9. In a modification, not shown in the drawing, it is possible to provide connected damping devices or different types of

damping devices both above and in the seawater.

In addition, from the viewpoint of efficiently reducing turbulence at the seawater surface, the region which the damping devices 20, 20A, and 20B cover is preferably the entire region of the used seawater outlet 6 of the desulfurization tower 2, if it is above the seawater, or the region surrounded by the barrier walls 10, if it is in the seawater; however, it is not limited thereto.

[0025]

Second Embodiment

Next, a second embodiment of the damping device according to the present invention will be described. Regarding the structure of the seawater desulfurizer and the damping device, components that are the same as those according to the above-described embodiment are assigned the same reference numerals, and a detailed description thereof will be omitted.

A seawater desulfurizer 1D shown in Fig. 7 includes, for example, as shown in Fig. 8, a damping device 30 having a funnel with an impact-force receiving plate. The damping device 30 having the funnel with the impact-force receiving plate includes a funnel portion 31 and an impact-force receiving plate 32.

[0026]

The funnel portion 31 is a portion where the bottom portion of the desulfurization tower 2 below the used seawater

outlet 6 is formed in a funnel shape. Specifically, the funnel portion 31 in this case is formed in such a manner that the bottom portion below the used seawater outlet 6 narrows and includes a bottom face 2a that is an inclined surface inclining downward from lower edges of side walls of the desulfurization tower 2 toward the center portion; and an outlet channel 33 that opens at the central axis side of the desulfurization tower 2 where the bottom face 2a of the inclined surface is lowest. In addition, it is preferable that the inclined surface of the bottom face 2a be gradually inclined, from the viewpoint of reducing the flow velocity flowing down.

The outlet channel 33 of the funnel portion 31 is a cylindrical channel extending into the diluting seawater. The impact-force receiving plate 32, which is circular plate-shaped with an area larger than that of the opening of the outlet channel 33, is provided above the outlet channel 33 in such a manner as to be substantially aligned with the central-axis position. This impact-force receiving plate 32 can provide a gap, which becomes a channel for the used seawater, between itself and the bottom face 2a and also is supported by, for example, a plurality of supporting members (not shown) provided on the bottom face 2a so that the impact-force receiving plate 32 is securely supported at a position lower than the boiler-exhaust-gas supply port 7 that introduces the

boiler exhaust gas.

[0027]

By providing the above-described damping device 30, the used seawater falling down in the desulfurization tower 2 collides with the impact-force receiving plate 32 at the center area and collides with the bottom face 2a around the circumferential area.

In this way, the used seawater falling at the center area loses its falling velocity due to the impact-force receiving plate 32, changes its flowing direction, and is guided by an upper surface of the impact-force receiving plate 32 to flow in the circumferential direction thereof, thus falling down from the edge of the impact-force receiving plate 32 toward the bottom face 2a. The falling velocity at this time is significantly lower than that when falling to the impact-force receiving plate 32.

In addition, the used seawater falling around the circumferential area substantially loses its falling velocity due to the inclined surface of the bottom face 2a, changes its flowing direction, and flows toward the outlet channel 33 while combining with the used seawater falling from the impact-force receiving plate 32. The flow velocity in this case is relatively small because the used seawater is approximately uniformly dispersed in the circumferential direction around an inlet portion of the outlet channel 33 and

moreover flows along the relatively gradually inclined surface.

[0028]

Because most of the used seawater flowing out from the outlet channel 33 in this way falls along the wall surface of the outlet channel 33, the penetration force of the used seawater plunging into the seawater surface of the diluting seawater is reduced. Accordingly, the used seawater that is mixed and diluted with the diluting seawater is relatively smoothly combined in the outlet channel 33 whose end is in the diluting seawater, thus minimizing the turbulence generated at the surface of the diluting seawater where the used seawater is combined. Therefore, the seawater desulfurizer 1D including the damping device 30 can prevent or reduce entrainment of the boiler exhaust gas in the desulfurization tower 2 in the diluting seawater.

[0029]

A seawater desulfurizer 1E of a modification shown in Fig. 9 includes, at the outlet channel 33 in the seawater, a damping device 30A which differs in that it has a horizontal channel portion 34 whose used seawater outlet 34a is bent towards the upstream side of the diluting seawater. In other words, it is configured such that the used seawater to be combined with the diluting seawater flows out into the seawater against the flow of the diluting seawater.

In this way, turbulence such as swirls is generated at the seawater as a result of combining the flow of the diluting seawater with the used seawater. Therefore, when mixing and diluting the used seawater and the diluting seawater, a superior mixing state, in which the entire mixing ratio is substantially uniform, can be efficiently achieved while flowing through the relatively short channel of the seawater oxidation treatment system 9. In addition, the seawater desulfurizer 1E including the damping device 30A is the same as those seawater desulfurizers described above in that it can also prevent or reduce entrainment of the boiler exhaust gas in the desulfurization tower 2 in the diluting seawater.

[0030]

According to the present invention described above, when mixing and diluting the desulfurized used seawater by making it fall from the desulfurization tower 2 into the diluting seawater in the seawater oxidation treatment system 9, the used seawater falling from the desulfurization tower 2 passes through the damping device 20 or the like; therefore, the penetration force of the used seawater plunging into the diluting seawater is reduced. Accordingly, it is possible to prevent or reduce entrainment of the combustion exhaust gas in the desulfurization tower 2 in the flow of the used seawater. Because the boiler exhaust gas entrained in the diluting seawater is discharged, together with the flow of the diluting

seawater, by flowing through the seawater oxidation treatment system 9, it is possible for the exhaust gas desulfurizer to prevent the leakage of the boiler exhaust gas from the desulfurization tower 2 to the surrounding area. In other words, with the exhaust gas desulfurizer using the seawater method, in which the desulfurized used seawater is treated by being made to fall into the diluting seawater, the penetration force of the used seawater is reduced, thus reducing the turbulence generated at the surface of the diluting seawater. Accordingly, it is possible to prevent or reduce entrainment of the combustion exhaust gas generated when the used seawater plunges into the seawater surface of the diluting seawater, thus preventing the leakage of the boiler exhaust gas outside the desulfurization tower 2.

[0031]

In each of the embodiments and modifications of the seawater desulfurizer described above, the leaking plate system is used as the seawater spray system of the seawater desulfurizer in which desulfurization is carried out by causing gas-liquid contact between the seawater flowing down from the upper portion of the desulfurization tower 2 and the combustion exhaust gas rising up from the lower portion of the desulfurization tower 2. However, the present invention is not limited thereto. It can also be applied to a seawater desulfurizer using, for example, a packing system, a spray

system, or a submerging system.

The damping device described in the first and the second embodiments can also be configured by appropriately combining both embodiments, besides using it as a single device, described above.

[0032]

In the second embodiment described above, the outlet channel 33 has a length allowing it to reach into the seawater. However, because the falling speed of the used seawater plunging into the diluting seawater considerably decreases, the length of the outlet channel 33 may be shortened to an appropriate position above the seawater, or the outlet channel 33 may not be provided at all. In addition, when the outlet channel 33 is shortened or when it is not provided at all, the grid-shaped damping device 20 may also be combined.

The present invention is not restricted to the embodiments described above. Suitable modifications can be made so long as they do not depart from the spirit of the present invention.

CLAIMS

1. An exhaust gas desulfurizer employing a seawater method in which desulfurization is conducted by causing gas-liquid contact between seawater falling from the upper portion of a desulfurization tower and combustion exhaust gas rising up from the lower portion of the desulfurization tower,

wherein used seawater after desulfurization falls from the desulfurization tower into diluting seawater flowing in a seawater oxidation treatment system and is mixed and diluted therewith, and an impact-force damping device for damping an impact force, which is generated when the used seawater falls down and plunges into the diluting seawater, is provided at a position below an inflow position of the combustion exhaust gas in the desulfurization tower.

2. An exhaust gas desulfurizer according to Claim 1, wherein the impact-force damping device is a grid-shaped member provided above the diluting seawater or therein.

3. An exhaust gas desulfurizer according to Claim 1, wherein the impact-force damping device is a funnel with an impact-force receiving plate.