DESCRIPTION

FOAM RECOVERY DEVICE AND FOAM RECOVERY SYSTEM

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 a foam recovery device and a foam recovery system for removing foam from effluent from an exhaust gas desulfurizer performing desulfurization using a seawater method.

This application is based on Japanese Patent Application No. 2007-040458, the content of which is incorporated herein by reference.

BACKGROUND ART

[0002]

Conventionally, in an electric power plant using coal, crude oil, or the like as fuel, sulfur oxides (SOx), such as sulfur dioxide (SO_2), 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 vertically 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. 2, for example, when the seawater (used seawater) used as an absorbent for desulfurization in the aforementioned desulfurization tower flows in a seawater treatment system (SWTS) 1 to be drained away, it is decarbonated (aerated) by aeration with air bubbles 3 discharged from an aeration nozzle 2 disposed at the bottom of the seawater treatment system 1.

[0004]

When the pH is adjusted by the aforementioned decarbonation, a large amount of foam 4 is produced on the surface of the used seawater flowing in the seawater treatment system 1 due to interaction among the micro-aerated air bubbles 3, components (soot and dust, etc.) in the boiler exhaust gas introduced into seawater in the desulfurization

tower, and organic substances contained in the seawater. Not only does this foam 4 tend to remain but it also contains hazardous substances. Therefore, discharging the foam 4 from the seawater treatment system 1 together with seawater directly to the surrounding sea area is undesirable from the viewpoints of scenery and environmental pollution.

[0005]

An oil recovery device for recovering oil floating on the water surface is a known conventional technology resembling or relating to elimination of foam on the water surface. This oil recovery device includes floating means that floats on the water surface and supports the oil recovery device, suction means for sucking the oil, and oil-collecting means that collects oil from an oil-collecting aperture and leads the collected oil to the suction means (for example, refer to Patent Document 1).

Furthermore, a sludge recovery device that can easily recover paint sludge and the like floating in a recovery tank has also been proposed (for example, refer to Patent Document 2).

Patent Document 1: Japanese Unexamined Patent Application, Publication No. 2004-351279 (see Fig. 1)

Patent Document 2: Japanese Unexamined Patent Application, Publication No. Hei 6-296911 (see Fig. 1)

Disclosure of Invention

[0006]

The above-described desulfurized used seawater flows in the seawater treatment system 1 and is drained into the surrounding sea area, and the foam 4 floating on the water surface causes scenery destruction and environmental pollution. Accordingly, in order to solve these problems, a device for appropriately removing the foam 4 on the water surface by separating the foam 4 from seawater and collecting it is necessary. That is, there are demands for development of a foam recovery device that can appropriately remove the foam 4 floating on the surface of desulfurized used seawater by separating and collecting the foam 4 from the desulfurized used seawater for draining only the used seawater, that is, not containing foam 4, into the surrounding sea area and also for development of a foam recovery system provided with such a foam recovery device.

The present invention has been made under these circumstances, and an object of the present invention is to provide a foam recovery device that can collect foam floating on the surface of desulfurized used seawater and drain only the foam-free used seawater into the surrounding sea area, as well as a foam recovery system including such a foam recovery device.

[0007]

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

A first aspect of the present invention provides a foam recovery device installed in a seawater treatment system for draining used seawater discharged from a desulfurization tower of an exhaust gas desulfurizer using seawater as an absorbent and configured to remove foam floating on the surface of used seawater by separating and collecting the foam.

The foam recovery device has a flotation structure in which the entire device is held floating in the seawater treatment system; and the flotation structure includes a foam-scooping portion configured to remove foam floating on the surface of seawater by separating the foam from the seawater and a concave storage portion configured to collect the foam separated and removed by the foam-scooping portion.

[0008]

In such a foam recovery device, the entire device is held floating in a seawater treatment system by the flotation structure that includes the foam-scooping portion for removing foam floating on the water surface by separating the foam from seawater and the concave storage portion for collecting the foam separated and removed by the foam-scooping portion. Consequently, the foam-scooping portion is always held at approximately the same height relative to the water surface by a buoyant force even if the water level of the used seawater

flowing in the seawater treatment system changes. Therefore, foam can be reliably separated from used seawater by holding the foam-scooping portion at the boundary position between the foam and the water surface and is thereby collected in the concave storage portion.

[0009]

A second aspect of the present invention provides a foam recovery system including a foam recovery device installed in a seawater treatment system for draining used seawater discharged from a desulfurization tower of an exhaust gas desulfurizer using seawater as an absorbent and configured to remove foam floating on the surface of used seawater by separating and collecting the foam.

The foam recovery device has a flotation structure in which the entire device is held floating in the seawater treatment system, and the flotation structure includes a foam-scooping portion configured to remove foam floating on the surface of seawater by separating the foam from the seawater and a concave storage portion configured to collect the foam separated and removed by the foam-scooping portion; a foam treatment device configured to dehydrate and dry the collected foam; and a suction and conveying device configured to suck the collected foam from the concave storage portion and convey the foam to the foam treatment device.

[0010]

Such a foam recovery system has a configuration including the foam recovery device having the flotation structure in which the entire device is held floating in the seawater treatment system, where the flotation structure has the foam-scooping portion for removing foam floating on the water surface by separating the foam from seawater and the concave storage portion for collecting the foam separated and removed by the foam-scooping portion; the foam treatment device for dehydrating and drying the collected foam by the foam-scooping portion; and the suction and conveying device for sucking the collected foam from the concave storage portion of the foam recovery device and conveying the foam to the foam treatment device. Consequently, foam can be reliably separated from the used seawater with the foam-scooping portion by holding the foam-scooping portion at the boundary position between the foam and the water surface by a buoyant force, and is thereby collected in the concave storage portion. The foam collected in the concave storage portion is conveyed to the foam treatment device by the suction and conveying device and is then dehydrated and dried to be separated into a foam component and a seawater component.

[0011]

According to the present invention above-described, foam is appropriately removed from the surface of the used seawater, which is discharged from a desulfurization tower and

then flows in a seawater treatment system to be drained, by separating and collecting the foam from the used seawater. Therefore, only used seawater, free of foam, is drained into the surrounding sea area. Consequently, the problems of scenery destruction and environmental pollution due to foam floating on the sea surface can be avoided.

BRIEF DESCRIPTION OF DRAWINGS

[0012]

[Fig. 1A] Fig. 1A is a diagram illustrating a foam recovery device and a foam recovery system according to an embodiment of the present invention, showing a configuration in which land-based facilities are illustrated, as well as a cross-section of the foam recovery device;

[Fig. 1B] Fig. 1B is a plan view of the foam recovery device of Fig. 1A, illustrating a foam recovery device and a foam recovery system according to an embodiment of the present invention; and

[Fig. 2] Fig. 2 is a side view illustrating a conventional device.

Explanation of Reference Signs:

[0013]

1: seawater treatment system

4: foam

10: foam recovery system

13: conveying device

14: foam treatment device

20: foam recovery device

21: front float

22: back float

23: foam-scooping portion

23a: end

24: concave storage portion

BEST MODE FOR CARRYING OUT THE INVENTION

[0014]

An embodiment of a foam recovery device and a foam recovery system according to the present invention will now be described with reference to the drawings.

A foam recovery system 10 shown in Figs. 1A and 1B, which is installed in a seawater treatment system (SWTS) 1 for draining used seawater, includes a foam recovery device 20 that removes foam 4 floating on the surface of used seawater by separating the foam 4 from the used seawater and collecting it. This foam recovery device 20 has a flotation structure in which the entire device is held floating in the seawater treatment system 1 by a buoyant force. In the configuration shown in the drawings, a front float 21 at the upstream side and a back float 22 at the downstream side are disposed in

series in the flow direction (shown by arrows F in the drawings) of the used seawater flowing in the seawater treatment system 1. The aforementioned used seawater is, for example, desulfurized used seawater discharged from a desulfurization tower of an exhaust gas desulfurizer (seawater desulfurizer) that uses seawater as an absorbent.

[0015]

In the flotation structure of the foam recovery device 20, a foam-scooping portion 23 for removing the foam 4 floating on the seawater surface by separating the foam 4 from the seawater is provided on the front float 21, and a concave storage portion 24 for collecting the foam 4 separated and removed with the foam-scooping portion 23 is provided between the front float 21 and the back float 22.

The foam recovery device 20 is a floating body having a width dimension approximately the same as the width W of the seawater treatment system 1 and is fixed so that the foam recovery device 20 cannot be forced to move from a predetermined position in the seawater treatment system 1 by the flow of water, while being able to move vertically by a buoyant force. That is, the foam recovery device 20 with the flotation structure can move in the vertical direction according to a change in the water level in the seawater treatment system 1, but is supported at a predetermined position so as not to move in the flow direction of used

seawater flowing in the seawater treatment system 1.

[0016]

The foam-scooping portion 23 is disposed at the upstream side of the foam recovery device 20 in the flow direction of used seawater. This foam-scooping portion 23 is a section having an end 23a with a sharp-edged cross-section extending over approximately the entire width of the flotation structure. The position of the end 23a in the height direction is approximately the same as the level of the seawater surface or slightly lower than the level of the seawater surface, that is, under the water.

The concave storage portion 24 is a space for storing foam and is rectangular in plan view, corresponding to the shape of the seawater treatment system 1. This concave storage portion 24 is a concave space with an open top face in which the front, back, right, and left wall faces are formed by the wall face 21a of the front float 21, the wall face 22a of the back float 22, and a pair of side walls 24a and 24b connecting the front float 21 and the back float 22, respectively, and the bottom face is closed off by connecting the lower portions of these front, back, right, and left wall faces.

[0017]

The foam recovery system 10 includes a conveying passage composed of piping 11 having one end in the concave storage

portion 24 and a flexible tube 12 interposed at an appropriate position of the piping 11. The conveying passage conveys the foam 4, collected in the concave storage portion 24 of the foam recovery device 20 structured as described above, for treatment. The other end of the piping 11 forming the conveying passage is connected to a suction and conveying device 13, and a foam treatment device 14 is disposed at the discharge side of the suction and conveying device 13.

[0018]

The suction and conveying device 13 described above may be a pump such as an ejector pump or a vacuum pump.

The foam treatment device 14 may use a centrifuge for dehydrating collected foam 4 to separate it into a foam component and seawater. The separated seawater is drained into the surrounding sea area, and the foam component is dried into a solid. This solid is reused in the facilities or buried underground.

That is, in addition to the foam recovery device 20 disposed in the seawater treatment system 1 and having a flotation structure (water-base facilities), the foam recovery system 10 also includes the ground-based facilities having the suction and conveying device 13 and the foam treatment device 14. The suction and conveying device 13 sucks the foam 4 collected in the concave storage portion 24 and conveys it to the foam treatment device 14, and the foam treatment device 14

dehydrates and dries the foam 4.

[0019]

Next, the functions of the foam recovery device 20 and the foam recovery system 10, having the structures described above, will be described together with a treatment process for collecting foam.

Desulfurized used seawater drained from a desulfurization tower flows in the seawater treatment system 1 in the direction shown by the arrow F. The foam 4 floats on the surface of the used seawater flowing in the seawater treatment system 1. When the foam 4 reaches the foam recovery device 20, the end 23a of the foam-scooping portion 23 enters the boundary portion between the used seawater and the foam 4 to separate them. The positional relation between the foam-scooping portion 23 and the surface of the used seawater is maintained approximately constant by the flotation structure of the foam recovery device 20, even if the water level changes.

[0020]

As a result, the used seawater is led along the bottom face of the front float 21 and thus flows under the foam recovery device 20. On the other hand, the foam 4 flows on the top face of the foam-scooping portion 23 and then falls into and is collected in the concave storage portion 24 disposed at the downstream side of the foam-scooping portion

23.

The foam 4 collected in the concave storage portion 24 is sucked by driving the suction and conveying device 13 and is conveyed to the foam treatment device 14 through the piping 11 and the flexible tube 12. The flexible tube 12 allows the piping 11 to move according to the vertical movement of the foam recovery device 20 due to a change in the water level.

[0021]

The foam 4 thus conveyed to the foam treatment device 14 is separated into seawater and a foam component. The separated seawater, free of foam, is drained into the surrounding sea area, and the separated foam component is dried into a solid and reused in the facilities or buried underground at an appropriate place.

Therefore, the foam 4 can be appropriately removed by separating and collecting it from the surface of the used seawater drained from a desulfurization tower and flowing in the seawater treatment system 1 for draining the used seawater. Accordingly, only the used seawater, that is, not containing the foam 4, can be drained into the surrounding sea area, and the problems of scenery destruction and environmental pollution caused by foam floating on the sea surface can be avoided.

[0022]

The foam recovery device 20 and the foam recovery system

10 described above may be provided for each desulfurization tower that drains used seawater. Alternatively, a single seawater treatment system 1 may receive used seawater drained from a plurality of desulfurization towers.

The present invention is not limited to the aforementioned embodiments and can be variously modified within the scope of the present invention.

CLAIMS

1. A foam recovery device installed in a seawater treatment system for draining used seawater discharged from a desulfurization tower of an exhaust gas desulfurizer using seawater as an absorbent and configured to remove foam floating on the surface of used seawater by separating and collecting the foam, wherein

the foam recovery device has a flotation structure in which the entire device is held floating in the seawater treatment system; and

the flotation structure includes a foam-scooping portion configured to remove foam floating on the surface of seawater by separating the foam from the seawater and a concave storage portion configured to collect the foam separated and removed by the foam-scooping portion.

2. A foam recovery system comprising:

a foam recovery device installed in a seawater treatment system for draining used seawater discharged from a desulfurization tower of an exhaust gas desulfurizer using seawater as an absorbent and configured to remove foam floating on the surface of used seawater by separating and collecting the foam, wherein

the foam recovery device has a flotation structure in

which the entire device is held floating in the seawater treatment system, and the flotation structure includes a foam-scooping portion configured to remove foam floating on the surface of seawater by separating the foam from the seawater and a concave storage portion configured to collect the foam separated and removed by the foam-scooping portion;

a foam treatment device configured to dehydrate and dry the collected foam; and

a suction and conveying device configured to suck the collected foam from the concave storage portion and convey the foam to the foam treatment device.