

Description
ASH DISCHARGER

Field of the Invention

5 [0001]

The present invention relates to an ash discharger that cools and discharges incinerated ash.

Background of the Invention

10 [0002]

Conventionally, in a waste disposal facility (e.g., an incinerator plant) provided with a waste incinerator (e.g., a stoker incinerator), an ash discharger is generally disposed in order to cool and to discharge ash (e.g., incinerated ash or incineration residue) after incineration. The ash discharger receives
15 incinerated ash dropped from an ash chute connected to the incinerator at an introduction port and cools the incinerated ash with water stored in the ash discharger. Then, the ash discharger discharges the cooled ash from a discharge port with a scraper. Further, although the pressure inside the incinerator including the ash chute is negative, the flow of air from the
20 discharge port to the introduction port of the ash discharger is blocked because the ash discharger has a water seal structure. In the ash discharger, in order to maintain the water seal structure, water is supplied from a water injection pipe based on a water level gauge.

[0003]

25 Incidentally, the waste to be incinerated in the incinerator may contain metallic aluminum. The main component of the incinerated ash is alkaline in a wet state. Thus, when alkali solution and the metallic aluminum chemically react with each other in the ash discharger, a combustible gas such as hydrogen may be generated. Further, when high-temperature incinerated ash comes into
30 contact with the water stored in the ash discharger, a steam gas is generated. These gases may cause the failure of the ash discharger and peripheral equipment.

Therefore, an ash discharger has been developed in which gas such as a combustible gas and steam generated inside the ash discharger are discharged
35 toward an ash chute having a negative pressure through a gas vent pipe (see Patent Document 1).

Citation List

Patent Literature

[0004]

Patent Document 1: JP 6906122 B

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Summary of Invention

Issue to be solved by the Invention

[0005]

However, in the ash discharger of Patent Document 1, incinerated ash sticks to the vicinity of a connecting portion between the ash chute and the gas vent pipe, depending on the properties of the incinerated ash and the operating conditions of the ash discharger. Then, it has been found that the sticking incinerated ash grows to a state in which blockage of the connecting portion may occur.

Therefore, an object of the present invention is to provide an ash discharger that can prevent the blockage and sufficiently perform degassing with a simple configuration.

Solution to the Issue

[0006]

An ash discharger according to the present invention includes a cooling bath including an introduction port being connected to an ash chute through which incinerated ash is discharged from an incinerator having a negative pressure, and a discharge port to discharge the incinerated ash cooled by stored water,

a scraper disposed in the cooling bath and pushing out the incinerated ash to the discharge port,

a drive device to drive the scraper inside a room for the drive device, which is on an opposite side to the discharge port with respect to the introduction port,

a water level gauge disposed in the room for the drive device and to detect a water level of the stored water in the cooling bath,

a water injection pipe to increase the stored water in the cooling bath, based on the water level detected by the water level gauge,

a gas vent pipe connected to the ash chute and the room for the drive device, and

a first water spraying nozzle connected to the water injection pipe to spray water to the gas vent pipe.

The gas vent pipe includes

a first passage portion continuously ascending from the room for the drive device,

a second passage portion connected to the first passage portion and continuously descending from a connecting portion at which the second

5 passage portion is connected with the first passage portion, and

an enlarged-diameter portion connected to a side surface of the ash chute and the second passage portion, including a lower end continuously descending

from a connection portion with the second passage portion toward the ash chute, and including an opening having a cross-sectional area larger than a

10 cross-sectional area of the second passage portion and communicating with the side surface of the ash chute.

The first water spraying nozzle is able to simultaneously spray water to both the first passage portion and the second passage portion.

15 Advantageous Effects of the Invention

[0007]

According to the ash discharger of the present invention, the enlarged-diameter portion is disposed between the second passage portion and the ash chute. Because the flow velocity of gas flowing from the second passage
20 portion toward the ash chute is reduced at the enlarged-diameter portion, the generation of a gas vortex, which is considered to be a cause of the growth of the incinerated ash sticking to the vicinity of the ash chute and the enlarged-diameter portion, is reduced, and the growth of the sticking incinerated ash can be suppressed.

25 Further, the first passage portion has a shape ascending from the room for the drive device, the second passage portion has a shape descending from the first passage portion, and the enlarged-diameter portion has a shape in which the lower end thereof continuously descends from the second passage portion toward the ash chute. Thus, by spraying water from the first water
30 spraying nozzle capable of simultaneously spraying water to both the first passage portion and the second passage portion, the incinerated ash sticking to the enlarged-diameter portion as well as to the first passage portion and the second passage portion can be washed away by the sprayed water. In other words, the incinerated ash, which can be a starting point of the growth, can be
35 removed.

Therefore, it is possible to provide an ash discharger that can prevent the above-described blockage and perform sufficient degassing with a simple configuration including at least the first passage portion, the second passage

portion, the enlarged-diameter portion, and the first water spraying nozzle, because the effect of reducing the gas vortex by the shape of the enlarged-diameter portion and the effect of washing by the first water spraying nozzle act in a synergistic manner.

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Brief Description of Drawings

[0008]

FIG. 1 is a cross-sectional view of an ash discharger according to an embodiment.

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FIG. 2 illustrates an ZY plan view (FIG. 2(1)) illustrating a shape of an opening which is a connecting portion between the ash chute and the gas vent pipe in FIG. 1, and an enlarged view (FIG. 2(2)) of a configuration around the gas vent pipe in FIG. 1.

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Description of Embodiments of the Invention

[0009]

An embodiment of an ash discharger of the present invention will be described below with reference to FIGS. 1 and 2. In these drawings, an orthogonal coordinate system including an X-axis, a Y-axis, and a Z-axis is used as appropriate for convenience of description. The embodiment is merely an example, and there is no intention to exclude various modifications and applications of techniques that are not explicitly described. Except for configurations essential to the present invention, each configuration of the embodiment can be selected or variously modified as necessary.

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Here, first, the outline of the configuration of an ash discharger 1 excluding the configuration around a gas vent pipe 18 in FIG. 1 (i.e., the configuration surrounded by dash-dotted line in FIG. 1) will be briefly described with reference to FIG. 1, and then, the configuration around the gas vent pipe 18 surrounded by the dash-dotted line will be described in detail with reference to FIG. 2.

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[0010]

FIG. 1 is a cross-sectional view schematically illustrating a configuration of the ash discharger 1 according to the embodiment. Thus, a part of the configuration around the gas vent pipe 18 illustrated in FIG. 2 (i.e., the configuration surrounded by the dash-dotted line in FIG. 1), and for example, a flange and the like are omitted in FIG. 1.

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The ash discharger 1 includes a cooling bath 2 in which stored water for cooling incinerated ash is stored at a predetermined water level (e.g., a broken

line in FIG. 1), and a scraper 3 and a drive device 4 disposed in the cooling bath 2. The cooling bath 2 is provided with an introduction port 5 from which the incinerated ash is introduced and a discharge port 6 from which the cooled incinerated ash is discharged.

5 A bottom plate of the cooling bath 2 includes a first inclined surface 2a that is inclined upward from immediately below the introduction port 5 toward the discharge port 6 (specifically, a lower end of the discharge port 6 in the vertical direction), and a second inclined surface 2b that is inclined upward from immediately below the introduction port 5 toward an opposite side to the
10 first inclined surface 2a. Thus, the lowest part of the bottom plate of the cooling bath 2 is immediately below the introduction port 5, and the bottom plate has a curved surface shape that is convex downward. The cross-sectional shape of the cooling bath 2 is uniform in the width direction, and the width dimensions of the first inclined surface 2a and the second inclined
15 surface 2b (the dimensions in the direction orthogonal to the paper surface of FIG. 1, i.e., the dimensions in the Y-axis direction) are all the same.
[0011]

The incinerated ash, discharged from the discharge port 6, drops from a discharge chute 7 having a tubular shape connected to the discharge port 6,
20 onto a conveying device 8 such as a conveyor. By conveying the incinerated ash with the conveying device 8, the incinerated ash is finally conveyed to the outside of the incinerator plant.

The stored water and liquid to be sprayed from a water injection pipe 12 and water spraying nozzles (19, 20, 21) installed at the gas vent pipe 18, which
25 will be described below, may be any liquid whose main component is water, and may be tap water, industrial water, recycled water (which has been used in a plant and then treated), or may be mixed water neutralized by mixing hydrochloric acid or the like. Hereinafter, these liquids used as the stored water will be simply referred to as "water".

30 [0012]

The introduction port 5 of the cooling bath 2 is formed of a wall surface (i.e., side wall, side surface) having a tubular shape (e.g., a rectangular tube shape). The side wall having a tubular shape is directly connected to the ash chute 9 having a rectangular tube shape. The upper end of the ash chute 9 is
35 connected to an incinerator (not illustrated) (e.g., a post-incineration stage of a stoker incinerator).

In order to form a so-called "water seal" configuration, the lower end of the side surface of the introduction port 5 is located below the predetermined water level of the stored water in the cooling bath 2.

5 The scraper 3 is a device that pushes out the cooled incinerated ash toward the discharge port 6. The scraper 3 includes an upper plate 3a facing upward, a push-out plate 3b facing the discharge port 6, and both side plates connected to the upper plate 3a and the push-out plate 3b (a side plate 3c which is one side plate of the two side plates is illustrated in FIG. 1). Because no lower plate corresponding to the upper plate 3a is disposed, the scraper 3 has a
10 box-like shape open toward the bottom plate of the cooling bath 2.

The scraper 3 is connected to an arm 4b to be described below and performs "forward movement" and "backward movement" along the bottom plate, while the lower end of the push-out plate 3b (i.e., the leading end of the scraper 3) is in contact with the bottom plate of the cooling bath 2 over the
15 entire width of the bottom plate.

The "forward movement" of the scraper 3 means that the scraper 3 is moved by the drive device 4 in a direction of pushing out the incinerated ash toward the discharge port 6 (i.e., the -X-axis direction in FIG. 1). In addition, the "backward movement" of the scraper 3 means that the scraper 3 is moved
20 by the drive device 4 in a direction opposite to the "forward movement" (i.e., the +X-axis direction in FIG. 1). Further, the "entire width" of the bottom plate of the cooling bath 2 means a dimension of the interior of the cooling bath 2 in a width direction (i.e., the Y-axis direction in FIG. 1).

[0013]

25 The drive device 4 is a device that drives the scraper 3, and is disposed in a room 10 for the drive device located on an opposite side to the discharge port 6 with respect to the introduction port 5. The room 10 for the drive device is partitioned from the outside of the room 10 by a side wall on the most +X-axis direction side among the side walls of the introduction port 5, the
30 second inclined surface 2b on the +X-axis direction side of the side wall, and a ceiling plate 10a.

The drive device 4 is disposed at a position which is located above the second inclined surface 2b, and is not immersed in the stored water (i.e., above the "predetermined water level"). The drive device 4 includes a drive shaft 4a
35 that is rotatable in two directions, and the arm 4b connecting the scraper 3 and the drive shaft 4a. The drive device 4 drives the arm 4b by rotating the drive shaft 4a, and as a result, causes the scraper 3 connected to the arm 4b to

perform reciprocating movement which is going forward and backward repeatedly.

[0014]

5 The amount of the stored water in the cooling bath 2 is regulated by a control device 13 that controls the injection of water from the water injection pipe 12 into the cooling bath 2, based on the measurement data of a water level gauge 11 disposed in the room 10 for the drive device, and by a drainage pipe 14, so as to be maintained at the "predetermined water level". In FIGS. 1 and 2, in addition to a main water injection pipe 12a, three water injection pipes 10 (12b, 12c, 12d) are illustrated as the water injection pipe 12, and these three water injection pipes will be described below. The main water injection pipe 12a penetrates the ceiling plate 10a and is fixed to the ceiling plate 10a.

15 The water level gauge 11 measures a water level of water (i.e., stored water) stored in the cooling bath 2 and transmits measurement data to the control device 13. The water level gauge 11 is inserted downward from the ceiling plate 10a and fixed thereto.

The control device 13 controls the opening and the closing of a solenoid valve 16 interposed in the middle of a water distribution pipe 15 including one end connected to the water injection pipe 12, based on the measurement data 20 regarding a water level (e.g., an actual water level which is an actual water level of the stored water stored in the cooling bath 2) received from the water level gauge 11. The other end of the water distribution pipe 15 is connected to a water source.

Here, a water storage tank 17 is exemplified as the water source, but the 25 water source is not limited thereto, and the other end may be directly connected to a water line (e.g., a water supply, an intermediate water supply, or the like) which is the water source. Although the solenoid valve 16 is provided at the water distribution pipe 15, the solenoid valve 16 may be provided at the water injection pipe 12 instead of the water distribution pipe 15.

30 [0015]

When the measurement data received from the water level gauge 11 indicates that the water level of the stored water is lower than a threshold value (e.g., the predetermined water level), the control device 13 opens the solenoid valve 16 to inject water from the water injection pipe 12 into the cooling bath 2. 35 When the measurement data indicates that the water level of the stored water is equal to or higher than the threshold value, the control device 13 closes the solenoid valve 16 to stop water injection to the cooling bath 2.

The drainage pipe 14 is a pipe that drains the stored water when the water level of the stored water exceeds the predetermined water level. An opening at the upper end of the drainage pipe 14 is arranged above and near the predetermined water level. Thus, the excessive stored water automatically overflows to be drained from the drainage pipe 14 without valve control.

[0016]

The configuration around the gas vent pipe 18 surrounded by the dashed line in FIG. 1 will be described in detail with reference to FIG. 2.

The gas vent pipe 18 is a pipe that automatically guides a gas having an atmospheric pressure, such as a combustible gas or steam generated in the room 10 for the drive device, to the ash chute 9 by utilizing the ash chute 9 having a negative pressure (i.e., a pressure lower than the atmospheric pressure).

Because the gas, discharged from the gas vent pipe 18 to the ash chute 9, is led from the ash chute 9 to the above-described incinerator, the failure of the ash discharger 1 due to the gas can be prevented.

As described above, because the ash discharger 1 has a water seal structure, there is no passage other than the gas vent pipe 18 through which the gas escapes from the room 10 toward the ash chute 9.

[0017]

The gas vent pipe 18 includes at least three components: (1) a first passage portion 18a including one end connected to a gas vent pipe connecting portion 10b disposed at the ceiling plate 10a of the room 10 for the drive device, and continuously ascending from the gas vent pipe connecting portion 10b; (2) a second passage portion 18b including one end connected to the other end of the first passage portion 18a or the vicinity of the other end, and continuously descending from a connecting portion with the first passage portion 18a; and (3) an enlarged-diameter portion 18c connected to a side wall (i.e., side surface) of the ash chute 9 and to the other end of the second passage portion 18b, including a lower end continuously descending from a connecting portion with the second passage portion 18b toward the ash chute 9, and including an opening having a cross-sectional area larger than a cross-sectional area of the second passage portion 18b and being formed to communicate with the side wall of the ash chute 9.

[0018]

The gas vent pipe connecting portion 10b is a member for airtightly connecting the through-hole formed in the ceiling plate 10a of the room 10 for the drive device to the one end of the first passage portion 18a. FIG. 2 illustrates a configuration in which a flange of the gas vent pipe connecting

portion 10b and a flange of the one end of the first passage portion 18a are fastened by bolts and nuts via an O-ring or a gasket. Similarly, FIG. 2 also illustrates a configuration in which the connection between the enlarged-diameter portion 18c and the second passage portion 18b is made by fastening
 5 respective flanges by bolts and nuts via an O-ring or a gasket. The first passage portion 18a and the second passage portion 18b are integrally formed in a substantially V-shape or a substantially X-shape, and by unfastening the flanges at both ends (i.e., the flanges connecting the first passage portion 18a and the gas vent pipe connecting portion 10b, and the flanges connecting the
 10 second passage portion 18b and the enlarged-diameter portion 18c), the integrally formed portion of the gas vent pipe 18 can be removed, which facilitates periodic maintenance and cleaning.

The side wall (i.e., side surface) of the ash chute 9 and the enlarged-diameter portion 18c may be fixed to each other by welding or the like via the
 15 opening.

[0019]

FIG. 2(1) is a diagram as viewed in the direction of the arrow A in FIG. 2(2). On the YZ plane, the opening through which the enlarged-diameter portion 18c and the side wall of the ash chute 9 communicate with each other is
 20 a rectangular opening. Because the opening has a rectangular shape, it is easy to make the enlarged-diameter portion 18c and to cut a through-hole for the opening in the side wall of the ash chute 9. However, depending on the design, the opening may have a shape other than a rectangular shape, such as a non-rectangular polygon, a circle, or an ellipse. When the opening has a
 25 shape other than a rectangular shape, the enlarged-diameter portion 18c is also formed into a pipe shape such as a truncated pyramid or a truncated conical shape corresponding to the opening, instead of a pipe having a truncated quadrangular pyramid shape with a rectangular cross section.

Because the configuration of the gas vent pipe 18 is as described above,
 30 the area on the ZY plane of the opening communicating between the enlarged-diameter portion 18c and the side wall of the ash chute 9 is naturally larger than the area of the cross-section of the second passage portion 18b perpendicular to the central axis of the second passage portion 18b. For example, the area of the opening on the ZY plane can be about ten times larger than the area of the
 35 second passage portion 18b.

[0020]

Here, the velocity of the gas passing through the first passage portion 18a and the second passage portion 18b is as high as about 10 m/sec, and thus

if the second passage portion 18b is directly connected to the side wall (i.e., side surface) of the ash chute 9, the gas discharged from the second passage portion 18b to the interior of the ash chute 9 produce a vortex in the vicinity of the directly connected portion. This vortex is considered to be a cause of the growth of fine incinerated ash sticking to the vicinity.

However, in the ash discharger 1, the enlarged-diameter portion 18c is disposed between the second passage portion 18b and the side wall (i.e., side surface) of the ash chute 9, and the cross-sectional area of the gas flow path on the ZY plane is gradually increased as the gas flows in the -X-axis direction by the enlarged-diameter portion 18c. Accordingly, the flow velocity of the gas discharged from the second passage portion 18b within the enlarged-diameter portion 18c is rapidly reduced. Thus, it is possible to reduce the occurrence of the above-described vortex in the vicinity of the opening where the enlarged-diameter portion 18c and the side wall of the ash chute 9 communicate with each other. As a result, the growth of the incinerated ash in the vicinity can be suppressed.

[0021]

In FIG. 2, the first passage portion 18a of the gas vent pipe 18 is formed of a straight pipe having a central axis along the Z-axis direction (i.e., vertical direction). The second passage portion 18b of the gas vent pipe 18 is formed of a straight pipe inclined downward (in the -Z-axis direction) from the connecting portion with the first passage portion 18a toward the -X-axis direction (a straight pipe inclined by about 15° from the X-axis on the XZ plane). The enlarged-diameter portion 18c of the gas vent pipe 18 is formed of a truncated pyramid-shaped pipe whose lower end is inclined downward (i.e., in the -Z-axis direction) from the connecting portion with the second passage portion 18b toward the -X-axis direction (e.g., a truncated pyramid-shaped pipe inclined by about 45° from the X-axis on the XZ plane).

The upper end of the enlarged-diameter portion 18c extends constantly along the X-axis from the connecting portion with the second passage portion 18b toward the -X-axis direction. That is, the upper end of the enlarged-diameter portion 18c, in other words, the upper surface of the above-described truncated pyramid-shaped pipe is horizontal (i.e., parallel to the XY plane (which is a horizontal plane)).

[0022]

In FIG. 2, the first passage portion 18a has been described as a straight pipe having a central axis along the Z-axis direction, but the first passage portion 18a may be a straight pipe having a central axis inclined from the Z-

axis or a curved pipe having a curvature, as long as the first passage portion 18a has a continuously descending shape with no horizontal portion (i.e., a shape without a portion at which the gradient is inverted, that is, a U-shaped or V-shaped portion at which a downward gradient is changed to an upward gradient) from the connecting portion with the second passage portion 18b to the gas vent pipe connecting portion 10b.

Similarly, in FIG. 2, the second passage portion 18b has been described as a straight pipe, but the second passage portion 18b may be a straight pipe having a central axis inclined from the X-axis or a curved pipe having a curvature, as long as the second passage portion 18b has a continuously descending shape with no horizontal portion (i.e., a shape without a portion at which the gradient is inverted, that is, a U-shaped or V-shaped portion at which a downward gradient is changed to an upward gradient) from the connecting portion with the first passage portion 18a to the enlarged-diameter portion 18c.

Further, in FIG. 2, the upper end of the enlarged-diameter portion 18c has been described as being horizontal, but the upper end may continuously ascend toward the ash chute 9 in order to further increase the area of the opening communicating between the enlarged-diameter portion 18c and the side wall of the ash chute 9 for further suppression of the generation of the vortex of the gas flow. In other words, the upper end may have a shape inclined upward (i.e., in the +Z-axis direction) toward the -X-axis direction. In addition, because the cross-sectional area of the enlarged-diameter portion 18c on the YZ plane only needs to gradually increase toward the -X-axis direction, depending on the design, the upper end may continuously descend toward the ash chute 9 at a gentler angle than the above-described lower end. In other words, the upper end may have a shape inclined downward (i.e., in the -Z-axis direction) toward the -X-axis direction at a gentler angle (for example, about 10° from the X-axis on the XZ plane) than the lower end.

[0023]

A water spraying nozzle is disposed at the gas vent pipe 18. In FIG. 2, three water spraying nozzles (i.e., a first water spraying nozzle 19, a second water spraying nozzle 20, and a third water spraying nozzle 21) are disposed. These nozzles will be described below one after another.

First, the first water spraying nozzle 19 is a nozzle that is disposed in the vicinity of the connecting portion between the first passage portion 18a and the second passage portion 18b, and that can simultaneously spray water or simultaneously inject water to both the first passage portion 18a and the second passage portion 18b. As the first water spraying nozzle 19, it is desirable to

use a wide-angle nozzle whose spray pattern is widened as being away from a spray port, such as a full-conical nozzle, an empty-conical nozzle, or a fan-shaped nozzle.

[0024]

5 A water injection pipe 12b, that supplies water to the first water spraying nozzle 19, is connected to either one of the water distribution pipe 15 located downstream of the solenoid valve 16 and the main water injection pipe 12a located downstream of the solenoid valve 16. Accordingly, when the control device 13 opens the solenoid valve 16, the first water spraying nozzle 19 sprays
10 or injects water.

 As described above, the first passage portion 18a has a continuously descending shape with no horizontal portion from the connecting portion with the second passage portion 18b to the gas vent pipe connecting portion 10b. The second passage portion 18b has a continuously descending shape with no
15 horizontal portion from the connecting portion with the first passage portion 18a to the enlarged-diameter portion 18c. The enlarged-diameter portion 18c has a shape in which the lower end thereof continuously descends from the connecting portion with the second passage portion 18b to the ash chute 9.

 Accordingly, the entire amount of the water sprayed or injected by the
20 first water spraying nozzle 19 flows into the cooling bath 2 without staying in the middle of each of the first passage portion 18a, the second passage portion 18b, and the enlarged-diameter portion 18c.

[0025]

 Because the gas flowing through the gas vent pipe 18 contains particles
25 of the incinerated ash, it is necessary to clean the gas vent pipe 18 at an appropriate time in order to prevent the blockage of the pipe passage by the incinerated ash deposited on the first passage portion 18a, the second passage portion 18b, and the enlarged-diameter portion 18c. According to the ash discharger 1, it is possible to simultaneously wash the first passage portion 18a,
30 the second passage portion 18b, and the enlarged-diameter portion 18c, because of reliably injecting water into the cooling bath 2 by the first water spraying nozzle 19, during the operation of the ash discharger 1. Thus, the frequency of the periodic maintenance of the ash discharger 1 can be reduced.

 Further, particles of the incinerated ash sticking to the enlarged-diameter
35 portion 18c and the side wall of the ash chute 9 in the vicinity of the opening, that is, the incinerated ash, which can be the starting point of the growth described above, can be washed away with the water sprayed or injected from the first water spraying nozzle 19.

Thus, the effect of washing the incinerated ash by the first water spraying nozzle 19 and the effect of suppressing the growth of the incinerated ash by the shape of the enlarged-diameter portion 18c act in a synergistic manner to extremely effectively prevent the blockage of the opening, and to prevent the blockage of the pipe passage inside the gas vent pipe 18, and therefore, the gas such as a combustible gas and steam in the room 10 for the drive device can be sufficiently discharged and the failure of the ash discharger 1 can be prevented.

[0026]

Next, the second water spraying nozzle 20 is a nozzle that is fixed to the upper surface of the enlarged-diameter portion 18c and that can spray or inject water downward (i.e., toward -Z-axis direction). In order to wash the bottom surface and the side surfaces of the enlarged-diameter portion 18c, it is desirable to use, as the second water spraying nozzle 20, a wide-angle nozzle whose spray pattern is widened as being away from a spray port, such as a full-conical nozzle, an empty-conical nozzle, or a fan-shaped nozzle.

A water injection pipe 12c, that supplies water to the second water spraying nozzle 20, is connected to any one of the water distribution pipe 15 located downstream of the solenoid valve 16, the water injection pipe 12b for the first water spraying nozzle 19 located downstream of the solenoid valve 16, and the main water injection pipe 12a located downstream of the solenoid valve 16. Accordingly, when the control device 13 opens the solenoid valve 16, the second water spraying nozzle 20 sprays or injects water.

As in the case of the first water spraying nozzle 19, the entire amount of the water sprayed or injected by the second water spraying nozzle 20 flows into the cooling bath 2.

[0027]

Finally, the third water spraying nozzle 21 is a nozzle that is fixed above the second passage portion 18b and that can spray or inject water obliquely toward the lower surface of the enlarged-diameter portion 18c. In order to efficiently wash the lower surface of the enlarged-diameter portion 18c, it is desirable to use a fan-shaped nozzle as the third water spraying nozzle 21. In the case where the third water spraying nozzle 21 is a fan-shaped nozzle, when water is sprayed or injected from the third water spraying nozzle 21, the spray pattern is linear in the YZ plane (i.e., substantially planar in a three-dimensional view), and thus the particles of the incinerated ash sticking to the lower surface of the enlarged-diameter portion 18c can be efficiently washed away.

A water injection pipe 12d, that supplies water to the third water spraying nozzle 21, is connected to any one of the water distribution pipe 15 located downstream of the solenoid valve 16, the water injection pipe 12b for the first water spraying nozzle 19 located downstream of the solenoid valve 16, the water injection pipe 12c for the second water spraying nozzle 20 located downstream of the solenoid valve 16, and the main water injection pipe 12a located downstream of the solenoid valve 16. Accordingly, when the control device 13 opens the solenoid valve 16, the third water spraying nozzle 21 sprays or injects water.

As in the case of the first water spraying nozzle 19 and the second water spraying nozzle 20, the entire amount of the water sprayed or injected by the third water spraying nozzle 21 flows into the cooling bath 2.

[0028]

The ash discharger 1 of the embodiment has been described above. In FIGS. 1 and 2, the first water spraying nozzle 19, the second water spraying nozzle 20, and the third water spraying nozzle 21 are installed in the gas vent pipe 18, but the second water spraying nozzle 20 and the third water spraying nozzle 21 may be appropriately installed in accordance with the state of deposition and growth of the incinerated ash. That is, there may be a case where only the first water spraying nozzle 19 is installed in the gas vent pipe 18 and neither the second water spraying nozzle 20 nor the third water spraying nozzle 21 is installed, or a case where only one of the second water spraying nozzle 20 and the third water spraying nozzle 21 is installed in the gas vent pipe 18 in addition to the first water spraying nozzle 19.

In FIGS. 1 and 2, the main water injection pipe 12a is installed in the ash discharger 1. However, because water is injected into the cooling bath 2 by at least the first water spraying nozzle 19, the main water injection pipe 12a does not necessarily have to be installed in the ash discharger 1. When the main water injection pipe 12a is installed in the ash discharger 1, the water injection amount of the main water injection pipe 12a may be set to be larger than that of the other water injection pipes (12b, 12c, 12d).

Reference Signs List

[0029]

1 Ash discharger

2 Cooling bath

(2a First inclined surface of bottom plate of cooling bath, 2b Second inclined surface of bottom plate of cooling bath)

- 3 Scraper
 - (3a Upper plate of scraper, 3b Push-out plate of scraper, 3c Side plate of scraper)
- 4 Drive device
- 5 (4a Drive shaft of drive device, 4b Arm of drive device)
- 5 Introduction port
- 6 Discharge port
- 7 Discharge chute
- 8 Conveying device
- 10 9 Ash chute
- 10 Room for drive device
 - (10a Ceiling plate, 10b Gas vent pipe connecting portion)
- 11 Water level gauge
- 12 Water injection pipe
- 15 (12a Main water injection pipe,
 - 12b Water injection pipe for first water spraying nozzle,
 - 12c Water injection pipe for second water spraying nozzle,
 - 12d Water injection pipe for third water spraying nozzle)
- 13 Control device
- 20 14 Drainage pipe
- 15 Water distribution pipe
- 16 Solenoid valve
- 17 Water storage tank
- 18 Gas vent pipe
- 25 (18a First passage portion, 18b Second passage portion, 18c Enlarged-diameter portion)
- 19 First water spraying nozzle
- 20 Second water spraying nozzle
- 21 Third water spraying nozzle
- 30

Claims

[Claim 1]

- An ash discharger comprising
- 5 a cooling bath including an introduction port being connected to an ash chute through which incinerated ash is discharged from an incinerator having a negative pressure, and a discharge port to discharge the incinerated ash cooled by stored water,
- a scraper disposed in the cooling bath and pushing out the incinerated
- 10 ash to the discharge port,
- a drive device to drive the scraper inside a room for the drive device, which is on an opposite side to the discharge port with respect to the introduction port,
- a water level gauge disposed in the room for the drive device and to
- 15 detect a water level of the stored water in the cooling bath,
- a water injection pipe to increase the stored water in the cooling bath, based on the water level detected by the water level gauge,
- a gas vent pipe connected to the ash chute and the room for the drive device, and
- 20 a first water spraying nozzle connected to the water injection pipe to spray water to the gas vent pipe,
- wherein the gas vent pipe includes
- a first passage portion continuously ascending from the room for the drive device,
- 25 a second passage portion connected to the first passage portion and continuously descending from a connecting portion at which the second passage portion is connected with the first passage portion, and
- an enlarged-diameter portion connected to a side surface of the ash chute and the second passage portion, including a lower end continuously descending
- 30 from a connection portion with the second passage portion toward the ash chute, and including an opening having a cross-sectional area larger than a cross-sectional area of the second passage portion and communicating with the side surface of the ash chute, and
- wherein the first water spraying nozzle is able to simultaneously spray
- 35 water to both the first passage portion and the second passage portion.

[Claim 2]

The ash discharger according to claim 1, further comprising

a water distribution pipe including one end connected to a water storage tank or a water supply and another end connected to the water injection pipe, a solenoid valve disposed at the water distribution pipe or the water injection pipe, and

- 5 a control device to control an opening degree of the solenoid valve, based on the water level detected by the water level gauge, wherein the control device closes the solenoid valve, when the water level detected is equal to or higher than a threshold value, and wherein the control device opens the solenoid valve, when the water level detected is lower than the threshold value to spray water from the first water spraying nozzle.

[Claim 3]

- 15 The ash discharger according to claim 2, further comprising either one or both of

a second water spraying nozzle disposed at or near an upper end of the enlarged-diameter portion, connected to the water injection pipe, and to spray water downward when the solenoid valve is open and

- 20 a third water spraying nozzle disposed at the second passage portion, connected to the water injection pipe, and to spray water toward the enlarged-diameter portion when the solenoid valve is open.

[Claim 4]

- 25 The ash discharger according to claim 3, wherein the opening has a polygonal shape, a circular shape, or an elliptical shape.

[Claim 5]

- 30 The ash discharger according to any one of claims 1 to 4, wherein one end of the enlarged-diameter portion is welded to the side surface of the ash chute, and another end of the enlarged-diameter portion is formed with a flange, wherein a ceiling plate of the room for the drive device is formed with a through-hole, and a gas vent pipe connecting portion connected to the through-hole and provided with a flange, 35 wherein the first passage portion and the second passage portion are integrally formed, and

wherein an interior of the room for the drive device and the opening
communicate with each other through the gas vent pipe by connecting a flange
of the first passage portion to the flange of the gas vent pipe connecting portion
and by connecting a flange of the second passage portion to the flange of the
5 enlarged-diameter portion.