

DESCRIPTION

Title of Invention

CLEANING TOOL FOR ASH-PUSHING AND DISCHARGING DEVICE

[Technical Field]

[0001]

The present invention relates to a cleaning tool for an ash-pushing and discharging device that cools and discharges incineration ash.

[Background Art]

[0002]

An ash-pushing and discharging device is a device that introduces incineration ash discharged from an incineration furnace, into a cooling tank from an introduction inlet, and that discharges the incineration ash from a discharge port after cooling the incineration ash in the cooling tank. A scraper that pushes the incineration ash toward the discharge port is disposed inside the cooling tank. The scraper is disposed such that a tip of the scraper is in contact with a bottom surface of the cooling tank over an entire width, and is driven by a drive device that is disposed opposite the discharge port with respect to the introduction inlet. When the incineration furnace is shut down, cleaning for removing the incineration ash is performed such that

the incineration ash does not stick in the ash-pushing and discharging device. At the time of cleaning, for example, a cleaning tool disclosed in Patent Document 1 can be used.

[0003]

In a description using terms in Patent Document 1 as they are, the cleaning tool has a substantially "L" shape formed by a horizontal plate capable of peeling off incineration ash which has adhered to a bottom portion of a cooling water tank (cooling tank), and a vertical plate that stands from a rear portion of the horizontal plate and that is pressed against a pusher (scraper), and the horizontal plate and the vertical plate are connected to each other by a plurality of segmented pieces subjected to wear-resistant treatment. In addition, a flat V-shaped or flat U-shaped blade portion subjected to wear-resistant treatment is formed at a front end of the horizontal plate, and a scooping piece having a substantially triangular cross section that scoops up the incineration ash from the blade portion is attached to a rear side of the blade portion. Further, a fulcrum piece is provided on the rear portion of the horizontal plate, and the cleaning tool is in a forward tilt posture with the fulcrum piece as a fulcrum. Since a drive range of the pusher is limited, an insert is disposed between the pusher and the vertical plate of the cleaning tool to drive the pusher. The cleaning tool can be gradually

moved toward the discharge port by driving the pusher while gradually increasing the number of the inserts. Accordingly, Patent Document 1 describes that the incineration ash in the ash-pushing and discharging device can be discharged from the discharge port.

[Citation List]

[Patent Document]

[0004]

[Patent Document 1] Japanese Unexamined Patent Application Publication No. 2004-144321

[Summary of Invention]

[Technical Subject]

[0005]

However, from the viewpoint of the size and weight of the cleaning tool of Patent Document 1, it is difficult for a worker to manually insert the cleaning tool into the cooling tank through an inspection port, and since a carry-in device such as a crane is required, the work cost is increased. In addition, since a large number of components forming the cleaning tool come into contact with the incineration ash, expensive wear-resistant treatment should be applied to the blade portion or to the plurality of segmented pieces, and the manufacturing cost is increased.

[0006]

Further, since the cleaning tool has a substantially

"L" shape, when the incineration ash is intended to be discharged from the discharge port without dropping the cleaning tool from the discharge port, the incineration ash remains at an end portion of the discharge port, and the incineration ash is also deposited between the horizontal plate and the vertical plate. For this reason, the incineration ash remaining at the discharge port located at a high place should be removed while ensuring the safety of the worker, and the incineration ash deposited on the cleaning tool should be removed. These cause the lengthening of the work time.

[0007]

In addition, the blade portion of the cleaning tool has a flat "V" shape or a flat "U" shape. On the other hand, since the bottom surface of the cooling tank that the blade portion is in contact with is curved toward the discharge port, even when both ends of the blade portion are in contact with the bottom surface, a central portion of the blade portion is raised up from the bottom surface. For this reason, the incineration ash enters a gap between the blade portion and the bottom surface, and the incineration ash cannot be effectively removed, which is a subject.

[0008]

The present invention is conceived in view of the

above-described subjects, and an object of the present invention is to provide a cleaning tool for an ash-pushing and discharging device capable of reducing the work cost and the manufacturing cost, shortening the work time, and effectively removing incineration ash.

[Subject to be solved]

[0009]

According to the present invention, there is provided a cleaning tool for an ash-pushing and discharging device including a cooling tank including an introduction inlet into which incineration ash is introduced, and a discharge port that discharges the cooled incineration ash, a scraper which is disposed in the cooling tank, of which a tip is in contact with a bottom surface of the cooling tank over an entire width, and which pushes the incineration ash toward a discharge port side, and a drive device that is disposed opposite the discharge port with respect to the introduction inlet, and that drives the scraper, the tool including: a plurality of blocks each including a pushing and discharging plate disposed substantially perpendicular to the bottom surface, and having a rectangular shape when viewed from the discharge port side, a scooping portion which is connected to a front surface of the pushing and discharging plate that is a surface facing the discharge port side, of which a tip is in contact with the bottom surface, and which

has a rectangular shape when viewed in a vertical direction of the bottom surface, and a frame connected to a rear surface of the pushing and discharging plate that is a surface facing opposite the front surface, to form a rectangular parallelepiped. The plurality of blocks adjacent to each other in an entire width direction are fitted and integrated with each other to have a dimension of the entire width, the pushing and discharging plates are integrated to have a rectangular shape when viewed from the discharge port side, and the scooping portions are integrated to have a rectangular shape when viewed in the vertical direction of the bottom surface. The plurality of blocks include a first block including a protrusion on a side of the frame, and a second block including a recess on a side of the frame, and the protrusion of the first block and the recess of the second block are fitted to each other, so that the plurality of blocks are integrated. In addition, the scraper presses the frames, so that the scooping portions scoop up the incineration ash, and the pushing and discharging plates push the incineration ash toward the discharge port side.

[Advantageous Effects of Invention]

[0010]

According to the cleaning tool for the ash-pushing and discharging device of the present invention, the cleaning

tool is divided into the plurality of blocks. Therefore, a worker can easily carry each block into the cooling tank, and can easily assemble the blocks into the integral cleaning tool by fitting the blocks to each other, so that the work cost can be reduced.

In addition, since components that mainly come into contact with the incineration ash are the pushing and discharging plate and the scooping portion having a simple shape (rectangular shape), the manufacturing cost can be reduced (can be manufactured at low cost), and maintenance is also easy.

Further, since the cleaning tool can be moved to an opening end of the cooling tank in a state where the scooping portions are in contact with the bottom surface, the incineration ash does not remain in the vicinity of the discharge port, and the pushing and discharging plates make it difficult for the incineration ash to be deposited on the cleaning tool itself. Therefore, work of removing the incineration ash remaining at the discharge port located at a high place is not required, and the cleaning of the cleaning tool is also easy, so that the safety of the worker can be ensured, and the work time can be shortened.

In addition, the incineration ash can be effectively removed by the pushing and discharging plates and the scooping portions.

[Brief Description of Drawings]

[0011]

Fig. 1 is a cross-sectional view showing an ash-pushing and discharging device to which a cleaning tool according to an embodiment is applied.

Fig. 2 is a front perspective view showing the cleaning tool according to the embodiment.

Figs. 3A and 3B are front perspective views showing a state of each of blocks forming the cleaning tool of Fig. 2 before being fitted to each other, and Fig. 3C is a back perspective view showing a state of each of the blocks before being fitted to each other.

Figs. 4A and 4B are cross-sectional views of the ash-pushing and discharging device for describing a method for using the cleaning tool.

Fig. 5A is a front perspective view showing a cleaning tool according to a first modification example, and Fig. 5B is a front perspective view showing a state of each of blocks forming the cleaning tool of Fig. 5A before being fitted to each other.

Fig. 6 is a back perspective view showing a cleaning tool according to a second modification example.

Fig. 7 is a front perspective view showing a cleaning tool according to a third modification example.

[Description of Embodiments]

[0012]

Hereinafter, a cleaning tool for an ash-pushing and discharging device as an embodiment will be described with reference to the drawings. In the drawings, for the sake of simplicity of description, a description will be appropriately given using an orthogonal coordinate system based on an X axis, a Y axis, and a Z axis.

The following embodiment is provided as merely an example, and is not intended to exclude the application of various modifications or techniques that are not specified in the following embodiment. Each configuration of the present embodiment can be modified and implemented in various forms without departing from the concept of the present embodiment. In addition, the configurations can be selectively adopted as needed or can be appropriately combined.

[0013]

Hereinafter, first, an overall configuration of the ash-pushing and discharging device will be described, next, a configuration of the cleaning tool will be described in detail, and finally, a method for using the cleaning tool will be described.

[0014]

[1. Configuration of ash-pushing and discharging device]

As shown in Fig. 1, an ash-pushing and discharging device 1 of the present embodiment is provided in an incineration furnace (for example, a stoker furnace), to cool incineration ash generated in the incineration furnace, in a cooling tank 2 and then to discharge the incineration ash to a conveyance device (not shown) (for example, a conveyor).

The ash-pushing and discharging device 1 includes the cooling tank 2 in which storage water for cooling the incineration ash is stored, and a scraper 6 and a drive device 7 disposed in the cooling tank 2. The cooling tank 2 is provided with an introduction inlet 4 into which the incineration ash is introduced, and with a discharge port 5 that discharges the cooled incineration ash. Specifically, the cooled incineration ash is dropped and discharged from an opening end 3d of the discharge port 5 onto the conveyance device.

[0015]

The scraper 6 is a device that pushes the cooled incineration ash toward a discharge port 5 side. The scraper 6 includes an upper surface 6a facing upward, a pushing and discharging surface 6b facing the discharge port 5 side, and both side surfaces (not shown), and has a box shape that is open to a bottom surface 3 side of the cooling tank 2.

The scraper 6 moves forward and rearward along the bottom surface 3 while causing a lower end of the pushing and discharging surface 6b (tip 6c of the scraper 6) to be in contact with the bottom surface 3 of the cooling tank 2 over an entire width.

Incidentally, the "forward movement" of the scraper 6 means that the scraper 6 moves in a pushing and discharging direction (a right direction in Fig. 1 or a forward direction "Df") to push the incineration ash toward the discharge port 5 side, and the "rearward movement" of the scraper 6 means that the scraper 6 moves in a direction opposite the forward movement (a direction in which the scraper 6 returns, a left direction in Fig. 1, or a rearward direction "Dr"). In addition, since the "entire width" of the bottom surface 3 means a substantial size in a width direction (direction orthogonal to the drawing sheet of Fig. 1) inside the cooling tank 2 (is the same as a dimension of an interval between both side surfaces of the cooling tank 2 or is slightly smaller than the dimension), there may be a slight gap between the scraper 6 and both the side surfaces.

[0016]

The drive device 7 is a device that drives the scraper 6, and is disposed opposite the discharge port 5 with respect to the introduction inlet 4 (left side in Fig. 1). The drive device 7 includes a drive shaft 7A that is

rotatable in two directions, and an arm 7B that connects the scraper 6 and the drive shaft 7A. The drive device 7 causes the scraper 6 to reciprocate forward and rearward (front-rear direction) by means of the arm 7B when the drive shaft 7A rotates.

The introduction inlet 4 of the cooling tank 2 is formed of wall surfaces forming a tubular shape (for example, a rectangular tubular shape). The wall surfaces are directly connected to an ash chute (not shown). Incidentally, an upper end of the ash chute is connected to the incineration furnace (not shown) (for example, a post-combustion stage of the stoker furnace).

[0017]

The bottom surface 3 of the cooling tank 2 includes a first inclined surface 3a that is inclined upward from directly below the introduction inlet 4 toward the discharge port 5 (specifically, the opening end 3d that is a lower end portion of the discharge port 5 in a vertical direction), and a second inclined surface 3b that is inclined upward from directly below the introduction inlet 4 toward a side opposite the first inclined surface 3a. Namely, the first inclined surface 3a is formed to gradually increase in the forward direction "Df", and the second inclined surface 3b is formed to gradually increase in the rearward direction "Dr". Incidentally, in the cooling tank 2, a bottom surface

portion directly below the introduction inlet 4 (hereinafter, referred to as a "lowermost surface 3c") is the lowest, and the bottom surface 3 has a curved shape that is convex downward. A cross-sectional shape of the cooling tank 2 is uniform in the width direction (direction orthogonal to the drawing sheet of Fig. 1), and width dimensions of the first inclined surface 3a, the lowermost surface 3c, and the second inclined surface 3b are all the same.

[0018]

The cooling tank 2 is roughly classified into three spaces in the forward and rearward directions of the scraper 6. Specifically, there are a space located above the first inclined surface 3a (first space 2A), a space located above the second inclined surface 3b (second space 2B), and a space (fire extinguishing and humidifying space 2C) directly below the introduction inlet 4 (above the lowermost surface 3c).

The incineration ash introduced from the introduction inlet 4 is extinguished, cooled, and humidified in the fire extinguishing and humidifying space 2C. The first space 2A is a space in which the incineration ash is continuously humidified, and the incineration ash that is pushed above a predetermined water level (not shown) of the storage water stored in the cooling tank 2 by the scraper 6 is dried by the removal of moisture, to the extent that the incineration

ash does not solidify. The second space 2B is a space in which the drive device 7 is disposed. In addition, in a state where the scraper 6 is most retracted (the state of Fig. 1), the majority of the scraper 6 is located in the second space 2B.

[0019]

The cooling tank 2 is provided with an inspection port 8 as indicated by a chain double-dashed line in Fig. 1. The inspection port 8 can be opened and closed by, for example, a door. The inspection port 8 is located in the vicinity of the bottom surface 3 of the fire extinguishing and humidifying space 2C, and is formed in such a size that at least each of blocks 10 and 20 forming a cleaning tool 9 to be described later can be carried in with a margin.

[0020]

[2. Configuration of cleaning tool]

Fig. 2 is a front perspective view showing the cleaning tool 9 of the present embodiment, and Figs. 3A to 3C are a front perspective view and a back perspective view showing a state of the cleaning tool 9 before being fitted. The cleaning tool 9 includes a plurality (here, two as one example) of the blocks 10 and 20, and the blocks 10 and 20 are fitted and integrated with each other in the width direction, namely, in a direction along the Y axis. Incidentally, a height direction of the blocks 10 and 20 is

a direction along the Z axis, and a front-rear direction of the blocks 10 and 20 is a direction along the X axis.

The cleaning tool 9 is formed by integrating the blocks 10 and 20 through fitting, and has a dimension of the entire width of the cooling tank 2, namely, a dimension that is the same as the dimension of the interval between both the side surfaces of the cooling tank 2, or that is slightly larger than the dimension.

[0021]

The blocks 10 and 20 include pushing and discharging plates 11 and 21 each having a rectangular shape in a Y-Z plane and being disposed substantially perpendicular to the bottom surface 3 of the cooling tank 2; scooping portions 12 and 22 each having a rectangular shape in an X-Y plane and being connected to front surfaces of the pushing and discharging plates 11 and 21; and frames 13 and 23 connected to rear surfaces of the pushing and discharging plates 11 and 21 to form a rectangular parallelepiped, respectively.

Incidentally, in a state where the storage water of the cooling tank 2 is drained and discharged, and then the cleaning tool 9 is carried into the fire extinguishing and humidifying space 2C from the inspection port 8 as shown in Fig. 1 (initial state), an X-axis direction of Fig. 2 coincides with the forward and rearward directions of the scraper 6, a Y-axis direction of Fig. 2 coincides with the

width direction of the ash-pushing and discharging device 1 (direction orthogonal to the drawing sheet of Fig. 1), and a Z-axis direction of Fig. 2 coincides with an up-down direction.

[0022]

The pushing and discharging plates 11 and 21 are flat members for pushing the incineration ash toward the discharge port 5 side, and each have a rectangular shape when viewed from the discharge port 5 side. Incidentally, the front surfaces of the pushing and discharging plates 11 and 21 are surfaces of the pushing and discharging plates 11 and 21 facing the side of the forward direction "Df" (pushing and discharging direction) of the scraper 6, in other words, surfaces facing the discharge port 5 side, and the rear surfaces of the pushing and discharging plates 11 and 21 are surfaces of the pushing and discharging plates 11 and 21 facing the side of the rearward direction "Dr" side of the scraper 6 (surfaces facing opposite the front surfaces).

[0023]

The scooping portions 12 and 22 are portions of which entire tips are in contact with the bottom surface 3 and which scoop up the incineration ash deposited on the bottom surface 3, and each have a rectangular shape when viewed in a vertical direction of the bottom surface 3. The scooping

portions 12 and 22 may be integrally provided at lower portions of the pushing and discharging plates 11 and 21, or may be post-attached to the lower portions of the pushing and discharging plates 11 and 21.

In the cleaning tool 9 shown in Fig. 2, cross-sectional shapes of the scooping portions 12 and 22 in an X-Z plane, in other words, cross-sectional shapes of the scooping portions 12 and 22 in a vertical cross section of the bottom surface 3 have a wedge shape in which the thickness is increased from the tips toward the pushing and discharging plates 11 and 21. Accordingly, even when the incineration ash deposited on the bottom surface 3 is stuck, the incineration ash can be scraped up. In addition, since the scooping portions 12 and 22 have a wedge shape, the scooping portions 12 and 22 can reliably bite into a lower part of the incineration ash, and the cleaning tool 9 can be prevented from rising up and tipping over. Therefore, the cleaning tool 9 can stably push the incineration ash.

[0024]

The frames 13 and 23 are framework members for forming the cleaning tool 9 into a rectangular parallelepiped, and for example, an L-shaped steel can be used. The frames 13 and 23 are connected to the rear surfaces of the pushing and discharging plates to form a rectangular parallelepiped. Therefore, (1) each of the frames 13 and 23 may be formed

into a rectangular parallelepiped from an L-shaped steel, and then the pushing and discharging plates 11 and 21 each corresponding to one surface thereof may be connected, or (2) a rectangular parallelepiped may be completed by forming each of portions excluding one surface of each of rectangular parallelepipeds, from an L-shaped steel, and then by connecting the pushing and discharging plates 11 and 21 each corresponding thereto. Incidentally, in the case of (2), the rectangular parallelepiped cannot be formed only by the L-shaped steel.

In the cleaning tool 9 shown as an example in Fig. 2, unlike a second modification example shown in Fig. 6, upper edge portions of the pushing and discharging plates 11 and 21 and upper surfaces of the frames 13 and 23 are flush with each other (the same height).

[0025]

The frames 13 and 23 shown in Fig. 2 include L-shaped steels 13a and 23a extending in the up-down direction (Z-axis direction), L-shaped steels 13b and 23b extending in the front-rear direction (X-axis direction), and L-shaped steels 13c and 23c extending in the width direction (Y-axis direction).

Incidentally, a cube may be formed by setting all the L-shaped steels 13a, 13b, and 13c to the same length, and a cube may be formed by setting all the L-shaped steels 23a,

23b, and 23c to the same length. In addition, the frames 13 and 23 of the two blocks 10 and 20 may have the same up-down dimension and front-rear dimension, and width dimensions (lengths of the L-shaped steels 13c and 23c extending in the width direction) may be different from each other.

[0026]

As shown in Fig. 2, in the cleaning tool 9, the two blocks 10 and 20 are fitted and integrated with each other and have the dimension of the entire width of the bottom surface 3 (dimension that is the same as the dimension of the interval between both the side surfaces of the cooling tank 2 or that is slightly smaller than the dimension), the pushing and discharging plates 11 and 21 are integrated to have a rectangular shape when viewed from the discharge port 5 side, and the scooping portions 12 and 22 are integrated to have a rectangular shape when viewed in the vertical direction of the bottom surface 3. Namely, the two pushing and discharging plates 11 and 21 form one rectangular pushing and discharging plate to form a flush pushing and discharging surface. In addition, the two scooping portions 12 and 22 form one scooping portion to form a flush scooping surface.

[0027]

Figs. 3A to 3C shows a state where the two blocks 10

and 20 forming cleaning tool 9 of Fig. 2 are divided.

As shown in Figs. 3A to 3C, the cleaning tool 9 includes the first block 10 including a protrusion 14 on a side of the frame 13, and the second block 20 including a recess 25 on a side of the frame 23.

Of two side surfaces of the pushing and discharging plate 11 and the frame 13 of the first block 10 in the Y-axis direction, the protrusion 14 having a rectangular shape and protruding in the Y-axis direction from the side surface located on a positive (+) direction side, and of side surfaces of the pushing and discharging plate 21 and the frame 23 of the second block 20 in the Y-axis direction, the recess 25 having a rectangular shape and being recessed in the Y-axis direction from the side surface located on a negative (-) direction side are provided. The protrusion 14 enters the inside of the recess 25 to be fitted to each other, so that the two blocks 10 and 20 are united and integrated.

[0028]

The first block 10 includes two insertion holes 16 penetrating through both end portions of an upper surface of the protrusion 14. In addition, the second block 20 includes two insertion holes 26 penetrating through both end portions of an upper surface of the recess 25.

The insertion holes 16 and 26 are provided at positions

where the insertion holes 16 and 26 communicate with each other when the protrusion 14 and the recess 25 are fitted to each other. Bolts 30 for preventing misalignment are inserted into the insertion holes 16 and 26.

Incidentally, for simplification of work, the bolts 30 are merely inserted into the insertion holes 16 and 26, and are not fastened with nuts. Since the bolts 30 do not need to be fastened with nuts, the bolts 30 may be rod-shaped pins without threads formed, instead of bolts with threads formed.

In addition, as long as a fitted state of the protrusion 14 and the recess 25 is maintained even without the bolts 30, the bolts 30 and the insertion holes 16 and 26 may be omitted.

[0029]

The blocks 10 and 20 include insert holders 17 and 27 for fitting an insert 40 (for example, a square member, preferably a wooden square member) to be described later, respectively. The insert holders 17 and 27 are provided on surfaces of the two L-shaped steels 13a and of the two L-shaped steels 23a (refer to Fig. 2) extending in the up-down direction of the frames 13 and 23 at the rears of the blocks 10 and 20, respectively, the surfaces facing a negative (-) X direction.

Here, the insert holders 17 and 27 each having a plate

shape bent in an "L" shape are provided as an example, but the shape of the insert holders 17 and 27 is not limited to the shape. In addition, as long as the movement of the insert 40 can be suppressed without using the insert holders 17 and 27, the insert holders 17 and 27 may be omitted.

[0030]

The blocks 10 and 20 includes handles 18 and 28 protruding from surfaces of the two L-shaped steels 13b and of the two L-shaped steels 23b (refer to Fig. 2) at the top extending in the front-rear direction of the frames 13 and 23, respectively, the surfaces facing a positive (+) Z direction. For example, a worker can easily move the first block 10 by holding both the handles 18 that are provided on the two respective L-shaped steels 13b.

Incidentally, the handles 18 and 28 are not indispensable configurations, and may be omitted as shown in Figs. 1 and 4A and 4B.

[0031]

Next, dimensional ratios of the cleaning tool 9 will be described. As shown in Fig. 1, a height dimension "Hc" (dimension in the Z-axis direction of Fig. 2) of the cleaning tool 9 is a dimension that is smaller than a shortest length "Hm" from the bottom surface 3 to a top surface 41 of the cooling tank 2 in a path from the introduction inlet 4 toward the discharge port 5 of the ash-

pushing and discharging device 1 and in the vertical direction of the bottom surface 3, and that is equal to or greater than half the shortest length "Hm". In addition, the height dimension "Hc" is smaller than twice a total length "Lf" of the cleaning tool 9 in the front-rear direction (dimension in the X-axis direction of Fig. 2) excluding the scooping portions 12 and 22 and including the frames 13 and 23 and the pushing and discharging plates 11 and 21.

Namely, the height dimension "Hc" of the cleaning tool 9 is set to satisfy the following Condition 1.

Condition 1: $(0.5 \times Hm) \leq Hc < Hm$ and $Hc < (2 \times Lf)$

[0032]

Incidentally, the "height dimension "Hc" of the cleaning tool 9" referred to here is a higher one of a dimension obtained by adding a height dimension of the handles 18 and 28 to a height dimension of the frames 13 and 23 and a height dimension of the pushing and discharging plates 11 and 21. For example, in the cleaning tool 9 shown in Fig. 2, since the upper edge portions of the pushing and discharging plates 11 and 21 and the upper surfaces of the frames 13 and 23 are flush with each other (the same height), and the handles 18 and 28 are provided, the height dimension "Hc" of the cleaning tool 9 is a dimension obtained by adding the height dimension of the handles 18 and 28 to the

height dimension of the frames 13 and 23.

[0033]

A size of the scooping portions 12 and 22 (the amount of protrusion from the pushing and discharging plates 11 and 21, in other words, the length of the scooping portions in the X-axis direction of Fig. 2) is set such that a difference ($L_c - L_f$) between a length " L_c " of the cleaning tool 9 in the front-rear direction (entire length, namely, a total length of dimensions of the scooping portion, the frame, and the pushing and discharging plate in the X-axis direction) and the length " L_f " is smaller than one-fifth of the length " L_f ". Namely, the size of the scooping portions 12 and 22 is set to satisfy the following Condition 2.

Condition 2: $(L_c - L_f) < (0.2 \times L_f)$

[0034]

[3. Method for using cleaning tool]

As shown in Fig. 1, the cleaning tool 9 is carried into the fire extinguishing and humidifying space 2C from the inspection port 8 in a state where the storage water in the cooling tank 2 is drained and in a state where the scraper 6 is most retracted. At this time, the plurality of blocks are carried in one by one in a divided state, and are fitted and integrated with each other in the cooling tank 2.

[0035]

In the cleaning tool 9, the scraper 6 presses the frames 13 and 23 from a rear surface side of the pushing and discharging plates 11 and 21, so that the scooping portions 12 and 22 scoop up the incineration ash, and the pushing and discharging plates 11 and 21 push the incineration ash toward the discharge port 5. Since a drive range of the scraper 6 is limited, the cleaning tool 9 cannot be moved to the vicinity of the discharge port 5 only by a forward and rearward reciprocating motion of the scraper 6. Therefore, as shown in Fig. 4A, the cleaning tool 9 is gradually moved forward toward the discharge port 5 side by sequentially inserting the inserts 40 between the pushing and discharging surface 6b of the scraper 6 and the cleaning tool 9 and by increasing the number of the inserts 40.

As indicated by a flow from Fig. 4A to Fig. 4B, the inserts 40 are gradually increased, and the cleaning tool 9 gradually approaches the discharge port 5 side. Therefore, as shown in Fig. 4B, when the cleaning tool 9 has reached the opening end 3d of the bottom surface 3, almost all the incineration ash is discharged from the opening end 3d, so that almost no incineration ash remains on the first inclined surface 3a or at the end portion of the discharge port 5. In addition, the pushing and discharging plates 11 and 21 and the scooping portions 12 and 22 satisfying

Condition 1 and Condition 2 cause almost no incineration ash to remain on the cleaning tool 9 itself.

[0036]

[4. Effects]

Since the cleaning tool 9 of the present embodiment can be divided into the plurality of blocks 10 and 20, the worker can easily carry each block into the cooling tank 2 from the inspection port 8, and complete assembly only by fitting the blocks 10 and 20 to each other, so that a carry-in device such as a crane is not required, and the work cost can be suppressed.

In the cleaning tool 9, only two types of members such as the pushing and discharging plates 11 and 21 and the scooping portions 12 and 22 each having a simple shape come into contact with the incineration ash. For this reason, when the cleaning tool 9 has degraded, the only thing required is to replace two types of the members 11 and 21 and the members 12 and 22, the manufacturing cost can be reduced, and maintenance is easy.

[0037]

Unlike the cleaning tool having an "L" shape disclosed in Patent Document 1, the cleaning tool 9 of the present embodiment can be moved to the end portion of the discharge port 5 of the ash-pushing and discharging device 1, in other words, to the very limit of the opening end 3d. And the

cleaning tool 9 can effectively remove the incineration ash by reliably being in contact with the entire width of the bottom surface 3 of the ash-pushing and discharging device 1 during movement. Therefore, not only the incineration ash can be effectively removed, but also the incineration ash does not remain at the discharge port 5 located at a high place, so that work of removing the incineration ash at the discharge port 5 is not required, and the safety of the worker can be ensured.

[0038]

Since the cleaning tool 9 of the present embodiment can be integrally formed of the plurality of blocks 10 and 20 only by fitting the protrusion 14 of the first block 10 and the recess 25 of the second block 20 to each other, the worker can easily complete the assembly of the cleaning tool 9. Accordingly, the work time can be shortened, and the work cost can be reduced.

Incidentally, when the cleaning tool 9 includes the bolts 30 (or pins) and the insertion holes 16 and 26, misalignment of the plurality of blocks can be prevented. In this case, since the bolts 30 (or pins) do not need to be fastened with nuts, work inside the ash-pushing and discharging device 1 that is narrow can be reduced.

[0039]

In the cleaning tool 9 of the present embodiment, since

a cross-sectional shape of each of the scooping portions 12 and 22 is a wedge shape, even when the incineration ash is stuck to the bottom surface 3, the incineration ash can be scraped off by the tips of the scooping portions 12 and 22. And the incineration ash on the bottom surface 3 can be pushed by the pushing and discharging plates 11 and 21 while being scraped up by inclined surfaces of the scooping portions 12 and 22. In addition, since the scooping portions 12 and 22 each have a wedge shape, the scooping portions 12 and 22 can reliably bite into a lower part of the incineration ash, and the cleaning tool 9 can be prevented from rising up and tipping over. Therefore, the cleaning tool 9 can stably and effectively remove the incineration ash.

[0040]

Since each dimension of the cleaning tool 9 of the present embodiment is set to satisfy $(0.5 \times H_m) \leq H_c < H_m$ of Condition 1, the cleaning tool 9 is prevented from being caught in the path toward the discharge port 5 of the ash-pushing and discharging device 1 and from being immovable. Therefore, the incineration ash can be pushed by the pushing and discharging plates 11 and 21 having a sufficient area. In addition, since each dimension of the cleaning tool 9 is set to satisfy $H_c < (2 \times L_f)$ of Condition 1, the cleaning tool 9 can be prevented from tipping over. Therefore, the

cleaning tool 9 can stably move to the vicinity of the discharge port 5, and the incineration ash can be effectively removed.

In addition, since each dimension of the cleaning tool 9 is set to satisfy $(L_c - L_f) < (0.2 \times L_f)$ of Condition 2, the cleaning tool 9 is configured (shaped) such that after cleaning work, almost no incineration ash remains on the pushing and discharging plates 11 and 21 and on the scooping portions 12 and 22. Therefore, not only the incineration ash can be reliably removed, but also the cleaning tool 9 itself is sufficiently cleaned by simple cleaning, and the work time can be shortened.

[0041]

[5. Modification examples]

The cleaning tool 9 described above is one example, and is not limited to the above-described configurations. Hereinafter, three types of modification examples will be described. The modification examples can also be combined with each other.

In the following description, the same components as those in the above-described embodiment are denoted by the same reference signs, and duplicate descriptions including the effects obtained in the embodiment will not be repeated. All the modification examples are configured to satisfy Condition 1 and Condition 2 described above.

[0042]

[5-1. First modification example]

A cleaning tool 9A of a first modification example shown in Figs. 5A and 5B is different from the cleaning tool 9 of the embodiment described above in that a plurality of blocks more than two, here, as one example, three blocks 10, 20, and 20' are integrated. Namely, in the cleaning tool 9A, three blocks adjacent to each other in the width direction (Y-axis direction) are fitted and integrated with each other to have the dimension of the entire width of the bottom surface 3 (dimension that is the same as the dimension of the interval between both the side surfaces of the cooling tank 2, or that is slightly smaller than the dimension), the pushing and discharging plates are integrated to have a rectangular shape in the Y-Z plane, and the scooping portions are integrated to have a rectangular shape in the X-Y plane.

[0043]

Specifically, the cleaning tool 9A of the first modification example includes one first block 10 having the same configuration as that of the cleaning tool 9 of the embodiment, and two second blocks 20 and 20'.

The other second block 20' located in the middle further includes a protrusion 24 on a side opposite a side on which the recess 25 is disposed. The protrusion 24 can

have, for example, the same shape as that of the protrusion 14 of the first block 10. Specifically, the protrusion 24 is formed in a rectangular shape protruding in the Y-axis direction from a side surface that is located on the positive (+) direction side, of two side surfaces of the pushing and discharging plate 21 and the frame 23 of the second block 20' in the Y-axis direction.

In the cleaning tool 9A of the present modification example, the protrusion 14 of the first block 10 located at an end is fitted to the recess 25 of the second block 20' in the middle, and the protrusion 24 of the second block 20' in the middle is fitted to the recess 25 of the another second block 20 located at an end, so that the three blocks are united and integrated.

[0044]

As described above, the first block 10, the second block 20' including the recess 25 and the protrusion 24, and the second block 20 different from the second block 20' are fitted and integrated with each other to form the cleaning tool 9A of the first modification example. Therefore, the cleaning tool 9A of the first modification example has a larger width dimension than that of the cleaning tool 9 of the embodiment in which the two blocks, namely, the first block 10 and the second block 20 are used.

Incidentally, here, an example has been shown in which

the first block 10 and the second block 20 that are the same as those of the cleaning tool 9 are used in the cleaning tool 9A, but the width dimensions of the blocks including the second block 20' may be the same or may be changed to be different from each other. When the width dimension of each block of the cleaning tool 9A is changed to a dimension different from that of the first block 10 and the second block 20, the cleaning tool 9 in which two blocks are used and the cleaning tool 9A in which three or more blocks are used can be set to the same width dimension.

[0045]

In the cleaning tool 9A shown in Fig. 5A, as one example, two blocks are integrated, but the number of blocks is not limited thereto, and the cleaning tool 9A may be configured to include a total of four or more blocks by increasing the number of the second blocks 20' each including the recess 25 and the protrusion 24. Even in this case, the cleaning tool 9A can be configured by fitting the blocks adjacent to each other in the width direction to each other, and by integrating all the blocks.

The ash-pushing and discharging device 1 has a plurality of sizes from a large one to a small one. Therefore, the width dimension of the cleaning tool 9A can be adjusted by increasing or decreasing the number of the second blocks 20', so that the types of the ash-pushing and

discharging devices to which the cleaning tool 9A is applicable can be increased.

In addition, in the cleaning tool 9A of the first modification example, each block can be reduced in weight by setting the number of divisions of the blocks for a specific ash-pushing and discharging device to three or more, for example, designing a large number of divisions such as four or five. Therefore, the cleaning tool 9A of the first modification example is a cleaning tool that is more effective in reducing the work time and in reducing the work cost.

[0046]

[5-2. Second modification example]

A cleaning tool 9B of a second modification example shown in Fig. 6 is different from the cleaning tool 9 of the embodiment described above in that pushing and discharging plates 11B and 21B of blocks 10B and 20B protrude upward from the upper surfaces of the frames 13 and 23.

Namely, a size of the pushing and discharging plates 11B and 21B (or a size of the frames 13 and 23) is set such that upper edge portions of the pushing and discharging plates 11B and 21B protrude upward from the upper surfaces of the frames 13 and 23. Incidentally, when a height dimension of the pushing and discharging plates 11B and 21B

is larger than a dimension obtained by adding the height dimension of the handles 18 and 28 to the height dimension of the frames 13 and 23, the height dimension of the pushing and discharging plates 11B and 21B is the height dimension "Hc" of the cleaning tool 9B.

[0047]

Since the cleaning tool 9B of the second modification example includes the pushing and discharging plates 11B and 21B having a larger area than that of the pushing and discharging plate 11 and 21 of the cleaning tool 9 of the embodiment, the cleaning tool 9B can more effectively push the incineration ash toward the discharge port 5 side than the cleaning tool 9 of the embodiment.

[0048]

[5-3. Third modification example]

In a cleaning tool 9C of a third modification example shown in Fig. 7, scooping portions 12C and 22C of blocks 10C and 20C are different in shape from those of the cleaning tool 9 of the embodiment. Specifically, a cross-sectional shape of the scooping portions 12C and 22C of the present modification example in the X-Z plane is a plate shape in which the thickness is substantially constant from tips of the scooping portions 12C and 22C toward the pushing and discharging plates 11 and 21. In Fig. 7, the cleaning tool 9C in which the scooping portions 12C and 22C made of an L-

shaped steel are fixed to lower end portions of the pushing and discharging plates 11 and 21 is shown as an example.

[0049]

Even with the cleaning tool 9C, similarly to the cleaning tool 9 of the embodiment, the incineration ash can be stably and effectively removed by causing the pushing and discharging plates 11 and 21 to push the incineration ash while scraping up the incineration ash.

[0050]

[5-4. Others]

In the embodiment and each modification example described above, a configuration in which the first block 10 is provided with the protrusion 14 having a rectangular shape, each of the second blocks 20 and 20' is provided with the recess 25 having a rectangular shape, and the first block 10 and the second blocks 20 and 20' are fitted and integrated with each other has been provided as an example, but instead of the protrusion, the recess may be formed in the first block 10, and instead of the recess, a protrusion may be formed in each of the second blocks 20 and 20'.

In addition, the shape of the protrusion and the recess is not limited to the rectangular shape, and may be other shapes.

Further, it may be enough that at least two adjacent blocks are fitted and integrated with each other, and

fitting may not be performed in such a manner that a protrusion and a recess are fitted to each other, for example, as in sliding type fitting members.

[Reference Signs List]

[0051]

1: ash-pushing and discharging device

2: cooling tank

2A: first space

2B: second space

2C: fire extinguishing and humidifying space

3: bottom surface

3a: first inclined surface

3b: second inclined surface

3c: lowermost surface

3d: opening end

4: introduction inlet

5: discharge port

6: scraper

6a: upper surface

6b: pushing and discharging surface

6c: tip

7: drive device

7A: drive shaft

7B: arm

8: inspection port

9. 9A, 9B, 9C: cleaning tool
10, 10B, 10C: block, first block
11, 11B: pushing and discharging plate
12, 12C: scooping portion
13: frame
13a, 13b, 13c: L-shaped steel
14: protrusion
16: insertion hole
17: insert holder
18: handle
20, 20', 20B, 20C: block, second block
21, 21B: pushing and discharging plate
22, 22C: scooping portion
23: frame
23a, 23b, 23c: L-shaped steel
24: protrusion
25: recess
26: insertion hole
27: insert holder
28: handle
30: bolt (pin)
40: insert
41: top surface of cooling tank
Df: forward direction
Dr: rearward direction

Hc: height dimension of cleaning tool

Hm: shortest length from bottom surface 3 to top surface 41 and in vertical direction of bottom surface 3

Lc: length of cleaning tool in front-rear direction

Lf: length in front-rear direction excluding scooping portions and including frames and pushing and discharging plates of length of cleaning tool in front-rear direction

Claims

[Claim 1]

A cleaning tool for an ash-pushing and discharging device including a cooling tank including an introduction inlet into which incineration ash is introduced, and a discharge port that discharges the cooled incineration ash, a scraper which is disposed in the cooling tank, of which a tip is in contact with a bottom surface of the cooling tank over an entire width, and which pushes the incineration ash toward a discharge port side, and a drive device that is disposed opposite the discharge port with respect to the introduction inlet, and that drives the scraper, the tool comprising:

a plurality of blocks each including a pushing and discharging plate disposed substantially perpendicular to the bottom surface, and having a rectangular shape when viewed from the discharge port side,

a scooping portion which is connected to a front surface of the pushing and discharging plate that is a surface facing the discharge port side, of which a tip is in contact with the bottom surface, and which has a rectangular shape when viewed in a vertical direction of the bottom surface, and

a frame connected to a rear surface of the pushing and

discharging plate that is a surface facing opposite the front surface, to form a rectangular parallelepiped,

wherein the plurality of blocks adjacent to each other in an entire width direction are fitted and integrated with each other to have a dimension of the entire width, the pushing and discharging plates are integrated to have a rectangular shape when viewed from the discharge port side, and the scooping portions are integrated to have a rectangular shape when viewed in the vertical direction of the bottom surface,

the plurality of blocks include a first block including a protrusion on a side of the frame, and a second block including a recess on a side of the frame,

the protrusion of the first block and the recess of the second block are fitted to each other, so that the plurality of blocks are integrated, and

the scraper presses the frames, so that the scooping portions scoop up the incineration ash, and the pushing and discharging plates push the incineration ash toward the discharge port side.

[Claim 2]

The cleaning tool for an ash-pushing and discharging device according to Claim 1,

wherein a plurality of the second blocks are provided,

the second block further includes a protrusion on a side opposite the side on which the recess is disposed, and

the protrusion of one second block and the recess of the second block different from the one second block are fitted to each other, so that the plurality of blocks are integrated.

[Claim 3]

The cleaning tool for an ash-pushing and discharging device according to Claim 2,

wherein a cross-sectional shape of the scooping portion in a vertical cross section of the bottom surface is one of a wedge shape in which a thickness is increased from the tip toward the pushing and discharging plate and a plate shape in which the thickness is substantially constant from the tip toward the pushing and discharging plate.

[Claim 4]

The cleaning tool for an ash-pushing and discharging device according to any one of Claims 1 to 3,

wherein a height dimension of the cleaning tool is a dimension that is smaller than a shortest length from the bottom surface to a top surface of the cooling tank in a path from the introduction inlet toward the discharge port and in the vertical direction of the bottom surface, and

that is equal to or greater than half the shortest length, and a dimension smaller than twice a length dimension of the cleaning tool in a front-rear direction excluding the scooping portion and including the frame and the pushing and discharging plate.