

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 existing in a direction opposite to an extrusion direction of the incinerated ash (for example, a "pusher waiting chamber 4" "in Patent Document 1) 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, accumulation of the return ash is prevented by periodically cleaning the ash extrusion device to remove the return ash, or by devising a structure of a pusher itself for extruding the incinerated ash as disclosed in the ash extrusion device of Patent Document 1.

[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, a drive device disposed on a side opposite to the discharge port with respect to the introduction port, and driving the scraper, a water injection pipe that increases the stored water inside the cooling tank, and a drainage pipe for draining 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 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 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. The first 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. 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 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 forming an opening in a lower end portion of a wall surface above the second inclined surface and below the predetermined water level, in the wall surface, a step of disposing a pipe above the second inclined surface and at a position which does not come into contact with the reciprocating scraper and the arm, and a step of connecting one end of the pipe serving as a jetting port of the gas to the opening.

[Advantageous Effects of Invention]

[0009]

According to the ash extrusion device of the present invention, the gas jetted inside the stored water through the first pipe generates the water flow while forming the bubbles. Therefore, the incinerated ash adhering to the gap can be separated by the bubbles, and the separated incinerated ash or the incinerated ash to be accumulated can be stirred by the water flow. In this manner, the gap can be prevented from being closed by the incinerated ash. Therefore, a flow of the stored water through the gap in response to a reciprocating operation of the scraper can be secured. In other words, the return ash can ride on the water flow generated by the reciprocating operation of the scraper, and can be discharged together with the stored water from the gap to a space directly below the introduction port. 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 connected to the opening formed in the lower end portion of the wall surface. That is, the general ash extrusion device can be remodeled by simply forming the opening in a portion of the wall surface of the cooling tank without changing any major component such as 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 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 of an ash extrusion device according to a first modification example.

Fig. 3 is a sectional view of an ash extrusion device according to a second modification example.

Fig. 4 is a sectional view illustrating a state where a scraper of the ash extrusion device illustrated in Fig. 3 is moved rearward.

Fig. 5 is a sectional view illustrating a state where the scraper of the ash extrusion device illustrated in Fig. 3 is moved forward.

[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 return ash as follows. The ash extrusion device adopts a simple structure connected to an opening formed in a lower end portion of a wall surface located above a second inclined surface in a cylindrical wall surface into which incinerated ash is introduced, and having a pipe for jetting a gas inward of

the cylindrical wall surface, and secures a passage (gap) through the return ash is circulated. 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 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 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 11 disposed above the second inclined surface 23b of the cooling tank 2, and a control device 10 controls opening and closing of an electromagnetic valve 82 of a water injection pipe 8, based on the actual water level detected by the water level gauge 11.

[0020]

The water injection pipe 8 is a pipe for increasing the stored water inside the cooling tank 2, and is disposed above the second inclined surface 23b. The electromagnetic valve 82 is interposed in an intermediate portion of the

water injection pipe 8. When the electromagnetic valve 82 is opened, a liquid such as tap water to be stored inside the cooling tank 2 is circulated inside the water injection pipe 8, and when the electromagnetic valve 82 is closed, circulation of the liquid is stopped.

[0021]

The cooling tank 2 is provided with a drainage pipe 12 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 12 is disposed 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 11 as described above, the control device 10 not only controls the electromagnetic valve 82 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 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

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 8 can be circulated to the fire extinguishing/humidifying space 24 through the gap "G".

[0026]

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

and flows to the second space 26 from the fire extinguishing/humidifying space 24.

[0027]

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".

[0028]

[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 the 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.

[0029]

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 which does not overlap the arm 41 in the width direction.

[0030]

One end 5a of the first pipe 5 is provided with a first jetting port 50 for jetting the gas introduced from the other end 5b. 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 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.

[0031]

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 first jetting port 50 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 opening is a hole or a cutout that penetrates in the thickness direction of the wall surface 20 in the lower end portion 20b, and it is preferable that the opening has a shape into which the first jetting port 50 can be fitted. The first jetting port 50 is inserted into the opening from a surface facing the outside (second space 26 side) of the rear wall 20R, and the tip of the first jetting port 50 is fixed at a position

that coincides with a surface facing the inside (fire extinguishing/humidifying space 24 side) of the rear wall 20R.

[0032]

Since the first pipe 5 is disposed in this way, the gas is jetted from the first jetting port 50 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.

[0033]

More specifically, in the ash extrusion device 1, the water flow of the stored water generated by the gas jetted from the first jetting port 50 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, the stored water including the return ash can be effectively discharged to the fire extinguishing/humidifying space 24 from the second space 26, in response to the reciprocating operation of the scraper 3.

[0034]

The inventor has found the followings. The return ash is not accumulated to such an extent that the return ash hinders driving of the scraper 3, as long as the stored water smoothly flows through the gap "G" as the scraper 3 moves forward and rearward, that is, unless the gap "G" is closed by the incinerated ash. The ash extrusion device 1 is specifically configured, based on the founding.

[0035]

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. Depending on the shape, a shape of the opening of the wall surface 20 may be set. A configuration may be adopted so that a nozzle

(not illustrated) is attached to the first jetting port 50 to vigorously jet the gas.

[0036]

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 the intermediate portion of the first pipe 5. In this manner, the gas is jetted from the first jetting port 50 at least when the scraper 3 moves rearward. Here, the following case will be described as an example. In order to reduce power consumption while sufficiently achieving the above-described bouncing effect, the control device 10 opens the first electromagnetic valve 52 to jet the gas when the scraper 3 moves rearward. When the scraper 3 is stopped or moves forward, the control device 10 closes the first electromagnetic valve 52. When the scraper 3 moves forward, the bouncing effect is reduced. However, when a configuration is adopted so that the gas is constantly jetted regardless of an operation of the scraper 3, a closing prevention effect of the gap "G" or an arching prevention effect (to be described later) can be further improved. In addition, the first jetting port 50 can be prevented from being closed by the entering return ash.

[0037]

[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. This remodeling method has three steps. The first step is a step of forming an opening 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 opening is formed in the lower end portion 20b of the wall surface above the second inclined surface 23b and below the predetermined water level, in the wall surface 20.

[0038]

The second step is a step of disposing the first pipe 5. 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. The third step is a step of connecting one end 5a of the first pipe 5 which is a jetting port of the gas, to the above-described opening. These three steps are performed in this order.

[0039]

[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 water flow while

forming the bubbles, and the above-described bouncing causes the water flow with the bubbles to flow into the vicinity of the gap "G". In this manner, the gap "G" can be prevented from being closed by the incinerated ash. Therefore, a flow of the stored water through the gap "G" in response to the reciprocating operation of the scraper 3 can be secured. In other words, the return ash can ride on the water flow generated by the reciprocating operation of the scraper 3, and can be discharged together with the stored water from the gap "G" to 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.

[0040]

The circulation through the gap "G" can be secured to some extent by the above-described bouncing, 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, a separation effect achieved by 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 12. 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.

[0041]

In addition, according to the above-described 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 first jetting port 50 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 first jetting port 50 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.

[0042]

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 connected to the opening of the lower end portion 20b of the wall surface 20. That is, the general ash extrusion device can be remodeled by simply forming the opening in a portion of the wall surface 20 of the cooling tank 2 without changing any major component such as the scraper 3 and the drive device 4. 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 the return ash can be realized with a simple structure.

[0043]

(2) According to the above-described ash extrusion device 1, the first compressor 51 may be provided to jet the compressed air from the first jetting port 50, 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 gap "G" can be further prevented from being closed. 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.

[0044]

(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 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 return ash inside the second space 26 can be discharged while the return ash rides on the water flow of the gap "G". Therefore, the accumulation of the return ash can be efficiently prevented.

[0045]

(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 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 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.

[0046]

[5. Modification Example]

The above-described ash extrusion device 1 is an example, and is not limited to the above-described configuration. Hereinafter, two types of modification examples will be described. The two modification examples can be combined with each other. In the following description, the same reference numerals will be assigned to the same elements as those in the above-described embodiment, and repeated description will be omitted.

[0047]

[5-1. First Modification Example]

An ash extrusion device 1' of a first modification example illustrated in Fig. 2 is mainly different from the

ash extrusion device 1 of the embodiment as follows. Two water injection pipes 7 and 9 and a water injection nozzle 71 are added to the ash extrusion device 1 of the embodiment, and further, respectively corresponding electromagnetic valves 72, 82, and 92 are added so that the control device 10 controls opening and closing of the electromagnetic valves 72, 82, and 92.

[0048]

That is, in addition to the configuration of the ash extrusion device 1, the ash extrusion device 1' of the present modification example includes a plurality of water injection pipes for increasing the stored water inside the cooling tank 2. Specifically, the ash extrusion device 1' includes three water injection pipes such as a first water injection pipe 7, a second water injection pipe 8, and a third water injection pipe 9. The first water injection pipe 7, the second water injection pipe 8, and the third water injection pipe 9 are respectively different water injection pipes. Here, the second water injection pipe 8 is disposed above the second inclined surface 23b as in the water injection pipe 8 of the above-described embodiment. Therefore, the same reference numeral is assigned.

As will be described later, the supply amount of the stored water supplied from the water injection pipes 7 to 9 is controlled by the above-described control device 10,

based on the actual water level (water level detected by the water level gauge 11).

[0049]

The water injection nozzle 71 is disposed on a surface (that is, the front wall 20F) in the wall surface 20 on the discharge port 22 side, and injects the water toward the gap "G". The first water injection pipe 7 is connected to the water injection nozzle 71. The electromagnetic valve 72 whose opening and closing is controlled by the control device 10 is interposed in the intermediate portion of the first water injection pipe 7. When the electromagnetic valve 72 is opened, the liquid such as tap water stored as the stored water is circulated inside the first water injection pipe 7, and when the electromagnetic valve 72 is closed, circulation of the liquid is stopped.

[0050]

In the ash extrusion device 1', in response to the reciprocating operation of the scraper 3, the incinerated ash absorbing and internally containing the stored water is discharged from the discharge port 22, and the liquid level of the stored water undulates up and down. Accordingly, the stored water is gradually discharged from the drainage pipe 12. Therefore, the stored water is automatically reduced, and the actual water level tends to be lower than the predetermined water level.

[0051]

Therefore, in order to alleviate a decreasing rate of the stored water, the control device 10 opens the electromagnetic valve 72 to inject a preset predetermined amount (predetermined amount) of the liquid (tap water or the like) from the water injection nozzle 71, and closes the electromagnetic valve 72 when the predetermined amount of the liquid is completely injected. A time required for injecting the predetermined amount of the liquid is appropriately set. However, as described above, the control device 10 aims to alleviate the decreasing rate of the stored water. Therefore, it is desirable to inject a relatively small amount of the liquid over a long period of time to such an extent that an arching prevention effect (to be described later) is achieved.

In this case, the control device 10 may open the electromagnetic valve 82 or the electromagnetic valve 92 to inject the water from the second water injection pipe 8 or the third water injection pipe 9.

[0052]

Therefore, the ash extrusion device 1' stirs the stored water around the gap "G" by water injection of the water injection nozzle 71. Therefore, compared to the ash extrusion device 1, the gap "G" can be more effectively prevented from being closed by the incinerated ash.

Therefore, without closing the gap "G", the circulation of the stored water in the gap "G" can be maintained. As a result, the amount of the return ash of the second space 26 (for example, the return ash accumulated on a back side of the scraper 3 and the second inclined surface 23b) can be reduced to such an extent that an operation of the drive device 4 is not affected.

In addition, even when a large amount of the incinerated ash falls from an ash chute and is accumulated above the predetermined water level, the accumulated incinerated ash can be destroyed and quickly humidified by the water injection of the water injection nozzle 71. Moreover, basically, the water injection of the water injection nozzle 71 directly hits the water surface. Therefore, it is possible to more effectively prevent arching in which the floating ash is solidified on the water surface below the introduction port 21.

[0053]

A timing at which the control device 10 injects the liquid such as tap water from the water injection nozzle 71 can be appropriately set. For example, when the scraper 3 moves forward, the liquid level rises, and a pile of the incinerated ash rises inside the cylindrical wall surface 20. Therefore, the control device 10 can efficiently cool the incinerated ash, and can efficiently prevent the arching

by injecting the liquid from the water injection nozzle 71 when the scraper 3 moves forward in the forward direction "Df". Regardless of the reciprocating operation of the scraper 3, when a configuration is adopted to continuously inject the liquid from the water injection nozzle 71 or a configuration is adopted to inject the liquid from the water injection nozzle 71 at a predetermined cycle of a short time by using timer control, a time for the water injection nozzle 71 to inject the water to the water surface of the fire extinguishing/humidifying space 24 is lengthened. Therefore, the arching can more effectively be prevented.

[0054]

For example, when a height difference obtained by subtracting the actual water level from the predetermined water level is equal to or greater than a predetermined value, the control device 10 opens at least the electromagnetic valve 72 to start injecting the predetermined amount of the liquid from the water injection nozzle 71, opens the electromagnetic valve 82 to inject the liquid from the second water injection pipe 8, and controls the stored water to be increased from the actual water level to the predetermined water level.

Alternatively, when the height difference obtained by subtracting the actual water level from the predetermined water level is equal to or greater than the predetermined

value, the control device 10 may open at least the electromagnetic valve 72 to start injecting the predetermined amount of the liquid from the water injection nozzle 71. Thereafter, when the height difference is smaller than the predetermined value, the control device 10 may open the electromagnetic valve 82 to inject the liquid only from the second water injection pipe 8, and may control the stored water to be increased from the actual water level to the predetermined water level.

The water level gauge 11 is disposed in the second space 26. Therefore, the water level can be properly adjusted by mainly injecting the water from the second water injection pipe 8 disposed in the second space 26.

[0055]

The third water injection pipe 9 is disposed above the first inclined surface 23a to inject the water to the incinerated ash located immediately before the discharge port 22. The electromagnetic valve 92 whose opening and closing is controlled by the control device 10 is interposed in the intermediate portion of the third water injection pipe 9. When the electromagnetic valve 92 is opened, the liquid such as tap water is circulated inside the third water injection pipe 9, and when the electromagnetic valve 92 is closed, the circulation of the liquid is stopped.

[0056]

As described above, a space above the predetermined water level in the first space 25 is a space for removing the water content of the incinerated ash. While the incinerated ash existing in the space gradually moves to the discharge port 22 as the scraper 3 moves, and the incinerated ash is dried by generally removing the water content for several hours. However, when the incinerated ash located above the predetermined water level is solidified by drying, there is a possibility that the vicinity of the discharge port 22 may be clogged.

[0057]

Therefore, the control device 10 injects the liquid such as tap water to the incinerated ash in the vicinity of the discharge port 22 by using the third water injection pipe 9, and properly moistens the incinerated ash to soften the incinerated ash to such an extent that the incinerated ash is not solidified. In this manner, the ash extrusion device 1' can easily discharge the incinerated ash from the discharge port 22. A timing at which the control device 10 injects the water from the third water injection pipe 9 is not particularly limited. The water may be injected in synchronization with the water injection nozzle 71 of the first water injection pipe 7 or may be injected at a predetermined cycle of a long time. When the water is injected in synchronization with the water injection nozzle

71 of the first water injection pipe 7, the scraper 3 moves forward, and presses the incinerated ash. Therefore, the incinerated ash can be easily discharged from the discharge port 22.

[0058]

[5-2. Second Modification Example]

An ash extrusion device 1" of a second modification example illustrated in Fig. 3 is mainly different from the ash extrusion device 1 of the embodiment as follows. The second pipe 6 and the second electromagnetic valve 62 corresponding thereto are added to the ash extrusion device 1 of the embodiment, and the gas is jetted from the second pipe 6. 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.

[0059]

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 toward a region between the second inclined surface 23b and the scraper 3.

As illustrated in an enlarged view in Fig. 3, a shape of one end 6a of the second pipe 6 of the present modification example is an L-shape including a corner portion substantially bent in the 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 second jetting port 60, even when one end 6a is pushed back to a side in the rearward direction "Dr" due to a pressure of the gas, the second pipe 6 is prevented from being deformed or displaced.

In addition, the second pipe 6 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 on the second inclined surface 23b. In addition, the gas is jetted from the second jetting port 60. Therefore, the second jetting port 60 can be prevented from being closed by the return ash scraped up by the rearward movement of the scraper 3.

[0060]

In addition, in the second pipe 6, the second jetting port 60 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 second pipe 6. Therefore, the gas from the second jetting port 60 is jetted

in a direction separated from the second inclined surface 23b. Therefore, there is no possibility that the gas jetted from the second jetting port 60 may scrape and give damage to the second inclined surface 23b.

[0061]

In the ash extrusion device 1", the water flow and the bubbles which are generated by the gas jetted from the second jetting port 60 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.

[0062]

In other words, the return ash accumulated inside the second space 26 is separated. 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 second jetting port 60 to maintain 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.

[0063]

The return ash stirred in the second space 26 rides on the water flow generated by the reciprocating operation of the scraper 3, and is discharged from the gap "G" to the fire extinguishing/humidifying space 24 together with the stored water. Therefore, according to the ash extrusion device 1" of the present modification example, the gas jetted from the first jetting port 50 prevents the gap "G" from being closed, and thereafter, the return ash can be stirred by the gas jetted from the second jetting port 60. Therefore, the accumulation of the return ash can be more effectively prevented.

[0064]

In the ash extrusion device 1" of the present modification example, the 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 which is 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.

[0065]

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.

[0066]

In the ash extrusion device 1" of the present modification example, the control device 10 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.

[0067]

For example, as illustrated in Fig. 4, when the scraper 3 moves rearward, the control device 10 jets the gas from the second jetting port 60 to stir the return ash, 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. In addition, the return ash scraped up by the scraper 3 is also stirred by the gas jetted from the second jetting port 60. Therefore, the second pipe 6 can be prevented from being damaged by the scraped-up return ash, and the second jetting port 60 can be prevented from being closed by the entering return ash. In this case, the stored water including the return ash may be discharged from the drainage pipe 12 in some cases.

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

[0068]

On the other hand, as illustrated in Fig. 5, 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. A configuration may be adopted to jet the gas 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.

[0069]

In the ash extrusion devices 1, 1', and 1" of the above-described embodiment and each 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]

[0070]

1, 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: First water injection pipe

8: Second water injection pipe, Water injection pipe

9: Third water injection pipe

10: Control device

11: Water level gauge

12: Drainage pipe

19: 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

71: Water injection nozzle

72, 82, 92: Electromagnetic valve

Df: Forward direction

Dr: Rearward direction

Wf, Wr: Water flow

G: 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;

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

a water injection pipe that increases the stored water inside the cooling tank; and

a drainage pipe for draining 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 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 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,

the first 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 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 water injection nozzle disposed on the wall surface,
wherein the water injection nozzle injects a liquid
toward the gap.

[Claim 4]

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

a water level gauge disposed above the second inclined
surface and detecting a water level of the stored water;
and

a control device that controls a supply amount of the
stored water supplied from the water injection pipe, based
on an actual water level which is a real water level detected
by the water level gauge,

wherein the water injection pipe includes a first
water injection pipe connected to the water injection

nozzle, and a second water injection pipe different from the first water injection pipe and disposed above the second inclined surface, and

when the actual water level is lower than the predetermined water level, the control device injects the liquid from the second water injection pipe, injects a predetermined amount of the liquid from the water injection nozzle through the first water injection pipe, and controls the actual water level to increase toward the predetermined water level.

[Claim 5]

The ash extrusion device according to any one of claims 1 to 4, 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 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 second jetting port and bubbles generated by the gas.

[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 forming an opening in a lower end portion of a wall surface above the second inclined surface and below the predetermined water level, in the wall surface;

- 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 connecting one end of the pipe serving as a jetting port of the gas to the opening.