

DESCRIPTION

Title of Invention

ASH EXTRUSION DEVICE AND METHOD FOR REMODELING ASH
EXTRUSION DEVICE

[Technical Field]

[0001]

The present invention relates to an ash extrusion device and a method for remodeling an ash extrusion device.

[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, for example, as disclosed in Patent Document 1, the incinerated ash tends to be accumulated after entering a back side lower portion of the scraper due to a reciprocating operation of the scraper. In this way, the incinerated ash entering a space ("pusher waiting chamber 4" in Patent Document 1) 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, in the related art, the ash extrusion device is periodically cleaned to remove the return ash, or a structure of the pusher itself for extruding the incinerated ash is devised as in the ash extrusion device of Patent Document 1. In this manner, accumulation of the return ash is prevented.

[Citation List]

[Patent Document]

[0005]

[Patent Document 1] Japanese Unexamined Patent
Application Publication No. 2006-317110

[Summary of Invention]

[Technical Subject]

[0006]

However, the ash extrusion device cannot be cleaned at any time, since the incinerator needs to be stopped. In addition, it takes a lot of labor and time. In addition, as disclosed in Patent Document 1, according to a configuration in which the structure of the scraper itself is devised to prevent the accumulation of the return ash, the structure becomes complicated, and manufacturing costs increase.

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 that does not require frequent cleaning, has a simple structure, and can prevent accumulation of return ash, and a method by which a general ash extrusion device can be inexpensively remodeled to an ash extrusion device of the present invention.

[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 into which incinerated ash is introduced and a discharge port for discharging the incinerated ash cooled by stored water, a scraper disposed inside the cooling tank, a tip of which is in contact with a total width of a bottom surface of the cooling tank, and extruding the incinerated ash to a discharge port side, and a drive device disposed on a side opposite to the discharge port with respect to the introduction port, and driving the scraper. The bottom surface of the cooling tank includes a first inclined surface inclined upward from 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 directly below the introduction port toward a side opposite to the first inclined surface. The stored water is stored inside the cooling tank at a predetermined water level above a lower end of the wall surface and below the discharge port. The drive device includes a drive shaft disposed above the second inclined surface, and the drive shaft pivots so that an arm connected to the drive shaft and the scraper causes the scraper to reciprocate forward and rearward along the bottom surface. The ash extrusion device further has a first pipe disposed at a position from one end to the other end at a position above the second

inclined surface, which does not come into contact with the reciprocating scraper and the arm. The first pipe includes the one end which is disposed below the predetermined water level, and the one end is provided with a first jetting port which jets a gas introduced from the other end toward a region between the second inclined surface and the scraper. 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.

[0008]

According to the present invention, there is provided a method for remodeling an ash extrusion device including a cooling tank including an introduction port having a cylindrical wall surface into which incinerated ash is introduced and a discharge port for discharging the incinerated ash cooled by stored water, a scraper disposed inside the cooling tank, a tip of which is in contact with a total width of a bottom surface of the cooling tank, and extruding the incinerated ash to a discharge port side, and a drive device disposed on a side opposite to the discharge port with respect to the introduction port, and driving the scraper, in which the bottom surface of the cooling tank includes a first inclined surface inclined upward from 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 directly below the introduction port toward a side opposite to the first inclined surface, the stored water is stored inside the cooling tank at a predetermined water level above a lower end of the wall surface and below the discharge port, and the drive device includes a drive shaft disposed above the second inclined surface, and the drive shaft pivots so that an arm connected to the drive shaft and the scraper causes the scraper to reciprocate forward and rearward along the bottom surface. The method includes a step of disposing the pipe at a position above the second inclined surface, which does not come into contact with the reciprocating scraper and the arm, and a step of disposing one end of the pipe serving as a jetting port of the gas, below the predetermined water level and toward a region between the second inclined surface and the scraper.

[Advantageous Effects of Invention]

[0009]

According to the ash extrusion device of the present invention, the gas jetted into the stored water through the first pipe generates the water flow while forming the bubbles. Therefore, the return ash floating inside the stored water can be stirred by the water flow, and the

return ash starting to be accumulated on a back side of the scraper or the second inclined surface can be separated and stirred by the bubbles. The stirred return ash rides on the water flow generated by the reciprocating operation of the scraper, and is discharged together with the stored water to a space directly below the introduction port from a gap between the scraper and a lower end portion of the wall surface. Therefore, the accumulation of the return ash can be prevented with a simple structure. Since the accumulation of return ash can be prevented, frequent cleaning is not required.

[0010]

In addition, according to the method for remodeling the ash extrusion device of the present invention, a general ash extrusion device is completely remodeled as follows. The first pipe is disposed at a position which does not come into contact with the scraper and the arm, and the first jetting port provided in one end is installed toward a region between the second inclined surface and the scraper. That is, the general ash extrusion device can be remodeled without changing any major component such as the cooling tank, the scraper, and the drive device. Therefore, remodeling work can be simply carried out at low cost within a short construction period, and the ash extrusion device

which can prevent the accumulation of the return ash can be realized with a simple structure.

[Brief Description of Drawings]

[0011]

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

Fig. 2 is a sectional view illustrating a state where a scraper of the ash extrusion device illustrated in Fig. 1 is moved rearward.

Fig. 3 is a sectional view illustrating a state where the scraper of the ash extrusion device illustrated in Fig. 1 is moved forward.

Fig. 4 is a sectional view of an ash extrusion device according to a modification example.

[Description of Embodiments]

[0012]

Hereinafter, an ash extrusion device as an embodiment will be described, and a remodeling method thereof will be described with reference to the drawings. 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 configurations can be selected when necessary, or can be appropriately combined with each other.

[0013]

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 later, an ash extrusion device of the present embodiment prevents accumulation of the return ash by adopting a simple structure in which a pipe for jetting a gas toward a region between a second inclined surface and a scraper is provided in a second space. Hereinafter, an overall configuration of the ash extrusion device will be first described, and subsequently, a configuration for preventing the accumulation of the return ash will be described in detail.

[0014]

[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 11 (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 into which the incinerated ash is introduced and a discharge port 22 for discharging the cooled incinerated ash.

[0015]

The scraper 3 is a device that extrudes the cooled incinerated ash to the 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. 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 direction opposite to the forward direction (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.

[0016]

The drive device 4 is a device for driving the scraper 3, and is disposed on a side (right side in Fig. 1) opposite to the discharge port 22 with respect to the introduction port 21. The drive device 4 includes a drive shaft 40 which can pivot in two directions, and an arm 41 that connects the scraper 3 and the drive shaft 40. The drive shaft 40 pivots so that the drive device 4 causes the scraper 3 to reciprocate forward and rearward by using the arm 41.

[0017]

The introduction port 21 of the cooling tank 2 is formed on a cylindrical (for example, rectangular cylindrical) wall surface 20. The wall surface 20 is directly connected to an ash chute (not illustrated). An upper end of the ash chute is connected to an incinerator (for example, a post-combustion stage of a stoker furnace) (not illustrated). A lower end of the wall surface 20 is located below a predetermined water level (broken line in Fig. 1) of the stored water inside the cooling tank 2.

[0018]

The bottom surface 23 of the cooling tank 2 includes a first inclined surface 23a inclined upward from directly below the introduction port 21 toward the discharge port 22

(specifically, an opening end 23d which is a lower end portion in a vertical direction of the discharge port 22), and a second inclined surface 23b inclined upward from directly below the introduction port 21 toward a side opposite to the first inclined surface 23a. That is, the first inclined surface 23a is formed to be gradually higher toward the forward direction "Df", and the second inclined surface 23b is formed to be gradually higher toward the rearward direction "Dr". In the cooling tank 2, a bottom surface portion (hereinafter, referred to as a "lowest surface 23c") directly below the introduction port 21 is lowest, and the bottom surface 23 has a curved surface shape protruding downward. A cross-sectional shape of the cooling tank 2 is uniform in a width direction, and width dimensions of the first inclined surface 23a, the lowest surface 23c, and the second inclined surface 23b are all the same.

[0019]

The drive shaft 40 of the drive device 4 is disposed at a position above the second inclined surface 23b, which is not immersed in the stored water (that is, above the predetermined water level). In order to secure water sealing, the predetermined water level of the stored water is set above a lower end of the wall surface 20 and below the discharge port 22. The stored water inside the cooling tank 2 is controlled to be maintained at the predetermined

water level. Specifically, a real water level (actual water level) of the stored water is detected by a water level gauge 9 disposed above the second inclined surface 23b of the cooling tank 2, and a control device 10 controls opening and closing of a water injection electromagnetic valve 72 of a water injection pipe 7, based on the actual water level detected by the water level gauge 9.

[0020]

The water injection pipe 7 is a pipe for increasing the stored water inside the cooling tank 2, and is disposed above the second inclined surface 23b. The water injection electromagnetic valve 72 is interposed in an intermediate portion of the water injection pipe 7. When the water injection electromagnetic valve 72 is opened, a liquid such as tap water to be stored inside the cooling tank 2 is circulated inside the water injection pipe 7, and when the water injection electromagnetic valve 72 is closed, circulation of the liquid is stopped.

[0021]

The cooling tank 2 is provided with a drainage pipe 8 for draining the stored water when a water level of the stored water exceeds the predetermined water level. An upper end opening of the drainage pipe 8 is disposed slightly above and in the vicinity of the predetermined water level. In this manner, excessive stored water is

automatically discharged without performing valve controlling. The stored water may be any liquid whose main component is water, may be tap water or recycled water (water treated after being used inside a plant), or may be mixed water neutralized after being mixed with hydrochloric acid.

[0022]

The control device 10 is an electronic control device included in the ash extrusion device 1, and is an electronic device equipped with a processor and a memory. Based on the actual water level measured by the water level gauge 9 as described above, the control device 10 not only controls the water injection electromagnetic valve 72 but also controls opening and closing of a first electromagnetic valve 52 interposed in the first pipe 5 (to be described later). In addition, the control device 10 controls the drive device 4.

[0023]

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.

[0024]

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 extinguished and humidified while being 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 7, the drainage pipe 8, and the water level gauge 9 are disposed. In addition, in a state where the scraper 3 is moved rearward most (state indicated by a solid line in Fig. 1), most of the scraper 3 is located inside the second space 26.

[0025]

As illustrated in an enlarged view in Fig. 1, a gap "G" through which the fire extinguishing/humidifying space 24 and the second space 26 communicate with each other is provided between the upper surface 3a of the scraper 3 and a lower end portion 20b of a rear wall 20R. The gap "G" is secured even in a state where the scraper 3 is moved forward

most (state indicated by a two-dot chain line in Fig. 1). The gap "G" enables the scraper 3 to reciprocate without coming into contact with the wall surface 20. Furthermore, the stored water injected from the water injection pipe 7 can be circulated to the fire extinguishing/humidifying space 24 through the gap "G".

[0026]

A positional relationship between the upper surface 3a of the scraper 3 and the lower end portion 20b of the rear wall 20R is set so that the gap "G" is gradually narrowed as the scraper 3 moves forward and is gradually widened as the scraper 3 moves rearward. For example, when a gap in a state where the scraper 3 is moved forward most is defined as G1 and a gap in a state where the scraper 3 is moved rearward most is defined as G2, a relationship of $G1 < G2$ is established. The fire extinguishing/humidifying space 24 and the second space 26 substantially communicate with each other only through the gap "G". A shape of the upper surface 3a of the scraper 3 may be a curved shape or a stepped shape for properly maintaining a size of the gap "G".

[0027]

[2. Main Configuration]

When the scraper 3 reciprocates, 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 in that the incinerated ash is configured to return to the fire extinguishing/humidifying space 24 through the gap "G" by preventing accumulation of the return ash entering the inside of the second space 26, instead of a method for preventing the incinerated ash from entering the second space 26 or cleaning the return ash accumulated on the second inclined surface 23b.

[0028]

Specifically, the ash extrusion device 1 has a linear first pipe 5 disposed from one end 5a (lower end) to the other end 5b (upper end) at a position above the second inclined surface 23b, which does not come into contact with the reciprocating scraper 3 and the arm 41. One end 5a of the first pipe 5 is disposed below the predetermined water level, and the other end 5b is disposed above the predetermined water level. Whereas the scraper 3 is provided over substantially the total width of the cooling tank 2, a plurality of the arms 41 are disposed at an interval in the width direction. Therefore, the first pipe 5 is disposed at a position on a rearward side (right side in Fig. 1) than a position where the scraper 3 is moved

rearward most, and the first pipe 5 is disposed at a position which does not overlap the arm 41 in the width direction.

[0029]

One end 5a of the first pipe 5 is provided with a first jetting port 50 for jetting gas introduced from the other end 5b toward a region between the second inclined surface 23b and the scraper 3. In the ash extrusion device 1, a first compressor 51 is provided in the other end 5b of the first pipe 5. The gas jetted from the first pipe 5 is compressed air which is compressed by the first compressor 51. A configuration may be adopted as follows. Instead of the compressed air, exhaust gas of the incinerator may be jetted from the first jetting port 50. In this case, instead of or in addition to the first compressor 51, an introduction pipe for introducing the exhaust gas from an exhaust gas duct of the incinerator to the other end 5b of the first pipe 5 may be connected.

[0030]

As illustrated in an enlarged view in Fig. 1, a shape of one end 5a of the first pipe 5 is an L-shape including a corner portion substantially bent in a horizontal direction. The corner portion is disposed to be in contact with the second inclined surface 23b. In this manner, when the gas is jetted from the first jetting port 50, even when one end 5a is pushed back to a side in the rearward direction "Dr"

due to a pressure of the gas, the first pipe 5 is prevented from being deformed or displaced. In addition, the first pipe 5 is prevented from being deformed or displaced due to a physical pressure of the return ash scraped up by the rearward movement of the scraper 3.

[0031]

In addition, in the first pipe 5, the first jetting port 50 is open in a substantially horizontal direction, specifically, in a direction (for example, the horizontal direction) orthogonal to an extending direction (for example, the vertical direction) of the first pipe 5. Therefore, the gas from the first jetting port 50 is jetted in a direction separated from the second inclined surface 23b. Therefore, there is no possibility that the gas may scrape the second inclined surface 23b to damage the second inclined surface 23b. In addition, as described above, although the upper surface 3a exists, the scraper 3 has a box shape open to the bottom surface 23 side of the cooling tank 2, in other words, having no bottom surface facing the upper surface 3a. Therefore, there is no possibility that the gas from the first jetting port 50 may scrape the scraper 3 to damage the scraper 3.

[0032]

Furthermore, the water flow and the bubbles which are generated by the gas jetted from the first jetting port 50

in the vicinity of the second inclined surface 23b moves forward in the forward direction "Df" between the second inclined surface 23b and the scraper 3. Eventually, the speed of the water flow and the bubbles is reduced, and the water flow and the bubbles gently collide with and bounced from the extrusion surface 3b or the upper surface 3a of the scraper 3. Alternatively, the water flow and the bubbles swirl without collision. Therefore, the return ash accumulated on the second space 26 (for example, accumulated on the second inclined surface 23b or accumulated on a back side of the scraper 3) is separated by the bubbles generated by the gas, and not only the separated return ash but also the return ash to be accumulated on the second space 26 are stirred by the water flow.

[0033]

In other words, the ash extrusion device 1 separates the return ash accumulated inside the second space 26. Before the return ash inside the second space 26 is accumulated on the second inclined surface 23b, the return ash is stirred by the gas jetted from the first jetting port 50, and the ash extrusion device 1 maintains a state where the return ash is mixed inside the stored water (flow state). Therefore, the ash extrusion device 1 easily discharges the return ash from the second space 26. In addition, in the ash extrusion device 1, the return ash is

pushed up and dispersed to a water surface from the back side of the scraper 3 or the vicinity of the second inclined surface 23b due to a buoyant force of the bubbles. Therefore, the ash extrusion device 1 can more easily discharge the return ash from the second space 26.

[0034]

A plurality of the first pipes 5 are disposed at a predetermined interval in the width direction of the ash extrusion device 1. For example, each of the first pipes 5 may be fixed to and supported by one support member (not illustrated) extending in the width direction. A cross-sectional shape of each of the first pipes 5 is not particularly limited, and a circular shape, an elliptical shape, or a polygonal shape can be applied. A configuration may be adopted so that a nozzle (not illustrated) is attached to the first jetting port 50 to vigorously jet the gas.

[0035]

In the ash extrusion device 1, the control device 10 controls jetting of the gas jetted from the first jetting port 50. Specifically, the control device 10 controls opening and closing of the first electromagnetic valve 52 interposed in an intermediate portion of the first pipe 5. The control device 10 jets the gas from the first jetting port 50 at least when the scraper 3 moves rearward.

[0036]

Here, a case where the control device 10 opens the first electromagnetic valve 52 and jets the gas while the scraper 3 moves rearward and closes the first electromagnetic valve 52 when the scraper 3 is stopped or moves forward will be described as an example.

[0037]

As illustrated in Fig. 2, when the scraper 3 moves rearward, the control device 10 jets the gas from the first jetting port 50. Therefore, the return ash is stirred, and the return ash is scraped up by the scraper 3.

In addition, due to the rearward movement of the scraper 3, a position of the stored water including the return ash rises above the predetermined water level in the second space 26, and a position of the stored water in the fire extinguishing/humidifying space 24 falls below the predetermined water level. Therefore, the return ash rides on a water flow "Wr" flowing through the gap "G" which is gradually widened as the scraper 3 moves rearward, and the return ash is discharged from the second space 26 to the fire extinguishing/humidifying space 24.

[0038]

Furthermore, due to the rearward movement of the scraper 3, the return ash scraped up by the scraper 3 in the second space 26 is stirred by the gas jetted from the

first jetting port 50. Therefore, the first pipe 5 can be prevented from being damaged by the scraped return ash, and the first jetting port 50 can be prevented from being closed by the return ash entering the first jetting port 50.

When the scraper 3 moves rearward, the stored water including the return ash may be discharged from the drainage pipe 8 in some cases.

Therefore, the accumulation of the return ash inside the second space 26 is prevented.

[0039]

On the other hand, as illustrated in Fig. 3, when the scraper 3 moves forward, the incinerated ash inside the fire extinguishing/humidifying space 24 rises. In the fire extinguishing/humidifying space 24, a position of the stored water including the return ash rises above the predetermined water level, and in the second space 26, a position of the stored water including the return ash falls below the predetermined water level. However, the gap "G" is gradually narrowed as the scraper 3 moves forward. Therefore, the stored water is less likely to flow to the second space 26 from the fire extinguishing/humidifying space 24 through the gap "G", and the amount of the return ash generated by a water flow "Wf" flowing through the gap "G" can be reduced. In this manner, the accumulation of return ash inside the second space 26 can also be prevented.

The control device 10 may be configured to jet the gas from the first jetting port 50 even when the scraper 3 moves forward. In this case, the stored water inside the second space 26 is constantly disturbed. Therefore, the accumulation of the return ash can be further prevented.

[0040]

[3. Method for Remodeling Ash Extrusion Device]

Here, a method for remodeling a general ash extrusion device into the above-described ash extrusion device 1 will be described. The remodeling method has two disposition steps. A first disposition step is a step of disposing the first pipe 5 for a general ash extrusion device having the cooling tank 2, the scraper 3, and the drive device 4 which are described above. In this step, the first pipe 5 is disposed above the second inclined surface 23b and at a position which does not come into contact with the reciprocating scraper 3 and the arm 41. In the present embodiment, the first pipe 5 is disposed at a position where the corner portion on the one end 5a side of the first pipe 5 comes into contact with the second inclined surface 23b.

[0041]

A second disposition step is a step of disposing the first jetting port 50 provided in one end 5a of the first pipe 5 below the predetermined water level and toward a region between the second inclined surface 23b and the

scraper 3. That is, an orientation of the first jetting port 50 is set so that the gas from the first jetting port 50 is jetted toward the region between the second inclined surface 23b and the scraper 3. The first disposition step and the second disposition step may be performed at the same time, or the former may be performed before the latter.

[0042]

[4. Advantageous Effect]

(1) According to the ash extrusion device 1 of the present embodiment, the gas jetted into the stored water through the first pipe 5 generates the bubbles and the water flow. Therefore, the return ash floating inside the stored water can be stirred, and the return ash starting to be accumulated can be stirred after being separated from the second inclined surface 23b. The stored water including the return ash rides on the water flow generated by the reciprocating operation of the scraper 3, is likely to be discharged to the fire extinguishing/humidifying space 24 from the second space 26 through the gap "G", and is less likely to be discharged to the second space 26 from the fire extinguishing/humidifying space 24. Therefore, the accumulation of the return ash can be prevented with a simple structure. In addition, since the accumulation of return ash can be prevented, frequent cleaning is not required.

[0043]

An advantageous effect of stirring the return ash can be expected even according to a configuration in which a liquid (for example, a liquid such as tap water the same as the stored water) is jetted from the pipe instead of the gas. However, in a case of the liquid, an advantageous effect of separating the return ash by using the bubbles cannot be expected.

In addition, the liquid amount of the stored water in the cooling tank 2 is limited to the liquid amount stored up to the predetermined water level when the scraper 3 is not operated, and the excessive liquid amount is discharged from the drainage pipe 8. Therefore, when the liquid is used instead of the gas, plant operating costs may be increased. In contrast, according to a configuration in which the gas is jetted from the first jetting port 50, the liquid amount of the stored water is not affected. Therefore, inexpensive plant operating costs can be achieved.

[0044]

In addition, the above-described ash extrusion device 1 is completely remodeled for the general ash extrusion device as follows. The first pipe 5 is disposed at the position which does not come into contact with the scraper 3 and the arm 41, and the first jetting port 50 provided in

one end 5a is installed toward the region between the second inclined surface 23b and the scraper 3. That is, remodeling can be performed without changing any of major components such as the cooling tank 2, the scraper 3, and the drive device 4. Therefore, remodeling work can be inexpensively and easily carried out within a short construction period, and the ash extrusion device 1 which can prevent the accumulation of the return ash can be realized with a simple structure.

[0045]

(2) According to the above-described ash extrusion device 1, compressed air having a strong stirring force is jetted from the first jetting port 50. Therefore, the return ash can be further stirred, and the accumulation of the return ash can be further prevented. In addition, the first compressor 51 may be provided to jet the compressed air, and the air itself does not require a high cost. Therefore, the inexpensive ash extrusion device 1 can be realized. In addition, according to a configuration in which the exhaust gas of the incinerator is jetted from the first jetting port 50, a temperature of the jetted gas is high. Therefore, a separation force is increased, and the accumulation of the return ash can be further prevented. In addition, in this case, the ash undergoes a carbonation

reaction due to carbon dioxide contained in the exhaust gas. Therefore, detoxified ash can be achieved.

[0046]

(3) In the above-described ash extrusion device 1, the control device 10 for controlling jetting of the gas jetted from the first jetting port 50 is provided, and the gas is jetted at least when the scraper 3 moves rearward. When the scraper 3 moves rearward, the water flow (arrow "Wr" in Fig. 2) in which the stored water inside the second space 26 flows to the fire extinguishing/humidifying space 24 is generated through the gap "G". Therefore, the gas is jetted at least when the scraper 3 moves rearward. In this manner, the stirred return ash can be discharged while the stirred return ash rides on the water flow "Wr" of the gap "G". Therefore, the accumulation of the return ash can be efficiently prevented. In addition, the return ash scraped up by the scraper 3 is also stirred by the gas jetted from the first jetting port 50. Therefore, pipes such as the first pipe 5 can be prevented from being damaged by the scraped-up return ash, and in addition, the first jetting port 50 can be prevented from being closed by the return ash.

[0047]

(4) In the above-described ash extrusion device 1, the positional relationship between the upper surface 3a of the

scraper 3 and the lower end portion 20b of the rear wall 20R is set so that the gap "G" is gradually narrowed as the scraper 3 moves forward and is gradually widened as the scraper 3 moves rearward. Therefore, when the scraper 3 moves forward, the stored water is less likely to flow into the second space 26 through the gap "G", and the amount of the return ash generated by the water flow "Wf" flowing through the gap "G" can be reduced. On the other hand, the gap "G" is gradually widened when the scraper 3 moves rearward. Therefore, the return ash rides on the water flow "Wr" flowing through the gap "G", and is likely to be discharged to the fire extinguishing/humidifying space 24. Therefore, the accumulation of the return ash inside the second space 26 can be prevented.

[0048]

(5) In addition, according to the above-described ash extrusion device 1, the corner portion of one end 5a of the first pipe 5 is disposed to be in contact with the second inclined surface 23b. Therefore, the first pipe 5 can be prevented from being deformed or displaced due to a reaction force when the gas is jetted from the first jetting port 50. In addition, the first pipe 5 can be prevented from being deformed or displaced due to the return ash scraped up by the scraper 3. Therefore, the gas can be accurately jetted to the region between the second inclined surface

23b and the scraper 3. Therefore, the gas is not directly jetted toward the second inclined surface 23b. Therefore, there is no possibility that the second inclined surface 23b may be damaged by the gas (specifically, wear damage in which the second inclined surface 23b is scraped by the gas to reduce the thickness).

[0049]

[5. Modification Example]

The above-described ash extrusion device 1 is an example, and is not limited to the above-described configuration. For example, as in an ash extrusion device 1' illustrated in Fig. 4, in addition to the configuration of the ash extrusion device 1, a linear second pipe 6 may be provided. The second pipe 6 is disposed from one end 6a to the other end 6b at a position above the second inclined surface 23b, which does not come into contact with the reciprocating scraper 3 and the arm 41. One end 6a of the second pipe 6 is disposed below the predetermined water level, and the other end 6b is disposed above the predetermined water level.

[0050]

One end 6a of the second pipe 6 is provided with a second jetting port 60 for jetting the gas introduced from the other end 6b. The second jetting port 60 is connected to an opening formed in the lower end portion 20b of the

wall surface (that is, the rear wall 20R) located above the second inclined surface 23b in the wall surface 20.

The incinerated ash accumulated in the gap "G" is separated by the bubbles generated by the gas jetted from the second jetting port 60. Not only the separated incinerated ash but also the incinerated ash accumulated or to be accumulated in the gap "G" are pushed to flow by the water flow generated by the gas, thereby preventing the gap "G" from being closed by the incinerated ash.

[0051]

Specifically, as illustrated in an enlarged view in Fig. 4, a shape of one end 6a of the second pipe 6 is an L-shape including a corner portion substantially bent in a horizontal direction. A tip side (second jetting port 60 side) from the corner portion is inserted into and fixed (connected) to an opening from the second space 26 side.

Since the second pipe 6 is disposed in this way, 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.

[0052]

More specifically, in the ash extrusion device 1', 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 first scrape off the incinerated ash accumulated on the upper surface 3a of the scraper 3. 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 the gap "G" are pushed to flow.

Therefore, since the gap "G" is prevented from being closed by the incinerated ash, compared to the ash extrusion device 1, the ash extrusion device 1' can more reliably discharge the stored water including the return ash to the fire extinguishing/humidifying space 24 from the second space 26, in response to the reciprocating operation of the scraper 3.

[0053]

Furthermore, in the ash extrusion device 1', the incinerated ash floating (floating ash) on the water surface directly below the introduction port 21 can be stirred and humidified by 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, particularly by the above-described bounced water flow and bubbles, and arching in which the floating ash is solidified on the water surface can be prevented.

An orientation of the second jetting port 60 is set so that the gas is not directly jetted toward the scraper 3. Therefore, the above-described bouncing causes the bubbles or the water flow to indirectly and gently come into contact with the wall surface 20 or the scraper 3 in the vicinity of the gap "G". Therefore, damage such as scraping the wall surface 20 or the scraper 3 can be prevented.

[0054]

In the ash extrusion device 1' of the present modification example, a second compressor 61 is provided in the other end 6b of the second pipe 6. The gas jetted from the second pipe 6 is compressed air compressed by the second compressor 61. A branch point may be provided between the first compressor 51 and the first electromagnetic valve 52 instead of the second compressor 61, and the other end 6b of the second pipe 6 may be connected to the branch point so that the first compressor 51 is shared. In addition, instead of the compressed air, a configuration may be adopted so that the exhaust gas of the incinerator is jetted from the second jetting port 60. In this case, instead of or in addition to the second compressor 61, an introduction

pipe for introducing the exhaust gas from the exhaust gas duct of the incinerator to the other end 6b of the second pipe 6 may be connected.

[0055]

A plurality of the second pipes 6 are disposed at a predetermined interval in the width direction of the ash extrusion device 1'. The number of the first pipes 5 and the number of the second pipes 6 may not be the same as each other, and disposing intervals do not have to be equal to each other. A cross-sectional shape of the second pipe 6 is not particularly limited, and a circular shape, an elliptical shape, or a polygonal shape can be applied. A configuration may be adopted so that a nozzle (not illustrated) is attached to the second jetting port 60 to vigorously jet the gas.

[0056]

In the ash extrusion device 1' of the present modification example, the control device 10 not only controls jetting of the gas jetted from the first jetting port 50, but also controls jetting of the gas jetted from the second jetting port 60. Specifically, the control device 10 controls opening and closing of the second electromagnetic valve 62 interposed in the intermediate portion of the second pipe 6. In this manner, the gas is jetted from the second jetting port 60 at least when the

scraper 3 moves rearward. For example, the control device 10 opens the second electromagnetic valve 62 and jets the gas when the scraper 3 moves rearward, and closes the second electromagnetic valve 62 when the scraper 3 is stopped or moves forward. In this way, the control device 10 controls the second jetting port 60 to jet the gas in synchronization with a jetting timing of the gas from the first jetting port 50. Therefore, the accumulation of the return ash can be more effectively prevented.

[0057]

In the ash extrusion devices 1 and 1' of the above-described embodiment and modification example, the control device 10 may be configured to control not only the jetting timing of the gas but also a jetting amount of the gas.

[Reference Signs List]

[0058]

1, 1': Ash extrusion device

2: Cooling tank

3: Scraper

3a: Upper surface

3b: Extrusion surface

3c: Tip

4: Drive device

5: First pipe

5a: One end

5b: Other end

6: Second pipe

6a: One end

6b: Other end

7: Water injection pipe

8: Drainage pipe

9: Water level gauge

10: Control device

11: Conveyance device

20: Wall surface

20b: Lower end portion

20F: Front wall

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

24: Fire extinguishing/humidifying space

25: First space

26: Second space

40: Drive shaft

41: Arm

50: First jetting port

51: First compressor

52: First electromagnetic valve

60: Second jetting port

61: Second compressor

62: Second electromagnetic valve

72: Water injection electromagnetic valve

Df: Forward direction

Dr: Rearward direction

Wf, Wr: Water flow

G, G1, G2: Gap

CLAIMS

[Claim 1]

An ash extrusion device comprising:

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

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

a drive device disposed on a side opposite to the discharge port with respect to the introduction port, and driving the scraper,

wherein the bottom surface of the cooling tank includes a first inclined surface inclined upward from 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 directly below the introduction port toward a side opposite to the first inclined surface,

the stored water is stored inside the cooling tank at a predetermined water level above a lower end of the wall surface and below the discharge port,

the drive device includes a drive shaft disposed above the second inclined surface, and the drive shaft pivots so that an arm connected to the drive shaft and the scraper causes the scraper to reciprocate forward and rearward along the bottom surface,

the ash extrusion device further comprises a first pipe disposed from one end to the other end at a position above the second inclined surface, which does not come into contact with the reciprocating scraper and the arm,

the first pipe includes the one end which is disposed below the predetermined water level, and the one end is provided with a first jetting port which jets a gas introduced from the other end toward a region between the second inclined surface and the scraper, 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 the gas is compressed air or an exhaust gas of an incinerator that generates the incinerated ash.

[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 control device jets the gas from the first jetting port, at least when the scraper moves rearward.

[Claim 4]

The ash extrusion device according to claim 3, further comprising:

a second pipe disposed from one end to the other end at a position above the second inclined surface, which does not come into contact with the reciprocating scraper and the arm,

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 formed in a lower end portion of a wall surface located above the second inclined surface in the wall surface, and

the stored water is circulated in a gap between the lower end portion of the 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 the bubbles generated by the gas.

[Claim 5]

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

wherein a gap between a lower end portion of the wall surface and an upper surface of the scraper is gradually narrowed as the scraper moves forward, and is gradually widened as the scraper moves rearward.

[Claim 6]

A method for remodeling an ash extrusion device including a cooling tank including an introduction port having a cylindrical wall surface into which incinerated ash is introduced and a discharge port for discharging the incinerated ash cooled by stored water, a scraper disposed inside the cooling tank, a tip of which is in contact with a total width of a bottom surface of the cooling tank, and extruding the incinerated ash to a discharge port side, and a drive device disposed on a side opposite to the discharge port with respect to the introduction port, and driving the

scraper, in which the bottom surface of the cooling tank includes a first inclined surface inclined upward from 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 directly below the introduction port toward a side opposite to the first inclined surface, the stored water is stored inside the cooling tank at a predetermined water level above a lower end of the wall surface and below the discharge port, and the drive device includes a drive shaft disposed above the second inclined surface, and the drive shaft pivots so that an arm connected to the drive shaft and the scraper causes the scraper to reciprocate forward and rearward along the bottom surface, the method comprising:

a step of disposing a pipe at a position above the second inclined surface, which does not come into contact with the reciprocating scraper and the arm; and

a step of disposing one end of the pipe serving as a jetting port of the gas, below the predetermined water level and toward a region between the second inclined surface and the scraper.