

Description

Title of the Invention

CLEANING METHOD FOR ASH DISCHARGER

Field of the Invention

[0001]

The present invention relates to a cleaning method for an ash discharger that cools and discharges incinerated ash.

Background of the Invention

[0002]

The ash discharger is a device for introducing, from an introduction port into a cooling tank, incinerated ash discharged from an incinerator, cooling the incinerated ash in the cooling tank, and then discharging the incinerated ash from a discharge port. A scraper that pushes out the incinerated ash to the discharge port is disposed inside the cooling tank. The scraper is disposed with a leading end of the scraper in contact with the entire width of the bottom surface of the cooling tank and is driven by a drive device disposed in a side opposite to the discharge port with respect to the introduction port. When the incinerator is shut down, cleaning work for removing the incinerated ash in the ash discharger is performed so that the incinerated ash does not stick in the ash discharger.

[0003]

In the cleaning work, for example, a metal cleaning tool disclosed in Patent Document 1 can be used. In this case, the metal cleaning tool is disposed at the head, and then wooden blocks (e.g., lumbers) are sequentially added, whereby the incinerated ash in a storage tank of the ash discharger can be discharged from the discharge port of the ash discharger by using driving (i.e., the reciprocation of moving backward and forward) of the scraper. Specifically, when a wooden block disposed on the scraper side with respect to the cleaning tool is pushed out toward the discharge port side by the scraper, the cleaning tool is pushed out toward the discharge port side by the wooden block. Then, the incinerated ash is pushed by the cleaning tool and discharged from the discharge port. Patent Document 1 below discloses a method of fixing some wooden blocks by a portable jack when arranging the wooden blocks to perform cleaning work efficiently and safely.

Citation List

Patent Literature

[0004]

Patent Document 1: Japanese Patent No. 7391260

Summary of the Invention
Issue to be solved by the Invention

5 [0005]

The ash discharger has a bottom surface inclined upward to the discharge port from an inspection port (i.e., a manhole) through which a worker can enter the inside of the ash discharger. Therefore, when the cleaning tool is pushed by the wooden block and pushed out toward the discharge port side, if pressure of the wooden block is applied only to the lower side of the scraper side of the cleaning tool, a part of the cleaning tool on the discharge port side rises from the bottom surface of the ash discharger, and there is a possibility that the discharge efficiency of the incinerated ash decreases.

Therefore, to prevent the rise by applying the pressure of the wooden block to the upper side of the scraper side of the cleaning tool, a multilayer stacking method for stacking wooden blocks in an up-down direction has been developed. For example, when the height of the cleaning tool is equal to or greater than the height of three stacked wooden blocks and less than the height of four stacked wooden blocks, wooden block sets in which the four wooden blocks are stacked are sequentially arranged in a lateral direction along the drive direction of the scraper from the cleaning tool toward the scraper side along the bottom surface.

[0006]

However, in the method of preventing the rise of the cleaning tool by stacking the wooden blocks up and down in multiple layers as described above, the number and volume of the wooden blocks increase. When the number of the wooden blocks increases, not only the number of man-hours or the work time of the worker who arranges the wooden blocks in the cleaning work of the ash discharger increases and the cleaning cost increases, but also the transportation cost of the wooden blocks increases. Therefore, its improvement has been desired.

The present invention has been devised in view of the above-described issues, and it is an object of the present invention to provide a cleaning method for an ash discharger that can prevent the rise of a cleaning tool and that can efficiently discharge incinerated ash, while reducing the number and volume of wooden blocks as compared with the known technique in a cleaning method for an ash discharger in which the wooden blocks are stacked in multiple layers up and down.

Solution to the Issue

[0007]

A cleaning method of the present invention relates to an ash discharger, wherein the ash discharger has a cooling tank including an introduction port composed of a wall surface having a tubular shape into which incinerated ash is introduced and a discharge port from which the incinerated ash cooled by stored water is discharged, a
 5 scraper disposed in the cooling tank, having a leading end in contact with an entire width of a bottom surface of the cooling tank and configured to push out the incinerated ash toward a side of the discharge port, and a drive device disposed in a side opposite to the discharge port with respect to the introduction port and configured to drive the scraper, wherein the bottom surface of the cooling tank includes a first
 10 inclined surface inclined upward from immediately below the introduction port toward an opening end where the discharge port is formed and a second inclined surface having a width identical to a width of the first inclined surface and inclined upward from immediately below the introduction port toward a side opposite to the first inclined surface, wherein the stored water is stored in the cooling tank at a
 15 predetermined water level above a lower end of the wall surface and below the discharge port, wherein the drive device includes a drive shaft disposed above the second inclined surface, and pivoting to cause an arm connected to the drive shaft and the scraper to reciprocate the scraper forward and backward along the bottom surface, wherein the ash discharger further has, on a first side wall immediately below the
 20 introduction port, an inspection port including a front end close to the discharge port and a rear end positioned on an opposite side of the front end as viewed in a direction of reciprocation of the scraper.

The cleaning method includes at least the following first step, second step, third step, fourth step, and fifth step.

25 [0008]

That is, the cleaning method includes a first step of discharging the stored water from the cooling tank, moving the scraper backward to a vicinity of the rear end, and opening the inspection port, and includes a second step of inserting and setting a metal cleaning tool in contact with an entire width of the bottom surface into
 30 the cooling tank from the inspection port after the first step, then performing either one of a first preparation step or a second preparation step described below, then moving the scraper forward and stopping the scraper in a vicinity of the front end.

[0009]

Here, the first preparation step is a step of arranging, at a position closer to the
 35 scraper than the metal cleaning tool in the cooling tank, first wooden blocks each having a length equivalent to a height of the metal cleaning tool and each being vertically placed along a width direction of the metal cleaning tool, and then arranging, at a position closer to the scraper than the first wooden blocks, a second

wooden block set or the second wooden block sets along the direction of the reciprocation, the set of which includes second wooden blocks each having a length equivalent to a width of the metal cleaning tool and each being horizontally stacked up along a height direction of the metal cleaning tool but below the height of the metal
5 cleaning tool.

The second preparation step is a step of arranging, at a position closer to the scraper than the metal cleaning tool in the cooling tank, the second wooden block set or the second wooden block sets along the direction of the reciprocation, the set of which includes the second wooden blocks being horizontally stacked up and which has
10 a height equivalent to the height of the metal cleaning tool.

[0010]

The cleaning method includes, after the second step, a third step of inserting a portable jack between the first side wall and the closest second wooden block set to the scraper pushed out to the vicinity of the front end by forward movement of the
15 scraper, extending the portable jack, and fixing the closest second wooden block set between the first side wall and a second side wall disposed opposite to the first side wall. Thereafter, the following fourth step is performed.

[0011]

That is, in the fourth step, in a case of performing the first preparation step in
20 the second step, the closest second wooden block set is fixed by using the portable jack in the third step, then the scraper is moved backward to the vicinity of the rear end, and then either one of the third preparation step, the fourth preparation step, and the fifth preparation step is performed.

The third preparation step is a step of arranging, between the fixed second
25 wooden block set and the scraper, an additional second wooden block set or the additional second wooden block sets along the direction of the reciprocation, the set of which includes the second wooden blocks stacked up to the same number of layers of the fixed second wooden block set.

The fourth preparation step is a step of arranging, between the fixed second
30 wooden block set and the scraper, additional vertically-placed wooden blocks along the width direction of the metal cleaning tool and each having a length contactable with at least a surface, which is toward the scraper, of the highest wooden second block in the fixed second wooden block set, and then arranging, at a position closer to the scraper than the additional vertically-placed wooden blocks, the additional second
35 wooden block set or the additional second wooden block sets along the direction of the reciprocation, the set of which includes the second wooden blocks stacked up to the same number of layers equal to or less than the number of layers of the fixed

second wooden block set, or then arranging the second wooden block or the second wooden blocks being horizontally placed along the direction of the reciprocation.

The fifth preparation step is a step of stacking, between the fixed second wooden block set and the scraper, third wooden blocks each having the same length, each having the same cross-sectional dimension as a cross-sectional dimension of the second wooden block, and each length direction of which is being perpendicular to a length direction of the second wooden block, to the same number of layers of the fixed second wooden block, and then arranging, at a position closer to the scraper than the third wooden blocks, the additional second wooden block set or the additional second block sets along the direction of the reciprocation, the set of which includes the second wooden blocks stacked with the same number of layers of the stacked third wooden blocks.

[0012]

In the fourth step, in a case of performing the second preparation step in the second step, the closest second wooden block set is fixed by using the portable jack in the third step, then the scraper moves backward to the vicinity of the rear end, and then the fourth preparation step is performed between the fixed second wooden block set and the scraper.

[0013]

The cleaning method further includes a fifth step of shortening, after performing the fourth step, the portable jack to release the fixation, taking out the portable jack from the inspection port, moving the scraper forward, and then stopping the scraper in the vicinity of the front end.

Advantageous Effects of the Invention

[0014]

According to the cleaning method for an ash discharger of the present invention, it is possible to efficiently discharge incinerated ash by preventing rise of the metal cleaning tool, while reducing the number and volume of wooden blocks as compared with a known cleaning method.

Brief Description of Drawings

[0015]

FIG. 1 is a cross-sectional view of an ash discharger for describing a basic configuration of the ash discharger applied with a cleaning method for the present invention and a first step of the cleaning method for the present invention.

FIG. 2 is a perspective view illustrating an example of a metal cleaning tool used in the ash discharger of FIG. 1.

FIG. 3 is a cross-sectional view of the ash discharger illustrating a part of the second step of the cleaning method for the present invention.

FIG. 4 is a cross-sectional view of the ash discharger illustrating another part of the second step of the cleaning method for the present invention.

5 FIG. 5 is a cross-sectional view of the ash discharger illustrating a part of the third step of the cleaning method for the present invention.

FIG. 6 is a cross-sectional view of the ash discharger illustrating a part of the fourth step of the cleaning method for the present invention.

10 FIG. 7 is a cross-sectional view of the ash discharger illustrating another part of the fourth step of the cleaning method for the present invention.

FIG. 8 is a cross-sectional view of the ash discharger illustrating a part of the fifth step of the cleaning method for the present invention.

FIG. 9 is a cross-sectional view of the ash discharger illustrating a part of the fourth step when the third step to the fifth step are repeated again after the fifth step.

15 FIG. 10 is a cross-sectional view of the ash discharger for describing a state at the time of end of the cleaning work.

FIG. 11 is a perspective view describing arrangement of wooden blocks in the cleaning method for an embodiment.

20 FIG. 12 is a perspective view describing arrangement of wooden blocks in the cleaning method for Modification 1.

FIG. 13 is a perspective view describing arrangement of wooden blocks in the cleaning method for Modification 1A.

FIG. 14 is a perspective view describing arrangement of wooden blocks in the cleaning method for Modification 1B.

25 FIG. 15 is a perspective view describing arrangement of wooden blocks in the cleaning method for Modification 1C.

FIG. 16 is a perspective view describing arrangement of wooden blocks in the cleaning method for Modification 1D.

30 FIG. 17 is a perspective view describing arrangement of wooden blocks in the cleaning method for Modification 2.

FIG. 18 is a perspective view describing arrangement of wooden blocks in the cleaning method for Modification 2A.

FIG. 19 is a perspective view describing arrangement of wooden blocks in the cleaning method for Modification 2B.

35 FIG. 20 is a perspective view describing arrangement of wooden blocks in the cleaning method for Modification 2C.

FIG. 21 is a perspective view describing arrangement of wooden blocks in the cleaning method for Modification 2D.

Description of Embodiments of the Invention

[0016]

Hereinafter, an embodiment and modifications of the cleaning method for the present invention will be described with reference to a plurality of drawings illustrating a state of an ash discharger corresponding to each step. In each of these drawings, for convenience, some descriptions will be appropriately given by using an orthogonal coordinate system including an X axis, a Y axis, and a Z axis.

The cleaning methods of the following embodiment and modifications are merely examples, and there is no intention to exclude various modifications and application of techniques that are not explicitly described in the following embodiment and modifications. The steps of the cleaning method described in the embodiment and modifications can be variously modified and carried out without deviating from the essence thereof, except for essential steps.

[0017]

Hereinafter, a basic configuration of an ash discharger applied with the cleaning method for the present invention and an example of a metal cleaning tool used for cleaning work will be described first with reference to FIGS. 1 and 2, and then each step of the cleaning method for the embodiment will be described with reference to FIGS. 3 to 10.

[0018]

As illustrated in FIG. 1, generally, an ash discharger 1 includes a cooling tank 2 in which water for cooling incinerated ash is stored up to a predetermined water level indicated by a two-dot chain line, a scraper 3 disposed in the cooling tank 2, a drive device 4 that drives the scraper 3, an introduction port 5 through which incinerated ash is introduced from an incinerator, and a discharge port 6 through which the incinerated ash cooled in the cooling tank 2 is discharged by the scraper 3 and the drive device 4.

The introduction port 5 of the cooling tank 2 is formed of a wall surface having a tubular shape (e.g., a rectangular tubular shape). This wall surface is connected to an ash chute not illustrated. The upper end of the ash chute is connected to, for example, a subsequent combustion layer of a stoker incinerator that is a waste incinerator.

A bottom surface 7 of the cooling tank 2 includes a first inclined surface 7a inclined upward from a lowermost surface 7c, at the lowest position in a bottom surface portion immediately below the introduction port 5, toward the discharge port 6. The bottom surface 7 also includes a second inclined surface 7b inclined upward from the lowermost surface 7c toward a side opposite to the discharge port 6. That

is, the first inclined surface 7a is formed so as to gradually increase toward a forward direction "Df" (i.e., +X axis direction), and the second inclined surface 7b is formed to gradually increase toward a backward direction "Dr" (i.e., -X axis direction). Therefore, the bottom surface 7 has a curved surface shape which is a convex shape
5 downwardly.

The cross-sectional shape in a width direction (i.e., a direction orthogonal to a paper surface of FIG. 1, that is, Y axis direction) of the cooling tank 2 is the same, and width dimensions of the first inclined surface 7a, the lowermost surface 7c, and the second inclined surface 7b are all the same.

10 [0019]

The scraper 3 includes an upper plate 3a, a push-out plate 3b connected to the upper plate 3a and facing the discharge port 6, and both side plates, although FIG. 1 illustrates only one side plate 3c of the two side plates, connected to the upper plate 3a and the push-out plate 3b. There is no bottom plate facing the upper plate 3a,
15 therefore, the scraper 3 has a box shape opened to the bottom surface 7 of the cooling tank 2.

The scraper 3 is moved forward and backward along the bottom surface 7 by the drive device 4, while the lower end of the push-out plate 3b (i.e., a leading end 3d of the scraper 3) is in contact with the entire width of the bottom surface 7 of the
20 cooling tank 2.

The term "moving forward" of the scraper 3 means that the scraper 3 moves in a discharge direction (i.e., the forward direction "Df", that is +X axis direction) in which the push-out plate 3b of the scraper 3 pressurizes the incinerated ash and discharges toward the discharge port 6 side. In addition, "moving backward" of the
25 scraper 3 means that the scraper 3 moves in the opposite direction of forward movement (i.e., the backward direction "Dr", that is -X axis direction). The "entire width" of the bottom surface 7 means a substantial size in the width direction (i.e., Y axis direction) inside the cooling tank 2. Specifically, as illustrated in FIG. 5 described later, the "entire width" of the bottom surface 7 means a dimension that is
30 the same as or slightly smaller than an interval between both side walls 9 of the cooling tank 2 and means a dimension between a side wall 9a (i.e., a first side wall) and a side wall 9b (i.e., a second side wall).

[0020]

The drive device 4 is a device that drives the scraper 3 and is disposed above
35 the second inclined surface 7b. The drive device 4 includes a drive shaft 4a, that is rotatable in two directions, and an arm 4b connecting the scraper 3 and the drive shaft 4a. By rotating the drive shaft 4a, the drive device 4 can reciprocate the scraper 3

connected to the arm 4b and can make the scraper 3 going forward and backward (i.e., a front and back direction, that is, $\pm X$ axis direction).

[0021]

In the two side walls 9 of the cooling tank 2, the first side wall 9a includes an inspection port 8, which is called a “manhole”, having a rectangular shape in the vicinity of the lowermost surface 7c as indicated by a dash-dot line in FIG. 1. The inspection port 8 has a sealed door not illustrated, and the worker can open and close the inspection port 8. The inspection port 8 is formed in such a size that at least a metal cleaning tool 10 made of metal described later (e.g., hereinafter, simply called a “cleaning tool 10”) can be carried in with a margin.

An end portion of the inspection port 8 on a side close to the discharge port 6 as viewed in the X axis direction (i.e., in other words, a direction of reciprocation of the scraper 3) is called a front end 8a here. An end portion opposite to the front end 8a, that is an end portion of the inspection port 8 on a side close to the drive device 4, is called a rear end 8b here.

[0022]

FIG. 2 is a front perspective view illustrating the cleaning tool 10 made of metal as an example of the cleaning tool. Because the cleaning tool 10 is the invention described in Japanese Patent No. 6823753 by the inventor of the present invention, a specific description will be omitted. As illustrated in FIG. 2, in this cleaning tool 10, the front surface facing the discharge port 6 side (i.e., $+X$ axis direction) toward the forward direction “Df” is closed with a planar member, whereas the rear surface facing the scraper 3 side (i.e., $-X$ axis direction) toward the backward direction “Dr”, the left side surface, the right side surface, and the upper surface are only surrounded by frames having an L-shaped cross section for forming the cleaning tool 10 into a cuboid shape. That is, the rear surface, the left side surface, the right side surface, and the upper surface surrounded by the frames are not closed but opened.

[0023]

Because the cleaning tool 10 can be divided into, for example, two metal blocks 10A and 10B, the worker can easily carry each of the divided metal blocks 10A and 10B individually from the inspection port 8 into the inside of the ash discharger 1 and assemble the metal blocks into the cleaning tool 10. The width of the cleaning tool 10 is a dimension of the entire width of the bottom surface 7. The cleaning tool 10 can form a rectangular push-out plate having the entire width by combining the metal block 10A and the metal block 10B, and the incinerated ash can be pushed toward the discharge port 6 by this push-out plate.

Here, although the cleaning tool 10 is illustrated to have a configuration in which the two metal blocks 10A and 10B are integrated, the cleaning tool 10 may have a configuration in which three or more metal blocks are integrated in accordance with the gist of Japanese Patent No. 6823753. Furthermore, as long as the cleaning tool
5 10 can be carried in from the inspection port 8 into the inside of the ash discharger 1, it is not always necessary to use the cleaning tool described in Japanese Patent No. 6823753, and another cleaning tool, for example, a non-divisible integrally formed cleaning tool having a shape similar to that of the cleaning tool described in Patent Document 1 may be used depending on the situation.

10 [0024]

Each step of the cleaning method for the embodiment, that is, the cleaning method for discharging the incinerated ash inside the ash discharger 1 from the discharge port 6, will be sequentially described with reference to FIGS. 3 to 11. FIGS. 3 to 10 are views illustrating states of the ash discharger 1, which is the same as
15 in FIG. 1 at certain time points, and therefore, not all reference signs are described in all the drawings, and the descriptions for the reference signs are appropriately omitted. FIG. 11 is a perspective view describing arrangement of wooden blocks (e.g., rectangular lumbers) in the cleaning method for the embodiment described with reference to FIGS. 3 to 10.

20 [0025]

[First step]

In the first step, as illustrated in FIG. 1, in a state where water (i.e., stored water) is stored in the cooling tank 2, the drive device 4 is driven to reciprocate the scraper 3 forward and backward, and the drive device 4 is stopped after pushing out as
25 much incinerated ash as possible toward the discharge port 6. At this time, the scraper 3 is moved backward to the vicinity of the rear end 8b of the inspection port 8 and the drive device 4 is stopped in order that the leading end 3d of the scraper 3 is stopped in the vicinity of the rear end 8b.

Then, the stored water in the cooling tank 2 is entirely discharged. Methods
30 of the discharge can include various methods. For example, a discharge valve not illustrated may be installed on the bottom surface 7 of the cooling tank 2 to discharge water. A hose may be put into the cooling tank 2 from above the drive device 4, and a discharge pump connected to the hose may be driven to discharge water.

Thereafter, the worker opens the sealed door of the inspection port 8 and opens
35 the inspection port 8.

In the following steps, the inspection port 8 means the inspection port 8 having the sealed door opened.

[0026]

[Second step]

After the first step, the worker inserts or carries the cleaning tool 10 into the cooling tank 2 from the inspection port 8. Then, the worker arranges and sets the cleaning tool 10 in a space between the push-out plate 3b of the scraper 3 and the incinerated ash, in order to be in contact with the entire width of the bottom surface 7.

After performing either one of the first preparation step and the second preparation step described later, the worker moves the scraper 3 forward and stops the scraper 3 in the vicinity of the front end 8a of the inspection port 8.

Each of the first preparation step and the second preparation step in the second step is a step of arranging wooden blocks (e.g., rectangular lumbers) on the scraper 3 side with respect to the cleaning tool 10, and the first preparation step and the second preparation step are mainly different in whether the wooden block to be disposed first is vertically placed or horizontally placed. The definitions of "being vertically placed" and "being horizontally placed" will be described later.

First, a case where the first preparation step is performed in the second step will be described.

The case where the second preparation step is performed in the second step will be described later in Modification 2.

[0027]

[First preparation step]

In the first preparation step in the second step, as illustrated in FIGS. 3 and 11, a plurality of first wooden blocks 11 (e.g., six wooden blocks here) are inserted or carried into the inside of the cooling tank 2 from the inspection port 8. Then, the first wooden blocks 11 vertically placed are arranged in a vertical orientation toward the width direction (i.e., Y axis direction) at a position closer to the push-out plate 3b of the scraper 3 than the cleaning tool 10, in other words, in the -X axis direction from the cleaning tool 10 so as to be in contact with the cleaning tool 10.

Thereafter, a plurality of second wooden blocks 12 (e.g., three wooden blocks here) are inserted or carried into the inside of the cooling tank 2 from the inspection port 8, and one set is disposed at a position closer to the scraper 3 than the first wooden blocks 11 already disposed, in other words, in the -X axis direction from the first wooden blocks 11 as a second wooden block set 12A, in which the second wooden blocks 12 are stacked in a horizontal orientation and in multiple layers (e.g., three layers here) up to a height less than a height "H" (i.e., a length in the Z axis direction) of the cleaning tool 10. That is, as one set of the second wooden block set 12A, a plurality of the second wooden blocks 12 horizontally placed are stacked in multiple layers in the height "H" direction (i.e., Z axis direction, that is, up-down direction) of the cleaning tool 10.

FIGS. 3 and 11 exemplify a case where three second wooden blocks 12 are stacked in the up-down direction as one set of the second wooden block set 12A in the first preparation step.

A plurality of the second wooden block sets 12A can be arranged in the direction (i.e., X axis direction) of the reciprocation of the scraper 3.
[0028]

The first wooden block 11 has a length “L1” equivalent to the height “H” (i.e., the length in the Z axis direction) of the cleaning tool 10, is first disposed in the first preparation step. The first wooden block 11 is disposed vertically placed in order to be in contact with the cleaning tool 10.

The "being vertically placed or being in a vertical orientation" means that wooden blocks are disposed uprightly in the up-down direction in a state where the length direction of the wooden blocks is along the height “H” of the cleaning tool 10. Here, the first wooden block 11 is disposed in a state where the length direction of the first wooden block 11 is along the height “H” of the cleaning tool 10 (i.e., in a vertical orientation). In FIG. 11, six of the first wooden blocks 11 vertically placed are arranged in or toward the width direction (i.e., Y axis direction), and the six first wooden blocks are in contact with the adjacent first wooden block or blocks.

The number of the first wooden blocks 11 arranged in the width direction is based on the relationship between the total width of the first wooden blocks 11 and a width “W” of the cleaning tool 10. In FIG. 11, the number of first wooden blocks 11 is designed for the total width to be narrower than the width “W” of the cleaning tool 10.

The meaning of that the length “L1” of the first wooden block 11 is equal to the height “H” includes that the length “L1” is the same as the height “H” and that the length “L1” is in a range of about ± 10 cm with respect to the height “H”. In FIG. 11, the length “L1” of the first wooden block 11 is slightly longer than the height “H” of the cleaning tool 10.

The reason for the length “L1” of the first wooden block 11 to be designed in this manner will be described. As illustrated in FIG. 2, the upper surface, the back surface, and the lateral surface of the cleaning tool 10 are opened. Therefore, in a case that the first block 11 having the length L1 is disposed during cleaning work, if the length “L1” is less than the height “H”, the incinerated ash may enter from the upper surface or the back surface of the cleaning tool 10 to the rear side (i.e., to the scraper side) from the first wooden block 11. Therefore, in order that the first wooden block 11 has a function as a wall that suppresses occurrence that the incinerated ash enter the rear side, the length “L1” of the first wooden block 11 is equal to the height “H” of the cleaning tool 10. To enhance the entry suppression

effect, it is desirable that the length "L1" of the first wooden block 11 is longer than the height "H" of the cleaning tool 10.

[0029]

The second wooden block 12 has a length "L2" equivalent to the width "W" (i.e., a length in the Y axis direction) of the cleaning tool 10, and the second wooden block 12 is horizontally placed next to the first wooden block 11 in the first preparation step.

The "being horizontally placed or being in horizontal orientation" means that wooden blocks are laid down in the horizontal direction in a state where the length direction of the wooden blocks is along the width "W" (i.e., Y axis direction) of the cleaning tool 10 or in state where it is along a plane (i.e., XY plane) perpendicular to the height direction of the cleaning tool 10. Here, the second wooden block 12 is laid down in a state where the length direction of the second wooden block 12 is along the width "W" (i.e., Y axis direction) of the cleaning tool 10 (i.e., in horizontal orientation).

The meaning of that the length "L2" of the second wooden block 12 is equal to the width "W" includes that the length "L2" is the same as the width "W", and that the length "L2" is in a range of about ± 10 cm with respect to the width "W". In FIG. 11, the length "L2" of the second wooden block 12 is shorter than the width "W". The length "L2" of the second wooden block 12 is shorter than the interval between both the side walls 9 of the cooling tank 2, that is the entire width of the bottom surface 7, to secure an installation space of a portable jack 13 described later.

[0030]

In an additional second wooden block set 14 stacked in "apparent" multiple layers in Modification 1 described later, some wooden blocks of the first layer are in a state of being laid down in a plane (i.e., XY plane) where the length direction of the wooden block is perpendicular to the height direction of the cleaning tool 10, but is not necessarily in a state of being along the width "W" (i.e., Y axis direction) of the cleaning tool 10. However, because the definition of "being horizontally placed or being in horizontal orientation" is as described above, some of the wooden blocks of the first layer are also in a state of "being horizontally placed or being in horizontal orientation".

A third wooden block 16 in Modification 1B and the like described later is in a state where the length direction thereof is laid down on the plane (i.e., XY plane) but is laid down in a direction (i.e., X axis direction) perpendicular to the width "W" (i.e., Y axis direction) of the cleaning tool 10. Therefore, the third wooden block 16 is not along the width "W" (i.e., Y axis direction) of the cleaning tool 10. However, because the definition of "being horizontally placed or being in horizontal orientation"

is as described above, the third wooden block 16 is also in a state of "being horizontally placed or being in horizontal orientation".

[0031]

When one set of the second wooden block set 12A is disposed, as illustrated in FIG. 5 described later, each of the second wooden blocks 12 is disposed in order that one end 12a of each of the second wooden blocks 12 is in contact with the second side wall 9b facing the first side wall 9a on which the inspection port 8 is formed. That is, the other end 12b of each of the second wooden blocks 12 in the second wooden block set 12A is not in contact with the first side wall 9a. Therefore, there is a space between the other end 12b and the first side wall 9a.

When a plurality of the second wooden block sets 12A are sequentially disposed in the -X axis direction, it is desirable to arrange the one ends 12a of all the second wooden blocks 12 included in each of the second wooden block sets 12A to be in contact with the second side wall 9b.

The number (i.e., the number of layers) of the second wooden blocks 12 stacked in the second wooden block set 12A is designed such that a height "h1" of the second wooden block set 12A is less than the height "H" of the cleaning tool 10.

For example, in FIG. 11, when the second wooden blocks 12 are stacked in four layers, the height "h1" of the second wooden block set 12A exceeds the height "H" of the cleaning tool 10, and when the second wooden block 12 is in three layers or less, the height "h1" of the second wooden block set 12A is less than the height "H" of the cleaning tool 10. Therefore, FIG. 11 exemplifies a case where the second wooden blocks 12 are stacked in three layers in the second wooden block set 12A.

[0032]

FIG. 3 is a view illustrating a state where six of the first wooden blocks 11 are vertically placed and then one of the second wooden block sets 12A is horizontally placed by the first preparation step mentioned above.

FIGS. 3 to 10 are views illustrating the ash discharger 1 which has already completely discharged the stored water, and thus, there is no description of a two-dot chain line indicating a predetermined water level as in FIG. 1.

After performing the first preparation step, while viewing the inside of the cooling tank 2 from the inspection port 8, the worker remotely operates the drive device 4 to move the scraper 3 forward and stops the scraper 3 when the leading end 3d of the scraper 3 reaches the vicinity of the front end 8a of the inspection port 8 as illustrated in FIG. 4. By stopping the scraper 3 at this position, it is possible to provide, between the push-out plate 3b of the scraper 3 and the front end 8a of the inspection port 8, a gap large enough to allow at least a hand or an arm of the worker to be inserted, as illustrated in FIG. 4. The second wooden block set 12A is

positioned slightly in the +X axis direction relative to the front end 8a of the inspection port 8.

At this time, the first wooden blocks 11 and the second wooden block set 12A are in a state of being sandwiched and fixed between the scraper 3 and the cleaning tool 10.

[0033]

FIGS. 3 and 4 illustrate, as an example, views in which the first wooden blocks 11 and one of the second wooden block sets 12A are disposed between the scraper 3 and the cleaning tool 10, but the same applies to a case where a plurality of the second wooden block sets 12A are arranged in the X axis direction. That is, the first wooden blocks 11 and the second wooden block sets 12A are sandwiched and fixed between the scraper 3 and the cleaning tool 10.

Also in a case that the plurality of the second wooden block sets 12A are disposed, similarly to FIG. 4, in a state where the scraper 3 is moved forward and stopped in the second step, the second wooden block set 12A disposed at the closest location to the scraper 3 among them, that is the second wooden block set 12A in direct contact with the scraper 3 when the scraper 3 moves toward the discharge port 6 side (i.e., the second wooden block set 12A located at the most -X axis direction side), is positioned slightly in the +X axis direction relative to the front end 8a of the inspection port 8.

Hereinafter, in both of a case that only one set of the second wooden block sets 12A is disposed between the scraper 3 and the cleaning tool 10 and a case that the second wooden block sets 12A are disposed between the scraper 3 and the cleaning tool 10, the second wooden block set 12A in direct contact with the scraper 3 when the scraper 3 moves toward the discharge port 6 side, in other words, the second wooden block set 12A located at the most -X axis direction side, is simply called “the closest second wooden block set”.

Not limited to the second wooden block set 12A, at a certain time point, a wooden block disposed between the scraper 3 and the cleaning tool 10 or a wooden block set stacked in the up-down direction located at the most -X axis direction side is expressed as “the closest” wooden block or “the closest” wooden block set.

[0034]

[Third step]

After the second step, the closest second wooden block set 12A is in a state of being sandwiched and fixed between the scraper 3 and the cleaning tool 10 with the first wooden block 11 as described above. In a case that the plurality of the second wooden block sets 12A are disposed, in addition to the closest second wooden block set 12A, all the other second wooden block sets 12A are also sandwiched between the

scraper 3 and the cleaning tool 10, and are brought into a state of being fixed with the first wooden block set 11. Therefore, there is no possibility that the closest second block set 12A moves spontaneously.

Therefore, in the third step, the worker puts his/her hand or arm through the gap described in the second step (i.e., the gap between the push-out plate 3b of the scraper 3 and the front end 8a of the inspection port 8), inserts the portable jack 13 between the other end 12b of the second wooden block 12 in the highest layer (i.e., denoted by "(1)" in FIG. 11) of the closest second wooden block set 12A inside the cooling tank 2 and the first side wall 9a to align as illustrated in FIG. 5, and then extends a cylinder of the portable jack 13. Due to this, the second wooden block 12 in the highest layer in the closest second wooden block set 12A is firmly fixed between the first side wall 9a and the second side wall 9b. Because FIG. 5 is a view under adjustment between the portable jack 13 and the highest layer (i.e., before fixing the highest layer), there are spaces between the portable jack 13 and the other end 12b of the second wooden block 12 in the highest layer and between the portable jack 13 and the first side wall 9a.

[0035]

Here, an example has been described in which the portable jack 13 firmly fixes the second wooden block 12 in the highest layer of the closest second wooden block set 12A between the first side wall 9a and the second side wall 9b, as a result, fixes the entire closest second wooden block set 12A between the first side wall 9a and the second side wall 9b most stably. However, according to investigation by the inventor, it has been found that when the second wooden blocks 12 positioned in half or more upper layers counted from the lowest layer of the closest second wooden block set 12A are fixed between the first side wall 9a and the second side wall 9b by the portable jack 13, the entire closest second wooden block set 12A can be stably fixed between the first side wall 9a and the second side wall 9b.

For example, as in FIG. 11, in the second wooden block set 12A that includes the second wooden blocks 12 stacked in three layers, if the second wooden block 12 in the highest layer of the closest second wooden block set 12A is fixed as described above by the portable jack 13, the entire second wooden block set 12A can be most stably fixed between the first side wall 9a and the second side wall 9b. In a case that the second wooden block 12 in the second layer counted from the lowest layer of the closest second wooden block set 12A is fixed as described above by the portable jack 13, the entire second wooden block set 12A can also be stably fixed between the first side wall 9a and the second side wall 9b.

Of course, if the second wooden block 12 in the lowest layer of the closest second block set 12A is fixed between the first side wall 9a and the second side wall

9b by the portable jack 13, the entire closest second wooden block set 12A also can be immovably fixed between the first side wall 9a and the second side wall 9b.

Therefore, in accordance with the design and specifications of the ash discharger 1 and the number of layers (i.e., the number of stacks) of the entire second wooden

5 block set 12A, it is possible to appropriately select which layer of the second wooden blocks 12 from the lowest layer to the highest layer of the closest second wooden block set 12A to be fixed by the portable jack 13.

[0036]

In the third step exemplified here, the second wooden block 12 fixed by the
10 portable jack 13 in the highest layer of the closest second wooden block set 12A is disposed slightly in the +X axis direction relative to the front end 8a of the inspection port 8. Therefore, by putting not the entire body but only the hand or arm of the worker from the inspection port 8, the worker can safely perform the work of adjusting the portable jack 13 and fixing the second wooden block 12 in the highest

15 layer of the closest second wooden block set 12A.

The portable jack 13 is a jack having such a size allowing one worker to carry and to set the portable jack simply and easily inside the cooling tank 2 of the ash discharger 1 from the gap between the push-out plate 3b of the scraper 3 and the front end 8a of the inspection port 8 with one hand or both hands. That is, the portable jack
20 13 is a small-size jack. The portable jack 13 is desirably a hydraulic cylinder-type jack from the viewpoint of load bearing capacity, but it may be an air cylinder-type jack when it can sufficiently support and fix the second wooden blocks 12.

In the present embodiment, the portable jack 13 is described as a jack in which a cylinder expands and contracts. But the portable jack 13 may be a manual-type
25 jack in which a pantograph or the like expands and contracts when a handle is rotated as long as the second wooden block 12 in the highest layer can be firmly fixed.

That is, in the present invention, that “the portable jack is extended” means that the cylinder, the pantograph, and the like are extended, and that “the portable jack is contracted” means that the cylinder, the pantograph, and the like are contracted.

30 [0037]

[Fourth step]

After the second wooden block 12 of the closest second wooden block set 12A is fixed in the third step, the worker remotely operates the drive device 4 to move the scraper 3 backward with viewing the inside of the cooling tank 2 from the inspection
35 port 8, and the worker stops the scraper 3 when the leading end 3d of the scraper 3 reaches the vicinity of the rear end 8b of the inspection port 8, in the fourth step as illustrated in FIG. 6. By stopping the scraper 3 at this position, it is possible to obtain a large space in which the worker can insert new wooden blocks (i.e.,

additional wooden blocks) between the front end 8a and the rear end 8b of the inspection port 8 inside the cooling tank 2.

Therefore, after stopping the scraper 3, as illustrated in FIG. 7, the worker inserts the "additional wooden blocks" from the inspection port 8 to the inside of the cooling tank 2 between the scraper 3 and the closest second wooden block set 12A including the second wooden block 12 in the highest layer fixed by the portable jack 13, and the worker sequentially arranges them without a large gap among them on the bottom surface 7 of the cooling tank 2.

In the fourth step, the "additional wooden blocks" are disposed. Specifically, in a case that the first preparation step is performed in the second step, either one of the third preparation step, the fourth preparation step, or the fifth preparation step is performed, and in a case that the second preparation step is performed in the second step, the fourth preparation step is performed.

Here, at first, a case that the first preparation step is performed in the second step and the "third preparation step" is performed in the fourth step will be described as an example. The fourth preparation step and the fifth preparation step will be described in Modifications 1 to 1D later.

[0038]

[Third preparation step]

In the third preparation step in the fourth step, the additional second wooden block set 14 is arranged or the additional second wooden block sets 14 are arranged horizontally. In the additional second wooden block set 14, the second wooden blocks 12 are stacked in the same number of layers as the layers of the closest second wooden block set 12A which includes the second wooden block 12 in the highest layer (i.e., the second wooden block 12 denoted by the number "(1)" in FIG. 11) fixed by the portable jack 13.

As described later, in FIG. 11, in each fourth step, three sets of the additional second wooden block sets 14 are arranged in the X axis direction. In FIG. 11, the numbers "(1)", "(2)", and "(3)" indicate the order of the second wooden block 12 in the highest layer of the closest wooden block set (i.e., the second wooden block set 12A or the additional second wooden block set 14) fixed by the portable jack 13 at each time point for each temporally different step.

The second wooden block 12 used for the additional second wooden block set 14 is the same as the second wooden block 12 used for the second wooden block set 12A. Therefore, the height of the additional second wooden block set 14 is the same as that of the second wooden block set 12A.

In the fourth step, because the second wooden block 12 in the highest layer is firmly fixed by the portable jack 13 and the large space can be obtained inside the

cooling tank 2 in the state of FIG. 6, when the single additional second wooden block set 14 is newly disposed or the additional second wooden block sets 14 are newly disposed, the worker can arrange the second wooden block 12 for the new additional second wooden block set 14 by putting only his/her hand or arm from the inspection port 8. This makes it possible to safely perform the installation work of the second wooden block 12 for the additional second wooden block set 14 to the inside of the cooling tank 2.

[0039]

[Fifth step]

10 After the fourth step, in the fifth step, the worker contracts the cylinder of the portable jack 13, releases the fixation of the second wooden block 12 in the highest layer fixed by the portable jack 13, and takes out the portable jack 13 from the inspection port 8.

15 At this time, because the first wooden block 11, the second wooden block set 12A, and the additional second wooden block sets 14 are disposed between the cleaning tool 10 and the scraper 3 substantially without any gap on the bottom surface 7 of the cooling tank 2, even if the portable jack 13 is removed, these plurality of wooden blocks (i.e., the first wooden block 11, the second wooden block set 12A, and the additional second wooden block sets 14) do not move spontaneously.

20 As described above, because the length "L2" of the second wooden block 12 is shorter than the length in the width direction (i.e., Y axis direction) of the cleaning tool 10, and because the one end 12a of each of the second wooden blocks 12 is disposed to be in contact with the second side wall 9b, there is a gap large enough to allow the hand or arm of the worker to pass through between the other end 12b of each of the second wooden blocks 12 and the first side wall 9a (see FIG. 5).

25 This enables the worker to put not the entire body of the worker but only the hand or arm through the inspection port 8. Therefore, the worker safely and easily removes and takes out the portable jack 13 to the outside of the cooling tank 2 of the ash discharger 1.

30 [0040]

Thereafter, while the worker views the inside of the cooling tank 2 from the inspection port 8, the worker remotely operates the drive device 4 to move the scraper 3 forward, and the worker stops the scraper 3 when the leading end 3d of the scraper 3 reaches the vicinity of the front end 8a of the inspection port 8 as illustrated in FIG. 8.

35 By stopping the scraper 3 at this position, between the push-out plate 3b of the scraper 3 and the front end 8a of the inspection port 8, it is possible to provide a gap large enough to allow at least a hand or an arm of the worker to be inserted, as illustrated in FIG. 8.

The additional second wooden block set 14 closest to the scraper 3, that is the additional second wooden block set 14 (i.e., the additional second wooden block set 14 present on the most -X axis direction side) in direct contact with the scraper 3 when the scraper 3 moves toward the discharge port 6 side, is positioned slightly in the +X axis direction relative to the front end 8a of the inspection port 8.

Among the additional second wooden block sets 14 newly added in the fourth step, the additional second wooden block set 14 closest to the scraper 3 is the closest additional second wooden block set 14 in FIG. 8 and at the fifth step.

[0041]

Thereafter, the third step, the fourth step, and the fifth step are sequentially cyclically repeated a plurality of times until the cleaning tool 10 reaches the vicinity of the discharge port 6.

FIGS. 9 and 11 illustrate, as an example, a state immediately after each step is performed in the order of the first step, the second step (i.e., the first preparation step is performed), the third step (i.e., the third step of first time), the fourth step (i.e., the fourth step of first time and the third preparation step is performed at this time), the fifth step, the third step (i.e., the third step of second time), and the fourth step (i.e., the fourth step of second time and the third preparation step is performed at this time) as viewed in the order of passage of time.

FIG. 11 illustrates the second wooden block 12 in the highest layer fixed by the portable jack 13 in the third step of the first time by "(1)", and the second wooden block 12 in the highest layer fixed by the portable jack 13 in the third step of the second time by "(2)". In the state of FIG. 11, the third step of the third time is not yet performed, but for reference, the second wooden block 12 in the highest layer fixed by the portable jack 13 in the third step of the third time is indicated by "(3)".

[0042]

When the third step, the fourth step, and the fifth step are sequentially repeated and when the fifth step is performed in the end, the position of the cleaning tool 10 on the first inclined surface 7a is in a distance close to the discharge port 6. At this time, most of the incinerated ash in the cooling tank 2 has already been discharged from the discharge port 6.

Therefore, while the worker views the discharge port 6 from the outside of the ash discharger 1, as illustrated in FIG. 10, the worker remotely operates the drive device 4 to move the scraper 3 forward to such an extent that the cleaning tool 10 does not fall off from the discharge port 6, and the worker stops the scraper 3 at a position where the cleaning tool 10 is visible from the discharge port 6. This makes it possible to complete the cleaning work of discharging almost the entire incinerated

ash in the cooling tank 2 from the discharge port 6 and discharging the incinerated ash in the ash discharger 1 from the discharge port 6.

According to the above cleaning method, as illustrated in FIG. 11, because the height “h1” of the second wooden block set 12A including the second wooden block 12 becomes lower than the height “L1” of the first wooden block 11 disposed in contact with the cleaning tool 10 and the height “H” of the cleaning tool 10 (cf., see the broken line arrow in FIG. 11) from the cleaning tool 10 toward the scraper 3, it is possible to prevent rise of the cleaning tool 10 while reducing the number and volume of the wooden blocks as compared with the known method, and efficiently and safely perform the cleaning work of the ash discharger 1.

[0043]

After completion of the cleaning work, the worker sequentially takes out the cleaning tool 10 and wooden blocks such as the first wooden block 11, the second wooden block set 12A, and the additional second wooden block set 14, from the discharge port 6 to the outside of the ash discharger 1, or sequentially takes out these wooden blocks and the cleaning tool 10 from the inspection port 8. Here, even in a case that the worker takes out these wooden blocks and the cleaning tool 10 from the inspection port 8, because the entire incinerated ash has already been discharged and the weight of the incinerated ash is not added to the wooden blocks and the cleaning tool 10, and therefore, these things do not spontaneously move toward the inspection port 8. Therefore, the worker can safely take out the wooden blocks and the cleaning tool 10 to the outside of the ash discharger 1.

[0044]

[Modification 1]

FIG. 12 is a perspective view describing arrangement of wooden blocks according to the cleaning method for Modification 1. The cleaning method for Modification 1 is different from the arrangement of wooden blocks in the cleaning method for the embodiment described with reference to FIGS. 3 to 11, in that the fourth preparation step described later is performed in the fourth step of the first time and the third preparation step is performed in the fourth step of the second time.

The cleaning method for Modification 1 is the same as the cleaning method for the embodiment except for the above-described differences, and therefore, overlapping description will be omitted.

FIG. 12 illustrates a state immediately after each step is performed in the order of the first step, the second step (i.e., the first preparation step is performed), the third step (i.e., the third step of first time), the fourth step (i.e., the fourth step of first time and the fourth preparation step is performed), the fifth step, the third step (i.e., the

third step of second time), and the fourth step (i.e., the fourth step of second time and the third preparation step is performed) as viewed in the order of passage of time.

[0045]

[Fourth preparation step]

5 In the fourth preparation step in the fourth step, a plurality of (e.g., six here) additional vertically-placed wooden blocks 15, having a length “L3” contactable with at least the surface on the scraper 3 side of the second wooden block 12 in the highest stack (i.e., denoted by the number “(1)” in FIG. 12) of the closest second wooden block set 12A fixed by the portable jack 13, are disposed along the width direction
10 (i.e., Y axis direction) while being vertically placed with the length direction thereof along the height direction (i.e., Z axis direction), at a position closer to the scraper 3 than the second wooden block set 12A, in other words, on the -X axis direction side of the second wooden block set 12A.

 Thereafter, at a position closer to the scraper 3 than the additional vertically-
15 placed wooden blocks 15, in other words, on the -X axis direction side of the additional vertically-placed wooden blocks 15, an additional second wooden block set 14' or the additional second block sets 14' (e.g., one set here), in which the same number of stacks or less (e.g., two layers here) of the second wooden blocks 12 as or than that of the second wooden block sets 12A are stacked, are arranged.

20 In the fourth preparation step, after the additional vertically-placed wooden blocks 15 are disposed, in place of the one set or the plurality of sets of the additional second block sets 14', the single additional second wooden block 12 which is only one layer or the additional second wooden blocks 12 each of which is only one layer may be arranged in the X axis direction.

25 [0046]

 The additional vertically-placed wooden block 15 is a wooden block different from the first wooden block 11, and the length “L3” thereof is equal to the length “L1” of the first wooden block 11 or shorter than the length “L1” of the first wooden block 11.

30 In the example illustrated in FIG. 12, the length “L3” of the additional vertically-placed wooden block 15 is the same as the height “h1” of the second wooden block set 12A, and is shorter than the length “L1” of the first wooden block 11.

 Here, the length “L3” of the additional vertically-placed wooden block 15 is a
35 length contactable with at least the surface on the scraper 3 side of the second wooden block 12 in the highest stack. In other words, the length “L3” of the additional vertically-placed wooden block 15 is a length in which the upper end of the additional vertically-placed wooden block 15 overlaps the surface on the scraper 3 side of the

second wooden block 12 in the highest stack when the second wooden block 12 in the highest stack is viewed in the +X axis direction from the scraper 3.

Therefore, the length "L3" of the additional vertically-placed wooden block 15 is larger than a height "h2" (e.g., here, a height at which the second wooden blocks 12 are stacked in two stacks) of the second wooden block set 12A excluding the second wooden block 12 in the highest stack.

From the viewpoint of reducing the volume of the wooden block, the length "L3" of the additional vertically-placed wooden block 15 is desirably equal to or less than the height "h1" of the entire second wooden block set 12A.

10 [0047]

After the fourth step of the first time (i.e., the fourth preparation step is performed) is performed, the fifth step of the first time is performed, then the third step of the second time, the fourth step of the second time (i.e., the third preparation step is performed), and the fifth step of the second time are sequentially cyclically repeated a plurality of times.

However, in FIG. 12, unlike the additional second wooden block set 14 in the third preparation step described in the cleaning method for the embodiment of FIG. 11, in order to reduce the number or volume of the wooden blocks in the fourth step of the second time (i.e., the third preparation step is performed), three sets of the additional second wooden block sets 14' in which the second wooden blocks 12 are stacked in "apparent" multiple layers (e.g., two layers here) are arranged.

In this "apparent" three sets of the additional second wooden block sets 14', the number of the second wooden blocks 12 in the second layer is three, whereas only two of the second wooden blocks 12 are arranged in the lowest layer that is the first layer. The second wooden block 12x of the two second wooden blocks 12 arranged in the first layer is arranged to support both two second wooden blocks 12y and 12z of the three second wooden blocks 12 arranged in the second layer. To support the two second wooden blocks 12y and 12z easily, the second wooden block 12x may be arranged to be inclined in the X axis direction and the Y axis direction.

In the second wooden block 12 having the "apparent" stack arrangement as described above, the cleaning method for the present invention has no possibility that the second wooden block 12 in the highest layer collapses and that its position changes. For example, there is no possibility that it changes from the second layer to the first layer. In this case, the number of the second wooden blocks 12 can be reduced as compared with three sets of two second wooden blocks 12 stacked up and down actually. As a result, the volume of the wooden blocks (e.g., lumbers) can be reduced.

[0048]

Here, as an example, the "apparent" three sets of the additional second wooden block sets 14' are disposed, but actual three sets of the additional second wooden block sets in which two second wooden blocks 12 are stacked up and down may be disposed.

5 Modification 1 can also obtain the same effects as those of the cleaning method for the embodiment. Furthermore, Modification 1 can reduce the number of the second wooden blocks 12 as compared with the cleaning method for the embodiment. [0049]

[Modification 1A]

10 FIG. 13 is a perspective view describing arrangement of wooden blocks according to the cleaning method for Modification 1A. The cleaning method for Modification 1A is the same as the cleaning method for Modification 1 except for a width "wX" of a first wooden block 11', and thus overlapping description will be omitted.

15 In FIG. 13, the width "wX" of the first wooden block 11' disposed on the outside in the width direction among the first wooden blocks 11 (e.g., six wooden blocks here) is wider than that of the other first wooden blocks 11, and the entire width "W" of the cleaning tool 10 is covered with six of the first wooden blocks 11 and 11'. That is, the entire back surface of the cleaning tool 10 is covered with the
20 first wooden blocks 11 and 11'.

As described above, in the cleaning method for the embodiment and the cleaning method for Modification 1, the end surface on the first side wall 9a side of the second wooden block 12 and the end surfaces on the first side wall 9a side of the first wooden blocks 11 are set to be flush with each other. Because the length "L2" of the second wooden block 12 is shorter than the width "W" of the cleaning tool 10, a
25 part of the back surface of the cleaning tool 10 is not covered with the first wooden block 11. Normally, there is almost no amount of incinerated ash entering the scraper 3 side from the back surface of the cleaning tool 10, and therefore, the first wooden block 11 illustrated in FIGS. 11 and 12 can also perform the cleaning work
30 without problems.

However, when the amount of incinerated ash entering the scraper 3 side from the back surface of the cleaning tool 10 is too large to be overlooked, it is desirable that the width "wX" of the first wooden block 11' disposed on the outside in the width direction is made wider than that of the other first wooden blocks 11 as in
35 Modification 1A, and the entire back surface of the cleaning tool 10 is covered with the first wooden blocks 11 and 11'. This makes it possible to prevent the incinerated ash from entering the scraper side from the back surface of the cleaning tool 10.

[0050]

[Modification 1B]

FIG. 14 is a perspective view describing arrangement of wooden blocks according to the cleaning method for Modification 1B. The cleaning method for Modification 1B is different from FIG. 12 illustrating the cleaning method for Modification 1 in that the fifth preparation step described later is performed in the fourth step of the second time and that the fourth step of the third time is performed. The cleaning method for Modification 1B is the same as the cleaning method for Modification 1 except for these differences, and thus overlapping description will be omitted.

10 In FIG. 14, the fifth preparation step is performed also in the fourth step of the third time.

FIG. 14 illustrates a state immediately after each step is performed in the order of the first step, the second step (i.e., the first preparation step is performed), the third step (i.e., the third step of first time), the fourth step (i.e., the fourth step of first time and the fourth preparation step is performed), the fifth step (i.e., the fifth step of first time), the third step (i.e., the third step of second time), the fourth step (i.e., the fourth step of second time and the fifth preparation step is performed), the fifth step (i.e., the fifth step of second time), the third step (i.e., the third step of third time), and the fourth step (i.e., the fourth step of third time and the fifth preparation step is performed) as viewed in the order of passage of time.

[0051]

[Fifth preparation step]

In the fifth preparation step in the fourth step, the third wooden blocks 16, stacked in the same number of layers (e.g., two layers here) as the number which is counted from the lowest layer toward the highest layer of the second wooden block 12 of the closest additional second wooden block set 14' fixed by the portable jack 13 in the immediately preceding third step, are arranged in the Y axis direction, while the third wooden blocks 16 horizontally placed with the length direction thereof along the X axis direction at a position closer to the scraper 3 than the closest additional second wooden block set 14', in other words, in the -X axis direction of the closest additional second wooden block set 14'. That is, the third wooden blocks 16 are arranged in the Y axis direction in a state where the third wooden blocks 16 are perpendicular to the length direction (i.e., Y axis direction) of the second wooden block 12.

Thereafter, at a position closer to the scraper 3 than the third wooden block 16, in other words, in the -X axis direction of the third wooden block 16, one new set of the additional second wooden block sets 14', in which the second wooden blocks 12 are stacked in the same number of layers (i.e., the same number of layers as the layers of the closest additional second wooden block set 14', and for example, two layers

here) as the layers of the third wooden block 16, is disposed. In this fifth preparation step, the additional second wooden block sets 14' may be arranged in the X axis direction.

Each of the third wooden blocks 16 has the same length as each other and the same cross-sectional dimension as that of the second wooden block 12. In FIG. 14, two rows (i.e., two sets) of the third wooden blocks 16, in which two of the third wooden blocks 16 are stacked, are arranged in the Y axis direction. The two rows of the third wooden block sets 16 arranged in the Y axis direction are disposed at intervals. That is, the third wooden blocks 16 are disposed at intervals except in the stacking direction.

This can reduce the number and volume of the wooden blocks as compared with the case that the third wooden block sets are disposed without gaps in the Y axis direction.

The cleaning method for Modification 1B can also obtain the same effects as those of the cleaning method for the embodiment.

The cleaning method for Modification 1B can further reduce the number and volume of the wooden blocks as compared with the cleaning method for the embodiment.

[0052]

[Modification 1C]

FIG. 15 is a perspective view describing arrangement of wooden blocks according to the cleaning method for Modification 1C. In the cleaning method for Modification 1C, the first wooden blocks 11 (e.g., two here) vertically placed are arranged at intervals in the Y axis direction in the second step (i.e., the first preparation step), and the additional vertically-placed wooden blocks 15 (e.g., two here) are vertically placed at intervals in the Y axis direction in the fourth step (i.e., fourth preparation step). Except for these points, the cleaning method for Modification 1C is the same as the cleaning method for Modification 1B, and thus overlapping descriptions will be omitted.

In FIG. 15, two of the first blocks 11 and two of the additional vertically-placed wooden blocks 15 are disposed vertically placed at intervals in the Y axis direction.

Therefore, the cleaning method for Modification 1C can further reduce the number and volume of the wooden blocks as compared with the cleaning method for Modification 1B.

[0053]

[Modification 1D]

FIG. 16 is a perspective view describing arrangement of wooden blocks according to the cleaning method for Modification 1D. The cleaning method for Modification 1D is the same as the cleaning method for Modification 1B except that the fourth preparation step is performed in the fourth step of the third time, and thus overlapping description will be omitted.

In FIG. 16, in the fourth preparation step of the fourth step of the third time, after an additional vertically-placed wooden block 15' having a length "L4" contactable with at least the surface on the scraper 3 side of the second wooden block 12 in the highest layer (e.g., denoted by the number "(3)" in FIG. 16) in the closest additional second wooden block set 14' is disposed, one layer, that is the single second wooden block 12, is disposed. Each of the second wooden blocks 12 may be arranged in the single layer and in the direction of reciprocation of the scraper 3 that is in the X axis direction.

The length "L4" of the additional vertically-placed wooden block 15' is equal to or slightly shorter than the height of layers (e.g., here, the total height of two layers) of the closest additional second wooden block set 14', and is shorter than the length "L3" of the additional vertically-placed wooden block 15 disposed in the fourth step of the first time (i.e., the fourth preparation step). In FIG. 16, two of the additional vertically-placed wooden blocks 15' are disposed at intervals from each other in the Y axis direction, and the number of the additional vertically-placed wooden blocks 15' is reduced.

In the cleaning method for Modification 1D, the heights of the vertically - placed wooden blocks (i.e., the first wooden block 11, the additional vertically-placed wooden block 15, and the additional vertically-placed wooden block 15') gradually decrease, and the number of layers of the horizontally placed wooden blocks (i.e., the second wooden block set 12A, the additional second wooden block set 14', and the second wooden block 12) gradually decreases from the cleaning tool 10 toward the scraper 3. Therefore, the number and volume of the wooden blocks can be further reduced as compared with the cleaning method for the embodiment.

[0054]

[Modification 2]

FIG. 17 is a perspective view describing arrangement of wooden blocks according to the cleaning method for Modification 2. The cleaning method for Modification 2 is a cleaning method in which the second preparation step is performed in the second step.

FIG. 17 illustrates a state immediately after each step is performed in the order of the first step, the second step (i.e., the second preparation step is performed), the third step (i.e., the third step of first time), the fourth step (i.e., the fourth step of first

time and the fourth preparation step is performed), the fifth step (i.e., the fifth step of first time), the third step (i.e., the third step of second time), the fourth step (i.e., the fourth step of second time and the fourth preparation step is performed), the fifth step (i.e., the fifth step of second time), the third step (i.e., the third step of third time), and the fourth step (i.e., the fourth step of third time and the third preparation step is performed), as viewed in the order of passage of time.

[0055]

[Second preparation step]

In the second preparation step in the second step, as illustrated in FIG. 17, at a position closer to the scraper 3 than the cleaning tool 10, in other words, in the -X axis direction of the cleaning tool 10, the second wooden block set 12A, in which the second wooden blocks 12 (e.g., four here) are stacked in multiple layers (e.g., four layers here) at the height “h2” equivalent to the height “H” of the cleaning tool 10, is disposed to be in contact with the cleaning tool 10. The second wooden block sets 12A may be arranged in the X axis direction.

The meaning of that the height “h2” of the second wooden block set 12A is equal to the height “H” of the cleaning tool 10 includes that the height “h2” is the same as the height “H” of the cleaning tool 10 or is in a range of about ± 10 cm with respect to the height “H”. In FIG. 17, for example, the height “H” of the cleaning tool 10 is lower than the height “h2” in which the four second wooden blocks 12 are stacked and is higher than the three second wooden blocks 12 are stacked. In this case, because the height “h2” is higher than the height “H”, the incinerated ash can be suppressed from entering the scraper 3 side by the upper end side of the second wooden block set 12A.

[0056]

As illustrated in FIG. 17, after the second preparation step is performed in the second step, the second wooden block 12 in the highest layer (i.e., denoted by the number “(1)” in FIG. 17) of the closest second wooden block set 12A is fixed by the portable jack 13 in the third step (i.e., the third step of the first time).

Then, in the fourth step (i.e., the fourth step of the first time), the fourth preparation step is performed. Here, the additional vertically-placed wooden blocks 15A (e.g., six here) having a length “L5”, contactable with at least the surface on the scraper 3 side of the second wooden block 12 (i.e., the wooden block of the number (1)) fixed by the portable jack 13, are arranged along the Y axis direction. And then, at a position closer to the scraper 3 than the additional vertically-placed wooden blocks 15A, the single additional second wooden block set 14 or the additional second wooden block sets 14 (e.g., one set here), in which the second wooden blocks 12

having the same number of layers or less (e.g., three layers here) as or than the layers of the second wooden block sets 12A are stacked, are arranged.

[0057]

5 In FIG. 17, the fourth preparation step is performed also in the fourth step of the second time. Here, in the third step of the second time, after the second wooden block 12 in the highest layer (i.e., denoted by the number "(2)" in FIG. 17) of the closest additional second wooden block set 14 is fixed by the portable jack 13, new additional vertically-placed wooden blocks 15B (e.g., six here), having a length "L6" contactable with at least the surface on the scraper 3 side of the second wooden block 10 12 in the highest layer (i.e., the wooden block of the number (2)), are arranged along the Y axis direction. And then, at a position closer to the scraper 3 than the additional vertically-placed wooden blocks 15B, the new single additional second wooden block set 14' or the new additional second wooden block sets 14', in which the same number or less (e.g., two) of the second wooden blocks 12 as or than the number 15 of the layers of the closest additional second wooden block set 14 are stacked, is/are arranged.

Thereafter, in FIG. 17, the third preparation step is performed in the fourth step of the third time. Here, as in Modification 1, three sets of the "apparent" additional second block sets 14' are disposed. As a matter of course, also in FIG. 17, three sets 20 of the additional second wooden block sets in which two second wooden blocks 12 are actually stacked up and down may be disposed.

[0058]

In FIG. 17, the height (i.e., length) "L5" of the additional vertically-placed wooden block 15A is lower than the height of the second wooden block set 12A, and 25 the height of the additional second wooden block set 14 disposed in the fourth step of the first time is lower than the height (i.e., length) "L5" of the additional vertically-placed wooden block 15A. The height (i.e., length) "L6" of the additional vertically-placed wooden block 15B is lower than the height of the additional second wooden block set 14, and the height of the additional second wooden block set 14' disposed in 30 the fourth step of the second time is lower than the height (i.e., length) "L6" of the additional vertically-placed wooden block 15B.

Therefore, the height of the disposed wooden block gradually decreases from the cleaning tool 10 toward the scraper 3, in other words, from the cleaning tool 10 toward the -X axis direction. Therefore, the volume of the wooden blocks can be 35 reduced as compared with the cleaning method for the embodiment.

[0059]

[Modification 2A]

FIG. 18 is a perspective view describing arrangement of wooden blocks according to the cleaning method for Modification 2A. The cleaning method for Modification 2A is the same as the cleaning method for Modification 2 except for a width “wY” of some of second wooden blocks 12' in the second wooden block set 12A disposed in the second step (i.e., the second preparation step), and thus overlapping description will be omitted.

In Modification 2A, among the four second wooden blocks 12 constituting the second wooden block set 12A, the width “wY” of the three second wooden blocks 12', disposed below the second wooden block 12 in the highest layer, is wider than that of the second wooden block 12 in the highest layer, and the width “wY” is the same as or equivalent to the width “W” of the cleaning tool 10.

As described above, normally, because the incinerated ash does not enter the scraper 3 side from the back surface of the cleaning tool 10, the cleaning work can be performed without problems, even when the width of the second wooden block set 12A is shorter than the width “W” of the cleaning tool 10 as illustrated in Modification 2 of FIG. 17.

However, when the amount of incinerated ash entering the scraper 3 side from the back surface of the cleaning tool 10 cannot be overlooked, as in Modification 2A illustrated in FIG. 18, by widening the width “wY” of some of the second wooden block 12' of the second wooden block set 12A and by covering the entire or most of the back surface of the cleaning tool 10 with the second wooden block 12', it is possible to prevent incinerated ash from entering the scraper 3 side.

The width of the second wooden block 12 in the highest layer is set to be shorter than the width “wY” of the three second wooden blocks 12' in order to secure a space into which the portable jack 13 is inserted.

[0060]

[Modification 2B]

FIG. 19 is a perspective view describing arrangement of wooden blocks according to the cleaning method for Modification 2B. The cleaning method for Modification 2B is different from the cleaning method for Modification 2 of FIG. 17 in that the fifth preparation step is performed in the fourth step of the third time and that in the fourth step of the fourth time is performed. The cleaning method for Modification 2B is the same as the cleaning method for Modification 2 except for these differences, and thus overlapping descriptions will be omitted.

In FIG. 19, the fifth preparation step is performed also in the fourth step of the fourth time.

FIG. 19 illustrates a state immediately after each step is performed in the order of the first step, the second step (i.e., the second preparation step is performed), the

third step (i.e., the third step of first time), the fourth step (i.e., the fourth step of first time and the fourth preparation step is performed), the fifth step (i.e., the fifth step of first time), the third step (i.e., the third step of second time), the fourth step (i.e., the fourth step of second time and the fourth preparation step is performed), the fifth step
 5 (i.e., the fifth step of second time), the third step (i.e., the third step of third time), and the fourth step (i.e., the fourth step of third time and the fifth preparation step is performed), the fifth step (i.e., the fifth step of third time), the third step (i.e., the third step of fourth time), and the fourth step (i.e., the fourth step of fourth time and the fifth preparation step is performed), as viewed in the order of passage of time.

10 Because the fifth preparation step is the same as that described above in Modification 1B of FIG. 14, the description thereof will be omitted.

[0061]

[Modification 2C]

FIG. 20 is a perspective view describing arrangement of wooden blocks
 15 according to the cleaning method for Modification 2C. In the cleaning method for Modification 2C, the additional vertically-placed wooden blocks 15A (e.g., two here), disposed in the fourth step of the first time (i.e., the fourth preparation step), are vertically disposed at intervals from each other in the Y axis direction. And the additional vertically-placed wooden blocks 15B (e.g., two here), disposed in the fourth
 20 step of the second time (i.e., the fourth preparation step), are disposed at intervals from each other in the Y axis direction. Except for these points, the cleaning method for Modification 2C is the same as the cleaning method for Modification 2B, and thus overlapping descriptions will be omitted.

In FIG. 20, two of the additional vertically-placed wooden blocks 15A and two
 25 of the additional vertically-placed wooden blocks 15B are disposed vertically-placed at intervals from each other in the Y axis direction. Therefore, the number and volume of the wooden blocks can be reduced as compared with the cleaning method for Modification 2B, in which the six additional vertically-placed wooden blocks 15A and the six additional vertically-placed wooden blocks 15B are disposed.

30 [0062]

[Modification 2D]

FIG. 21 is a perspective view describing arrangement of wooden blocks
 according to the cleaning method for Modification 2D. The cleaning method for Modification 2D is the same as the cleaning method for Modification 2C except that
 35 the fourth preparation step is performed in the fourth step of the fourth time, and thus overlapping description will be omitted.

In FIG. 21, in the fourth preparation step of the fourth step of the fourth time, one layer, that is, the single second wooden block 12 is disposed after an additional

vertically-placed wooden block 15C, having a length "L7" (e.g., the height is the same as that of the closest additional second wooden block set 14' having two layers) contactable with at least the surface on the scraper 3 side of the second wooden block 12 in the highest layer (i.e., denoted by the number "(4)" in FIG. 21) in the closest additional second wooden block set 14', is disposed in the fourth preparation step of the fourth step of the fourth time. The second wooden blocks 12, that are not stacked and form one layer, may be arranged in the direction of reciprocation of the scraper 3 that is in the X axis direction.

[0063]

According to the above-described embodiment and each modification, it is possible to perform the cleaning work of the ash discharger 1 efficiently and safely by preventing rise of the cleaning tool 10, while reducing the number and volume of wooden blocks as compared with the known method.

In the cleaning method for the embodiment and each modification, the number of stacked wooden blocks in each wooden block set, the number of wooden blocks vertically placed, and the number of sets or wooden blocks arranged toward the reciprocation direction are not limited to those in the examples illustrated in FIGS. 3 to 21, and can be appropriately changed in accordance with the gist of the present invention.

20

Reference Signs List

[0064]

- 1 Ash discharger
- 2 Cooling tank
- 25 3 Scraper (3a Upper plate, 3b Push-out plate, 3c Side plate, 3d Leading end)
- 4 Drive device (4a Drive shaft, 4b Arm)
- 5 Introduction port
- 6 Discharge port
- 7 Bottom surface (7a First inclined surface, 7b Second inclined surface, 7c Lowermost surface)
- 30 8 Inspection port (8a Front end of inspection port, 8b Rear end of inspection port)
- 9 Side wall (9a First side wall, 9b Second side wall)
- 10 Metal cleaning tool (10A First metal block, 10B Second metal block)
- 11, 11' First wooden block
- 35 12, 12', 12x, 12y, 12z Second wooden block (12a One end of wooden block, 12b Other end of wooden block)
- 12A Second wooden block set
- 13 Portable jack

14, 14' Additional second wooden block set

15, 15A, 15B, 15C, 15' Additional vertically-placed wooden block

16 Third wooden block

Df Forward direction

5 Dr Backward direction

Claims

[Claim 1]

A cleaning method for an ash discharger,

wherein the ash discharger has a cooling tank including an introduction port composed of a wall surface having a tubular shape into which incinerated ash is introduced and a discharge port from which the incinerated ash cooled by stored water is discharged, a scraper disposed in the cooling tank, having a leading end in contact with an entire width of a bottom surface of the cooling tank and configured to push out the incinerated ash toward a side of the discharge port, and a drive device disposed in a side opposite to the discharge port with respect to the introduction port and configured to drive the scraper,

wherein the bottom surface of the cooling tank includes a first inclined surface inclined upward from immediately below the introduction port toward an opening end where the discharge port is formed and a second inclined surface having a width identical to a width of the first inclined surface and inclined upward from immediately below the introduction port toward a side opposite to the first inclined surface,

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

wherein the drive device includes a drive shaft disposed above the second inclined surface, and pivots to cause an arm connected to the drive shaft and the scraper to reciprocate the scraper forward and backward along the bottom surface,

wherein the ash discharger further has, on a first side wall immediately below the introduction port, an inspection port including a front end close to the discharge port and a rear end positioned on an opposite side of the front end as viewed in a direction of reciprocation of the scraper, and

the cleaning method comprising

a first step of discharging the stored water from the cooling tank, moving the scraper backward to a vicinity of the rear end, and opening the inspection port,

a second step of inserting and setting a metal cleaning tool in contact with an entire width of the bottom surface into the cooling tank from the inspection port after the first step, then performing either one of

a first preparation step of arranging, at a position closer to the scraper than the metal cleaning tool in the cooling tank, first wooden blocks each having a length equivalent to a height of the metal cleaning tool and each being

vertically placed along a width direction of the metal cleaning tool, and then arranging, at a position closer to the scraper than the first wooden blocks, a second wooden block set or the second wooden block sets along the direction of the reciprocation, the set of which includes second wooden blocks each having a length equivalent to a width of the metal cleaning tool and each being horizontally stacked up along a height direction of the metal cleaning tool but below the height of the metal cleaning tool,
and

a second preparation step of arranging, at a position closer to the scraper than the metal cleaning tool in the cooling tank, the second wooden block set or the second wooden block sets along the direction of the reciprocation, the set of which includes the second wooden blocks being horizontally stacked up and which has a height equivalent to the height of the metal cleaning tool,

then moving the scraper forward and stopping the scraper in a vicinity of the front end,

a third step of inserting a portable jack between the first side wall and the closest second wooden block set to the scraper pushed out to the vicinity of the front end by forward movement of the scraper, extending the portable jack, and fixing the closest second wooden block set between the first side wall and a second side wall disposed opposite to the first side wall,

a fourth step of fixing, in a case of performing the first preparation step in the second step, the closest second wooden block set by using the portable jack in the third step, then moving the scraper backward to a vicinity of the rear end, then performing either one of

a third preparation step of arranging, between the fixed second wooden block set and the scraper, an additional second wooden block set or the additional second wooden block sets along the direction of the reciprocation, the set of which includes the second wooden blocks stacked up to the same number of layers of the fixed second wooden block set,

a fourth preparation step of arranging, between the fixed second wooden block set and the scraper, additional vertically-placed wooden blocks along the width direction of the metal cleaning tool and each having a length contactable with at least a surface, which is toward the scraper, of the highest wooden second block in the fixed second wooden block set, and then arranging, at a position closer to the scraper than the additional vertically-placed wooden blocks, the additional second wooden block set or the additional second wooden block sets along the direction of the reciprocation, the set of which includes the second wooden blocks stacked up to the same number of layers

equal to or less than the number of layers of the fixed second wooden block set, or then arranging the second wooden block or the second wooden blocks being horizontally placed along the direction of the reciprocation, and

a fifth preparation step of stacking, between the fixed second wooden block set and the scraper, third wooden blocks each having the same length, each having the same cross-sectional dimension as a cross-sectional dimension of the second wooden block, and each length direction of which is being perpendicular to a length direction of the second wooden block, to the same number of layers of the fixed second wooden block, and then arranging, at a position closer to the scraper than the third wooden blocks, the additional second wooden block set or the additional second block sets along the direction of the reciprocation, the set of which includes the second wooden blocks stacked with the same number of layers of the stacked third wooden blocks,

in a case of performing the second preparation step in the second step, fixing the closest second wooden block set by using the portable jack in the third step, then moving the scraper backward to the vicinity of the rear end, and then performing the fourth preparation step between the fixed second wooden block set and the scraper; and

a fifth step of shortening the portable jack to release the fixation, taking out the portable jack from the inspection port, then moving the scraper forward and stopping the scraper in the vicinity of the front end.

[Claim 2]

The cleaning method for the ash discharger according to claim 1, wherein in the third step, the portable jack fixes the highest second wooden block in the closest second wooden block set or the second wooden block positioned in half or more upper layer counted from the lowest layer in the closest second wooden block set, between the first side wall and the second side wall, and therefore the portable jack fixes the closest second wooden block set between the first side wall and the second side wall.

[Claim 3]

The cleaning method for the ash discharger according to claim 2, wherein the third step, the fourth step, and the fifth step are sequentially repeated until the metal cleaning tool reaches a vicinity of the discharge port.

[Claim 4]

The cleaning method for the ash discharger according to claim 3,
wherein

the first wooden blocks are separated by intervals,

the third wooden blocks are separated by intervals, except in a stacking
direction, or

the additional second wooden block sets in the third preparation step
have at least smaller total number of the second wooden blocks in the lowest
layer than the total number of the second wooden blocks in the highest layer.

[Claim 5]

The cleaning method for the ash discharger according to any one of
claims 1 to 4, wherein a height of wooden blocks including the first wooden
blocks vertically placed or a height of the second wooden blocks stacked
horizontally, gradually decreases from the metal cleaning tool toward the
scraper.