

DESCRIPTION

Title of Invention

ASH EXTRUSION DEVICE

[Technical Field]

[0001]

The present invention relates to an ash extrusion device that cools and discharges incinerated ash (incineration residue).

[Background Art]

[0002]

In the related art, an incinerator plant is known as a plant for incinerating incineration objects such as waste. In an incinerator (for example, a stoker furnace) inside the plant, ash (incinerated ash) generated by burning the incinerating object is dropped from an ash chute to an ash extrusion device, and is cooled by stored water inside the ash extrusion device. Thereafter, the ash is discharged to a conveyance device from the ash extrusion device. The ash extrusion device is provided with a scraper (also called a "pusher") that extrudes the incinerated ash cooled by the stored water to the discharge port. The scraper reciprocates in a forward direction toward the discharge port side and a rearward direction opposite to the forward

direction to extrude the incinerated ash inside the stored water.

[0003]

Incidentally, in a general ash extrusion device, the incinerated ash tends to be accumulated after entering a back side lower portion of the scraper due to reciprocating motion of the scraper. In this way, the incinerated ash entering a space existing in a direction opposite to an extrusion direction of the incinerated ash is also called "return ash". When the amount of accumulated return ash increases, driving of the scraper is hindered, thereby causing a possibility that the incinerated ash may not be extruded from the discharge port.

[0004]

Therefore, an ash extrusion device has been developed which can reduce and suppress the amount of return ash with a simple structure. For example, in Patent Document 1, a straight pipe (first pipe) long in the vertical direction is arranged in a space (second space) in which return ash can be deposited, and gas is ejected from a jetting port at a lower end of the pipe, whereby the accumulation of return ash is prevented by a water flow of the stored water in the cooling tank and bubbles caused by the gas. Further, in Patent Document 2, in addition to the pipe (first pipe) having a jetting port connected to the lower end portion of

the cylindrical wall surface through which the incinerated ash is introduced, by providing the same pipe (second pipe) the same as Patent Document 1, accumulation of return ash can be more effectively suppressed.

[Citation List]

[Patent Document]

[0005]

[Patent Document 1] Japanese Patent No. 6718563

[Patent Document 2] Japanese Patent No. 6752988

[Summary of Invention]

[Technical Subject]

[0006]

The first pipe provided in the ash extrusion device of Patent Document 1 and the second pipe provided in the ash extrusion device of Patent Document 2 are both inserted from openings provided over the respective drive units originally provided in the ash extrusion devices and fixed to the portions over the drive units while being brought into contact with the bottom plates of the ash extrusion devices, so that the pipes are disposed with ease. However, since the pipes are long in the vertical direction, when the ash extrusion devices are stopped and the insides of the ash extrusion devices are cleaned or inspected, there is a possibility of causing inconvenience such as a time required for cleaning or checking by hindering the movement of a

person, or erroneously damaging the pipes by a person, and therefore there is room for improvement.

The present invention has been devised in view of the above-described subject, and an object of the present invention is to provide an ash extrusion device which can reduce and suppress the amount of return ash with a simple structure, and eliminates inconvenience in cleaning or checking.

[Subject to be solved]

[0007]

According to the present invention, there is provided an ash extrusion device including a cooling tank including an introduction port having a cylindrical wall surface through which incinerated ash is introduced and a discharge port that discharges the incinerated ash cooled by stored water; a scraper that is disposed inside the cooling tank, that has a tip being in contact with a total width of a bottom surface of the cooling tank, and that extrudes the incinerated ash to a discharge port side; a drive device that is disposed on a side opposite to the discharge port with respect to the introduction port and that drives the scraper; and a drainage pipe that drains out the stored water when the stored water inside the cooling tank exceeds a predetermined water level above a lower end of the wall surface and below the discharge port. The bottom surface of

the cooling tank includes a first inclined surface inclined upward from a portion directly below the introduction port toward an opening end where the discharge port is formed, and a second inclined surface having a width the same as a width of the first inclined surface and inclined upward from a portion directly below the introduction port toward a side opposite to the first inclined surface. The drive device includes a drive shaft disposed above the second inclined surface, and causes the scraper to reciprocally move forward and rearward along the bottom surface by an arm connected the scraper to the drive shaft in response to rotation of the drive shaft. The ash extrusion device further includes: a first pipe including a first pipe tip portion that is airtightly provided at a position out of contact with the scraper and the arm and below the predetermined water level so as to penetrate the second inclined surface of the cooling tank and that jets a gas from a first jetting port toward a region between the second inclined surface and the scraper, a connection pipe coupled to the first pipe tip portion at an outside of the cooling tank, and a straight pipe coupled to the connection pipe; a first gas supplying device that supplies the gas to the first pipe; a first flange that is fixed to an outer surface of the cooling tank; and a second flange that airtightly covers to the first flange. The first pipe tip portion is airtightly

fixed to the second flange and that is integrated with the second flange. The second flange and the first pipe tip portion have a plurality of candidates different in angle of fixing the first pipe tip portion to the second flange. The second flange and the first pipe tip portion are replaced with one of the plurality of candidates that integrates the second flange and the first pipe tip portion at the angle of fixing suitable for a property of the incinerated ash. Return ash to be accumulated on the second inclined surface side is stirred by a water flow of the stored water generated by the gas jetted from the first jetting port and bubbles generated by the gas.

[Advantageous Effects of Invention]

[0008]

According to the ash extrusion device of the present invention, it is possible to reduce and suppress the amount of return ash with a simple structure. In addition, since the first pipe is not present inside the cooling tank except for the first pipe tip portion, it is possible to solve the inconvenience in cleaning or checking the inside of the ash extrusion device.

[Brief Description of Drawings]

[0009]

Fig. 1 is a sectional view of an ash extrusion device according to an embodiment.

Fig. 2 is an enlarged view (sectional view cut along Arrow B-B of Fig. 3) showing the main part of the ash extrusion device of Fig. 1.

Fig. 3 is a diagram seen from the direction of Arrow A of Fig. 2.

Fig. 4 is a diagram showing the same cross section as that of Fig. 2 and illustrating the attaching structure of a first pipe tip portion of the ash extrusion device of Fig. 1.

Fig. 5 is an enlarged schematic top view illustrating an installing position of a first flange of the ash extrusion device of Fig. 1.

[Description of Embodiments]

[0010]

Hereinafter, an ash extrusion device as an embodiment will be described. The embodiment described below is a merely example, and there is no intention of excluding applications of various modifications or techniques which are not specified in the following embodiment. Respective configurations of the present embodiment can be modified and implemented in various ways within the scope not departing from the concepts. In addition, the respective configurations except for the configuration essential to the present invention can be selected when necessary, or can be appropriately combined with each other.

[0011]

As described in the background art, when the amount of accumulated "return ash" increases, driving of a scraper is hindered, thereby causing a possibility that incinerated ash may not be extruded from a discharge port. Therefore, as will be described below, adopting a simple structure in which the first pipe is disposed outside the cooling tank and in which the tip (first pipe tip portion) of the first pipe for jetting the gas toward a region between the second inclined surface of the cooling tank and the scraper penetrates the cooling tank, the ash extrusion device of the present embodiment solves the inconvenience caused when cleaning and checking while suppressing the deposition of the return ash.

[0012]

First, description will be made in relation to the overall configuration of the ash extrusion device and then the main configuration of the ash extrusion device. The overall configuration of the ash extrusion device 1 shown in Fig. 1 is the same as the overall configuration of the ash extrusion device 1 described in Patent Document 2. In the following description, like reference numbers designate the same or similar configurations between the present invention and Patent Document 2, and a detailed description of the configuration is omitted here. Further, in the drawings,

for the sake of convenience of explanation, description will appropriately use an orthogonal coordinate system consisting of an X axis, a Y axis, and a Z axis. The X-axis direction is forward and rearward directions of a scraper 3 to be described below. The Y-axis direction is a width direction of a cooling tank 2 to be described below. The Z-axis direction is the vertical direction.

[0013]

[1. Overall Configuration]

As illustrated in Fig. 1, an ash extrusion device 1 of the present embodiment is provided in an incinerator (for example, a stoker furnace). The incinerated ash generated in the incinerator is cooled in a cooling tank 2, and thereafter, is discharged to a conveyance device 19 (for example, a conveyor). The ash extrusion device 1 has the cooling tank 2 in which stored water for cooling the incinerated ash is stored, and a scraper 3 and a drive device 4 which are disposed inside the cooling tank 2. The cooling tank 2 is provided with an introduction port 21 defined by a cylindrical (for example, rectangular cylindrical) wall surface 20 through which the incinerated ash is introduced, and a discharge port 22 that discharges the incinerated ash cooled by the stored water. The lower end of the wall surface 20 is positioned below a predetermined water level (broken line in Fig. 1) of the

stored water in the cooling tank 2.

[0014]

A bottom surface 23 of the cooling tank 2 is provided with a first inclined surface 23a which is inclined upward from a bottom surface part (hereinafter referred to as a "lowest surface 23c") directly below the introduction port 21 toward the discharge port 22 (specifically, an opening end 23d at the vertical lower end of the discharge port 22), and a second inclined surface 23b which is inclined upward from the part directly below the introduction port 21 toward the opposite side of the first inclined surface 23a. The bottom surface 23 of the cooling tank 2 has a curved surface shape protruding downward, and the cross-sectional shape of the cooling tank 2 is uniform in the width direction. The width dimensions of the first inclined surface 23a, the lowest surface 23c, and the second inclined surface 23b are all the same.

[0015]

The scraper 3 is a device that extrudes the cooled incinerated ash to a discharge port 22 side. The scraper 3 includes an upper surface 3a facing upward, an extrusion surface 3b facing the discharge port 22 side, and both side surfaces (not illustrated), and has a box shape open to a bottom surface 23 side of the cooling tank 2. The scraper 3 moves forward and rearward along the bottom surface 23 while

a lower end (that is, a tip 3c of the scraper 3) of the extrusion surface 3b comes into contact with a total width of the bottom surface 23 of the cooling tank 2.

[0016]

The drive device 4 is a device that drives the scraper 3, and is disposed on the opposite side of the discharge port 22 (the right side in Fig. 1) with respect to the introduction port 21. The drive device 4 includes a drive shaft 40 that is disposed above the second inclined surface 23b and that is rotatable in two directions, and an arm 41 that connects the scraper 3 to the drive shaft 40. When the drive shaft 40 rotates, the drive device 4 causes the arm 41 to reciprocally move the scraper 3 forward and rearward along the bottom surface 23.

Forward moving means that the scraper 3 moves in a direction of extruding the incinerated ash to the discharge port 22 side (left direction in Fig. 1, forward direction "Df"), and rearward moving means that the scraper 3 moves in a opposite direction to the direction of the forward moving (direction in which the scraper 3 returns, right direction in Fig. 1, and rearward direction "Dr"). In addition, the total width means a size in a width direction (direction orthogonal to the paper surface in Fig. 1) inside the cooling tank 2.

[0017]

The ash extrusion device 1 includes a water level gauge 11 that detects the water level of the stored water in the cooling tank 2, and a water injection pipe 8 that is installed above and near to the water level gauge 11 and that pours water according to the water level detected by the water level gauge 11 to increase the stored water in the cooling tank 2.

The water level gauge 11 is, for example, arranged above the second inclined surface 23b, and is arranged at a position between a rear end of the scraper 3 when the scraper 3 is moved the most rearward (in Fig. 1, a state indicated by the two-dot chain line) and a wall surface 20 (a rear wall 20R) in which an opening hole to be described below is formed. This enables accurate detection of the water level.

Further, the water injection pipe 8 is disposed, for example, in the forward direction "Df" side than the rear end of the scraper 3 when the scraper 3 is moved the most rearward. As a result, the water level gauge 11 can timely be cleaned with the poured water from the water injection pipe 8.

[0018]

The predetermined water level of the stored water in the cooling tank 2 is set to be above the lower end of the wall surface 20 and below the discharge port 22 for the

purpose of water sealing. The stored water in the cooling tank 2 is controlled to be maintained at this predetermined water level. For example, the control device 10 controls the opening and closing of an electromagnetic valve 82 interposed in the middle of the water injection pipe 8 on the basis of the water level detected by the water level gauge 11. Further, the cooling tank 2 is provided with a drainage pipe 12 that drains out the stored water when the water level of the stored water exceeds the predetermined water level.

[0019]

In addition to the opening and closing control of the electromagnetic valve 82 described above, the control device 10 controls ejection of a gas from a first jetting port 50 of a first pipe 5 and ejection of a gas from a second jetting port 60 of a second pipe 6 to be described below. Further, the control device 10 controls the drive device 4.

[0020]

The cooling tank 2 is substantially divided into three spaces in the forward and rearward directions of the scraper 3. Specifically, the spaces include a space (fire extinguishing/humidifying space 24) directly below the introduction port 21 (above the lowest surface 23c), a space (first space 25) located above the first inclined surface

23a, and a space (second space 26) located above the second inclined surface 23b.

The fire extinguishing/humidifying space 24 is a space in which the incinerated ash is introduced from the introduction port 21, and the incinerated ash is humidified while being extinguished and cooled. The first space 25 is a space in which the incinerated ash pressed by the scraper 3 is continuously humidified, the water content in the incinerated ash located above the predetermined water level is removed, and the incinerated ash is dried to such an extent that the incinerated ash is not solidified. The second space 26 is a space in which the drive device 4, the water injection pipe 8, the drainage pipe 12, and the water level gauge 11 are disposed. In addition, in a state where the scraper 3 is moved rearward most (state indicated by a two-dot chain line in Fig. 1), most of the scraper 3 is located inside the second space 26.

[0021]

As enlarged in Fig. 1, a gap "G" through which a space (fire extinguishing/humidifying space 24) directly under the introduction port 21 and a space (second space 26) above the second inclined surface 23b communicate with each other is provided between the upper surface 3a of the scraper 3 and the lower end portion 20b of the rear wall 20R (i.e., the wall surface of the wall surface 20 facing a discharge port

22 side surface (i.e., the front wall 20F)). The gap "G" is secured even in a state in which the scraper 3 moves the most forward (state indicated by a solid line in Fig. 1).

The stored water flows through the gap "G" in a direction opposite to the reciprocating motion of the scraper 3. That is, when the scraper 3 moves rearward, the stored water passes through the gap "G" in the forward direction "Df" and flows from the second space 26 to the fire extinguishing/humidifying space 24, and when the scraper 3 moves forward, the stored water passes through the gap "G" in the rearward direction "Dr" and flows from the fire extinguishing/humidifying space 24 to the second space 26.

[0022]

[2. Main Configuration]

When the scraper 3 reciprocally moves, a water flow is generated in the stored water, and the incinerated ash immersed in the stored water enters the second space 26 from the gap "G" together with the stored water, and can become the return ash accumulated in the second space 26. The ash extrusion device 1 is characterized by a configuration that inhibits return ash entering the second space 26 from being accumulated and returns the return ash to the fire extinguishing/humidifying space 24 through the gap "G" and

also by a solution to the inconvenience when being cleaned or checked.

[0023]

Specifically, the ash extrusion device 1 includes the first pipe 5 including a first pipe tip portion 5A that jets a gas toward a region between the second inclined surface 23b and the scraper 3, a connection pipe 5B connected to the first pipe tip portion 5A at an outside of the cooling tank 2, and a straight pipe 5C connected to the connection pipe 5B. The first pipe tip portion 5A is airtightly installed so as to penetrate the second inclined surface 23b of the cooling tank 2 at a position out of contact with both the scraper 3 and the arm 41 which reciprocally move and also below the predetermined water level. Incidentally, the scraper 3 is provided over substantially the total width of the cooling tank 2, while arms 41 are arranged to be spaced apart from one another in the width direction, the first pipe tip portion 5A is arranged at a position not overlapping the arm 41 in the width direction.

[0024]

At one end of the first pipe tip portion 5A, a first jetting port 50 that ejects (jets) the gas is provided. The ash extrusion device 1 includes a first compressor 51 (first gas supplying device) provided at the other end of the first pipe 5. The ash extrusion device 1 stirs the return ash to

be accumulated on the second inclined surface 23b side by the water flow of the stored water generated by the gas jetted from the first jetting port 50 and the bubbles formed by the gas. A first electromagnetic valve 52, which is controlled to be opened and closed by the control device 10, is interposed in the middle of the first pipe 5 (for example, in the straight pipe 5C).

[0025]

The gas ejected from the first jetting port 50 is compressed air compressed by the first compressor 51. Instead of the compressed air, the exhaust gas of the incinerator that generates the incinerated ash may be jet from the first jetting port 50. In this case, it is sufficient that, instead of or in addition to the first compressor 51, an introduction pipe for introducing the exhaust gas from the exhaust gas duct of the incinerator to the other end of the first pipe 5 is connected. This means that the first gas supplying device is not limited to the first compressor 51.

[0026]

Next, description will now be made in relation to the peripheral configuration of the first pipe tip portion 5A. As shown in Figs. 2 to 4, the ash extrusion device 1 further includes a first flange 53 that is in the form of a doughnut and that is seal-welded to an outer face of the cooling tank

2, and a second flange 54 that airtightly covers to the first flange 53. The first pipe tip portion 5A is a straight pipe that is airtightly fixed to the second flange 54. Under a state where the second flange 54 is airtightly fixed to the first flange 53, the first pipe tip portion 5A is arranged to extend horizontally.

[0027]

The second inclined surface 23b (the bottom plate of the ash extrusion device 1) is provided with a through hole 23h through which the first pipe tip portion 5A is inserted. The first flange 53 is in the form of a disk and doughnut, and are seal-welded to the outer face of the second inclined surface 23b while aligning the doughnut-shaped hole with the through hole 23h.

Note that the seal-welding means welding for the purpose of sealing. The black-painted parts shown by reference number 56 in Figs. 2 and 4 are welded portions subjected to seal-welding.

[0028]

The second flange 54 is a disk having the same diameter as the first flange 53 and serves as a lid that closes the doughnut-shaped hole of the first flange 53, and is airtightly fixed to the first flange 53. The first flange 53 is provided with bolt inserting hole 53h (one shown in Fig. 4) of a female thread structure into which fastening

bolt 55 is screwed. In addition, the second flange 54 is provided with a bolt inserting hole 54h (one shown in Fig. 4) which is a simple through hole. Although Fig. 3 illustrates a configuration in which the first flange 53 and the second flange 54 are fixed to each other by four bolts 55, the number of bolts 55 is not limited to four. Further, the shapes of the flanges 53 and 54 are not limited to the disks, and do not have to be the same in diameter as each other as far as the flanges can be airtightly fixed to each other.

[0029]

The first pipe tip portion 5A penetrates the second flange 54 and is seal-welded to the second flange 54, so that the second flange 54 and the first pipe tip portion 5A are integrated in advance. The first pipe 5 of the present embodiment is composed of the first pipe tip portion 5A integrated with the second flange 54, a straight pipe 5C disposed in a path avoiding other devices and the like, and a connection pipe 5B capable of airtightly connecting the first pipe tip portion 5A and the straight pipe 5C. The number of the connection pipes 5B and the number the straight pipes 5C may each be one, or two or more. Further, in order to avoid other devices and the like, as shown in Fig. 3, when being connected to the first pipe tip portion 5A, the connection pipe 5B may be inclined by a

predetermined angle θ (e.g., 45 degrees) with respect to the Z-axis direction when seen from the direction of the X axis.

As shown in Fig. 4, the first pipe tip portion 5A integrated with the second flange 54 is inserted into the doughnut-shaped hole of the first flange 53 and the through hole 23h of the bottom surface 23, and is airtightly fixed by bolt-screwing two flanges 53 and 54 while sandwiching a gasket (not shown).

[0030]

The shape of the first pipe tip portion 5A at the first jetting port 50 is a bamboo spear shape that forms an acute angle from the lower end toward the upper end. When the two flanges 53 and 54 are airtightly fixed and the ash extrusion device 1 is driven, the return ash may move along the bottom surface 23 of the ash extrusion device 1 toward the first pipe tip portion 5A. To deal with such the return ash, since the first jetting port 50 has a bamboo spear shape (a shape in which the lower jaw further than the upper jaw in the case of a human mouth), the incinerated ash that has moved along the bottom surface 23 moves between the lower side of the lower jaw and the bottom surface 23 (a space indicated by reference number "S" in Fig. 2), so that the first jetting port 50 is less likely to be closed.

[0031]

Here, although this description assumes the

configuration in which the first pipe tip portion 5A is fixed so as to extend horizontally, candidates for a variety of angles of fixing of the first pipe tip portion 5A to the second flange 54 may be prepared. Since the second flange 54 with the first pipe tip portion 5A can be easily replaced, it is sufficient to use one of the candidates for an angle that can bring a large effect to reduce the amount of return ash, for example, according to the property of the incinerated ash. Further, the shape of the first jetting port 50 of the first pipe tip portion 5A is not limited to the bamboo spear shape described above. Alternatively, the shape may be changed according to the fixed angle of the first pipe tip portion 5A.

[0032]

The number of the first pipes 5 provided in the ash extrusion device 1 may be increased or decreased depending on the size of the ash extrusion device 1. That is, depending on the type of the ash extrusion device 1, the first pipe 5 may be installed in only one point, or the first pipes 5 may be installed in two or more points. If the first pipes 5 are installed in the cooling tank 2, these first pipes 5 are preferably arranged in width direction (Y-axis direction) of the cooling tank 2 at regular intervals. For example, as shown in Fig. 5, two first flanges 53 may be welded between the operation ranges of the two arms 41, and

the first pipe 5 may be connected to each first flange 53. Alternatively, the amount of return ash at the outside position of the width direction of the operation range of the arm 41 may be decreased by welding another first flange 53 to this outside position and connecting the first pipe 5 to the flange 53. Each of the first pipes 5 is provided with the first compressor 51 and the first electromagnetic valve 52.

[0033]

If the first flanges 53 are installed in the cooling tank 2, the corresponding second flanges 54 and the corresponding first pipes 5 are installed to the respective first flanges 53. In this case, the control device 10 may control the timings of the ejection of the gas from the first jetting ports 50 of the first pipe tip portions 5A protruded from the respective first flanges 53. The control device 10 may eject gas from the first jetting ports 50 concurrently or at time intervals. For example, when two of the first jetting ports 50 are provided, the gas may be alternately jetted. Since the water flow changes between the case where the gas is jetted concurrently and the case where the gas is jetted at time intervals, the control device 10 may perform a control that can achieve a larger effect in reducing the amount of the return ash in accordance with the property and the amount of the

incinerated ash. The control device 10 ejects gas from the first jetting port 50 at least when the scraper 3 moves rearward. However, the control device 10 may have a configuration in which the gas is constantly ejected regardless of the motion of the scraper 3.

[0034]

As shown in Fig. 1, the ash extrusion device 1 further includes the second straight pipe 6 disposed from one end (lower end) to the other end (upper end) at a position above the second inclined surface 23b and at a portion out of contact with the scraper 3 and the arm 41 that reciprocally move. The one end of the second pipe 6 is disposed below the predetermined water level, and is provided with a second jetting port 60 that ejects the gas introduced from the other end. On the other end of the second pipe 6, a second compressor 61 (second gas supplying device) is provided. The gas ejected from the second pipe 6 is compressed air compressed by a second compressor 61 or the exhaust gas of the incinerator.

[0035]

The shape of the one end of the second pipe 6 is an L-shape having a corner portion bent in the substantially horizontal direction. The second jetting port 60 is connected to an opening hole formed on the lower end portion 20b of the wall surface (i.e., the rear wall 20R, partial

wall surface), which a part of the wall surface 20 located above the second inclined surface 23b. The opening hole is a hole or a notch that penetrates the wall surface 20 in the thickness direction thereof at the lower end portion 20b, and the opening hole preferably has a shape to which the second jetting port 60 can be fitted. The second jetting port 60 is inserted into the opening hole from a surface facing the outer side (toward the second space 26) of the rear wall 20R, and is fixed at a position where the tip of the second jetting port 60 coincides with a surface facing the inner side (toward the fire extinguishing/humidifying space 24) of the rear wall 20R.

[0036]

The ash extrusion device 1 causes the stored water to flow through the gap "G" between the lower end portion 20b of the wall surface 20 and the upper surface 3a of the scraper 3 by the water flow of the stored water generated by the gas ejected from the second jetting port 60 and the bubble formed by the gas. More specifically, by arranging the second pipe 6 in the above manner, the gas is jetted from the second jetting port 60 in the vicinity of the gap "G", and the water flow of the stored water generated by the gas and the bubbles generated by the gas are bounced from the incinerated ash accumulated on the upper surface 3a of the scraper 3. In this manner, the incinerated ash staying

around the gap "G" and the floating incinerated ash (floating ash) are stirred.

[0037]

In detail, in the ash extrusion device 1, first, the water flow of the stored water generated by the gas jetted from the second jetting port 60 and the bubbles generated by the gas scrape off the incinerated ash accumulated on the upper surface 3a of the scraper 3. Then the bubbles bounced from the accumulated incinerated ash and flowing into the vicinity of the gap "G" separates the incinerated ash adhering around the gap "G", and due to the water flow bounced from the accumulated incinerated ash and flowing into the vicinity of the gap "G", the separated incinerated ash and the incinerated ash to be accumulated in this gap are pushed to flow.

Therefore, since the gap "G" is prevented from being closed by the incinerated ash, the stored water including the return ash can be effectively discharged from the second space 26 to the fire extinguishing/humidifying space 24, in response to the reciprocating motion of the scraper 3.

[0038]

[3. Action and Effect]

(1) According to the ash extrusion device 1 of the present embodiment, the water flow and bubbles generated by the gas jetted from the first jetting port 50 in the

vicinity of the second inclined surface 23b move in the forward direction "Df" between the second inclined surface 23b and the scraper 3, eventually slow down and gently hit on the extrusion surface 3b or the upper surface 3a of the scraper 3 facing the discharge port 22 to splash back or swirl without hitting. Therefore, the return ash accumulated in the second space 26 (e.g., accumulated on the second inclined surface 23b, accumulated on the back side of the scraper 3) is peeled off by the bubbles of the gas, and the return ash to be deposited in the second space 26 as well as the peeled return ash is stirred by the water flow.

[0039]

In other words, the return ash accumulated in the second space 26 is peeled off, and the return ash is stirred by the gas ejected from the first jetting port 50 before the return ash in the second space 26 is accumulated on the second inclined surface 23b. Eventually a state (fluidity state) that the return ash is mixed in the stored water is kept. Therefore, the ash extrusion device 1 can easily discharge the return ash from the second space 26. Further, in the ash extrusion device 1, the return ash is pushed up to the water surface from the vicinity of the back side of the scraper 3 or the second inclined surface 23b by the buoyancy of the bubbles and is then dispersed. Also by this action, the ash extrusion device 1 can further easily

discharge the return ash from the second space 26.

[0040]

The return ash stirred in the second space 26 is discharged from the gap "G" to the fire extinguishing/humidifying space 24 together with the stored water on the water flow generated by the reciprocating motion of the scraper 3. Accordingly, the ash extrusion device 1 can reduce and suppress the amount of the return ash with a simple structure.

Further, the first pipe 5, which is not present inside the cooling tank 2 except for the first pipe tip portion 5A, can eliminate inconvenience caused when the inside of the ash extrusion device 1 is cleaned or checked, for example, consuming time for cleaning and checking because the pipe disposed inside the ash extrusion device 1 hinders the movement of the person, or erroneously damaging the pipes by a person.

[0041]

Since the first pipe tip portion 5A is airtightly fixed to the second flange 54 and integrated with the second flange 54 and the second flange 54 is configured to airtightly cover the first flange 53 seal-welded to the outer surface of the cooling tank 2, the first pipe tip portion 5A can be airtightly provided so as to penetrate the cooling tank 2.

By arranging the first pipe tip portion 5A so as to extend in the horizontal direction, the gas from the first jetting port 50 is ejected in the direction away from the second inclined surface 23b. For the above, the gas ejected from the first jetting port 50 would not damage the second inclined surface 23b by, for example, cutting the second inclined surface 23b.

[0042]

By providing the first flanges 53 to the cooling tank 2 and also providing the second flange 54 with the first pipe tip portion 5A to each of the first flanges 53, the accumulation of the return ash can be further suppressed over a wide range of the cooling tank 2.

Further, by ejecting gas from the first pipe tip portions 5A concurrently or at time intervals, the control device 10 can generate an appropriate water flow that can deal with the property of the incinerated ash to effectively reduce and suppress the amount of the return ash. In addition, by adopting a configuration that ejects gas instead of a liquid, it is possible to reduce and suppress the amount of the return ash without affecting the liquid amount of the stored water.

[0043]

The shape of the above first pipe tip portion 5A at the first jetting port 50 is a bamboo spear shape that forms an

acute angle from the lower end toward the upper end. By devising the shape in this way, it is possible to prevent the first jetting port 50 from being closed by the incinerated ash that has moved along the bottom surface 23, and it is possible to reduce or prevent the clogging of the first pipe 5 due to the return ash.

[0044]

The ash extrusion device 1 is also provided with a second pipe 6. The gas jetted into the stored water through the second pipe 6 is formed into bubbles while generating a water flow, and then the water flow accompanied by the bubbles flows into the vicinity of the gap "G" due to the above-described bounce. This can inhibit the incinerated ash from closing the gap "G", and consequently, it is possible to ensure the transfer of the stored water through the gap "G" accompanied by the reciprocating motion of the scraper 3. In other words, the return ash can be discharged from the gap "G" to the fire extinguishing/humidifying space 24 together with the stored water on the water flow generated by the reciprocating motion of the scraper 3. Therefore, it is possible to further enhance the effect of reducing and suppressing the amount of return ash with a simple structure. Further, by the water flow of the stored water generated by the ejected gas from the second jetting port 60 and the bubbles generated by the ejected gas, in

particular, by the bounded water flow and the bounded bubbles as described above, the incinerated ash (floating ash) floating on the water surface immediately under the introduction port 21 can be stirred and humidified so that arching which is the phenomenon that the floating ash is solidified on the water surface can be avoided.

[0045]

In addition, by appropriately installing the water injection pipe 8 and the water level gauge 11, the water level gauge 11 can be washed timely to reduce measurement errors. This can appropriately maintain the water level of the stored water in the cooling tank 2.

[0046]

The above-described ash extrusion device 1 is an example, and is not limited to the above-described configuration.

For example, in the ash extrusion device 1 of the above-described embodiment, the control device 10 may be configured to control not only the ejection timings but also the amount of the ejected gas.

[Reference Signs List]

[0047]

- 1: ash extrusion device
- 2: Cooling tank
- 3: Scraper

3a: Upper surface
3b: Extrusion surface
3c: Tip
4: Drive device
5: First pipe
5A: First pipe tip portion
5B: Connection pipe
5C: Straight pipe
6: Second pipe
8: Water injection pipe
10: Control device
11: Water level gauge
12: Drainage pipe
19: Conveyance device
20: Wall surface
20b: Lower end portion
20R: Rear wall
21: Introduction port
22: Discharge port
23: Bottom surface
23a: First inclined surface
23b: Second inclined surface
23c: Lowest surface
23d: Opening end
23h: Through hole

24: Fire extinguishing/humidifying space

25: First space

26: Second space

40: Drive shaft

41: Arm

50: First jetting port

51: First compressor (first gas supplying device)

52: First electromagnetic valve

53: First flange

53h: Bolt inserting hole

54: Second flange

54h: Bolt inserting hole

55: Bolt

56: Welded portion

60: Second jetting port

61: Second compressor (second gas supplying device)

62: Second electromagnetic valve

82: Electromagnetic valve

Df: Forward direction

Dr: Rearward direction

G: Gap

CLAIMS

[Claim 1]

An ash extrusion device comprising:

a cooling tank including an introduction port having a cylindrical wall surface through which incinerated ash is introduced and a discharge port that discharges the incinerated ash cooled by stored water;

a scraper that is disposed inside the cooling tank, that has a tip being in contact with a total width of a bottom surface of the cooling tank, and that extrudes the incinerated ash to a discharge port side;

a drive device that is disposed on a side opposite to the discharge port with respect to the introduction port and that drives the scraper; and

a drainage pipe that drains out the stored water when the stored water inside the cooling tank exceeds a predetermined water level above a lower end of the wall surface and below the discharge port,

wherein the bottom surface of the cooling tank includes a first inclined surface inclined upward from a portion directly below the introduction port toward an opening end where the discharge port is formed, and a second inclined surface having a width the same as a width of the first inclined surface and inclined upward from a portion directly

below the introduction port toward a side opposite to the first inclined surface,

the drive device includes a drive shaft disposed above the second inclined surface, and causes the scraper to reciprocally move forward and rearward along the bottom surface by an arm connected the scraper to the drive shaft in response to rotation of the drive shaft,

the ash extrusion device further comprises:

a first pipe including

a first pipe tip portion that is airtightly provided at a position out of contact with the scraper and the arm and below the predetermined water level so as to penetrate the second inclined surface of the cooling tank and that jets a gas from a first jetting port toward a region between the second inclined surface and the scraper,

a connection pipe coupled to the first pipe tip portion at an outside of the cooling tank, and

a straight pipe coupled to the connection pipe;

a first gas supplying device that supplies the gas to the first pipe;

a first flange that is fixed to an outer surface of the cooling tank; and

a second flange that airtightly covers to the first flange,

the first pipe tip portion is airtightly fixed to the

second flange and that is integrated with the second flange;

the second flange and the first pipe tip portion have a plurality of candidates different in angle of fixing the first pipe tip portion to the second flange,

the second flange and the first pipe tip portion are replaced with one of the plurality of candidates that integrates the second flange and the first pipe tip portion at the angle of fixing suitable for a property of the incinerated ash, and

return ash to be accumulated on the second inclined surface side is stirred by a water flow of the stored water generated by the gas jetted from the first jetting port and bubbles generated by the gas.

[Claim 2]

The ash extrusion device according to claim 1,

wherein a plurality of the first flanges are provided to the cooling tank; and

each of the first flanges is provided with the corresponding second flange and the corresponding first pipe.

[Claim 3]

The ash extrusion device according to claim 2, further comprising:

a control device that controls jetting of the gas jetted from the first jetting port,

wherein the gas is compressed air or exhausted gas of an incinerator that generates the incinerated ash, and

the control device jets, when at least the scraper moves rearward, the gas from the first jetting ports of the plurality of first pipes provided one to each of the plurality of first flanges concurrently or at time intervals.

[Claim 4]

The ash extrusion device according to claim 3,

wherein the first jetting port of the first pipe tip portion has a lower end projecting toward an extending direction of the first pipe tip portion further than an upper end thereof.

[Claim 5]

The ash extrusion device according to any one of claims 1 to 4, further comprising:

a water level gauge that detects a water level of the stored water in the cooling tank;

a water injection pipe that is disposed above and close to the water level gauge and that pours water according to the water level detected by the water level gauge to

increase the stored water in the cooling tank; and

a second pipe disposed from one end to the other end at a position above the second inclined surface and at a position out of contact the scraper and the arm that reciprocally move,

wherein the second pipe includes the one end which is disposed below the predetermined water level, and the one end is provided with a second jetting port which jets the gas introduced from the other end to the one end,

the second jetting port is connected to an opening hole formed in a lower end portion of a partial wall surface located above the second inclined surface in the wall surface,

the water level gauge is disposed at a position above the second inclined surface and between a rear end of the scraper when the scraper is moved the most rearward and the partial wall surface formed with the opening hole,

the water level gauge is washed with poured water from the water injection pipe,

the stored water is circulated in a gap between the lower end portion of the partial wall surface and an upper surface of the scraper by the water flow of the stored water generated by the gas jetted from the second jetting port and bubbles generated by the gas.