(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 730 839 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
28.10.2020 Bulletin 2020/44

(21) Application number: **19750979.7**

(22) Date of filing: **08.02.2019**

(51) Int Cl.:
F23J 1/02 *(2006.01)* ***F23J 1/00*** *(2006.01)*

(86) International application number:
PCT/JP2019/004662

(87) International publication number:
WO 2019/156221 (15.08.2019 Gazette 2019/33)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **09.02.2018 JP 2018022206**

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(54) **ASH PUSHING DEVICE**

(57) An ash discharger (1) includes an ash introduction opening (2), an ash cooling tank (3), a scraper (4), a driving unit (5) that drives the scraper (4), an ash discharge opening (6), a first communicating portion (7) inclined downward from the ash cooling tank (3), a float tank (8) connected to the first communicating portion (7), a liquid level gauge (24), a first liquid supply device (27) that supplies liquid to the discharge opening, a second liquid supply device (34) that supplies liquid to the ash cooling tank (3), and a control device (9) that controls the first liquid supply device (27) and the second liquid supply device (34). The control device (9) supplies the liquid up to a predetermined liquid level when the liquid surface has dropped, and supplies the liquid to a vicinity of the discharge opening (6) when a torque is equal to or greater than a predetermined value.

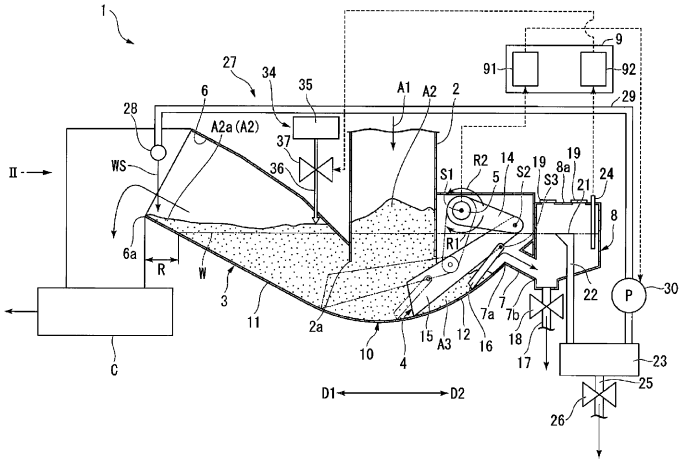


FIG. 1

EP 3 730 839 A1

Description

Technical Field

[0001] The present invention relates to an ash discharger.

[0002] This application claims priority based on Japanese Patent Application No. 2018-022206 filed in Japan on February 9, 2018, of which the contents are incorporated herein.

Background Art

[0003] In a stoker type incinerator such as a garbage incinerator, the main ash produced by burning garbage on a grate bar is dropped from an ash chute to an ash discharger, and is cooled with liquid (for example, water) in the ash discharger. This liquid also functions to prevent air from entering from the ash discharger into the stoker type incinerator.

[0004] In the ash discharger, when a scraper is driven to push the ash, the liquid is also discharged from a discharge opening along with the ash. Thus, to keep the liquid surface in the device at a predetermined level, it is necessary to supply liquid such as water into the device. Patent Document 1 discloses an ash discharger that includes a mechanism for circulating a liquid in an ash discharger to reduce the amount of liquid newly supplied.

Citation List

Patent Document

[0005]

Patent Document 1: Japanese Unexamined Patent Application Publication No. H08-261438
Patent Document 2: Japanese Unexamined Patent Application Publication No. H08-5049

Summary of Invention

Technical Subject

[0006] In the ash discharger disclosed in Patent Document 1, disadvantageously, ash entering into a driving unit side of the scraper when the scraper retracts, which is referred to as return ash, adversely affects the scraper and the driving unit that drives the scraper.

[0007] In addition, disadvantageously, due to the graining of ash with the progress of the separation of garbage in recent years, ash in the vicinity of the discharge opening (where the ash is drained) is solidified, such that the ash carrying capacity is reduced, which makes continuous operation of the ash discharger is difficult.

[0008] Patent Document 2 describes a technology for removing ash in the vicinity of the discharge opening with a cutter in order to enable the continuous operation of the ash discharger. However, in the technology described in Patent Document 2, a special mechanism such as the cutter needs to be provided, which increases costs.

[0009] An object of the present invention is to provide an ash discharger that can facilitate the continuous operation of the ash discharger at low costs.

Subject to be Solved

[0010] According to a first aspect of the present invention, an ash discharger includes: an ash introduction opening through which ash incinerated in a garbage incinerator is introduced; an ash cooling tank connected to a lower side of the ash introduction opening, the ash cooling tank including an inclined surface inclined upward toward a downstream side, and being filled with a liquid above a lower end of the ash introduction opening; a scraper that pushes the ash introduced into the ash cooling tank toward the downstream side; a driving unit that retractably drives the scraper; a discharge opening connected to the inclined surface, through which the ash pushed by the scraper is discharged; a first communicating portion including one end connected to the ash cooling tank below a liquid surface of the liquid in the ash cooling tank at a side opposite to the discharge opening across the scraper, the first communicating portion being inclined downward from the ash cooling tank; a float tank connected to the other end of the first communicating portion; a liquid level gauge that measures a liquid level in the float tank; a first liquid supply device that supplies the liquid to a vicinity of the discharge opening; a second liquid supply device that supplies the liquid to the ash cooling tank; and a control device that controls the first liquid supply device and the second liquid supply device based on information from the liquid level gauge and information related to a torque of the driving unit. When the liquid surface has dropped from a predetermined liquid level, the control device controls the second liquid supply device to supply the liquid to the predetermined liquid level based on the information from the liquid level gauge, and when the torque is equal to or greater than a predetermined value, the control device controls the first liquid supply device to supply the liquid to the vicinity of the discharge opening based on the information related to the torque.

[0011] According to such configuration, return ash deposited in the ash cooling tank may be discharged to the float tank via the first communicating portion, reducing adverse effects of the return ash on the driving unit.

[0012] In addition, when the torque of the driving unit becomes greater than or equal to a predetermined value, that is, when the ash is solidified and is not easily discharged, liquid can be supplied to the ash in the vicinity of the discharge opening to soften the solidified ash.

[0013] Due to the effects above, the ash discharger can be continuously operated at low costs without providing any special mechanism such as a cutter.

[0014] According to a second aspect of the present invention, the first liquid supply device according to the first aspect includes: a circulation liquid injection nozzle disposed above the discharge opening, the circulation liquid injection nozzle spraying the liquid to a drainage region of the ash cooling tank; and a circulation pump that circulates the liquid in the ash cooling tank or the float tank to the circulation liquid injection nozzle.

[0015] According to such configuration, the ash can be efficiently softened by spraying the liquid in a drainage region where solidified ash deposits easily.

[0016] According to a third aspect of the present invention, in the ash discharger according to the second aspect, the scraper includes: a scraper body that pushes the ash; and an auxiliary scraper connected to the scraper body, the auxiliary scraper guiding return ash of the ash to the first communicating portion.

[0017] According to such configuration, the return ash that adversely affects the scraper and the driving unit can be actively discharged.

[0018] According to a fourth aspect of the present invention, the ash discharger according to the third aspect further includes an openable opening lid provided on an upper side of the float tank, and opening the opening lid enables cleaning of an inside of the float tank.

[0019] According to such configuration, by opening the opening lid, the inside of the first communicating portion and the float tank can be easily cleaned.

[0020] According to a fifth aspect of the present invention, in the ash discharger according to any one of the first to fourth aspects, the first communicating portion is a pipe that communicates the ash cooling tank with the float tank, and the ash cooling tank communicates with the float tank only via the pipe.

[0021] According to such configuration, since the ash cooling tank communicates with the float tank only via the first communication pipe, the liquid surface in the ash cooling tank is physically separated from the liquid surface in the float tank. As a result, scum (floating ash) floating near the liquid surface in the ash cooling tank does not easily enter into the float tank. This reduces the risk of the liquid level measurement being inhibited due to contamination of the liquid level gauge or the like.

[0022] According to a sixth aspect of the present invention, the ash discharger according to any one of the first to fourth aspects further includes a second communicating portion formed to connect the liquid surface in the ash cooling tank to a liquid surface in the float tank.

[0023] According to such configuration, because the liquid surface in the ash cooling tank is not physically separated from the liquid surface in the float tank, the scum floating on the liquid surface in the ash cooling tank enters into the float tank. However, the scum can be safely and easily removed by opening the opening lid while continuing operation.

Advantageous Effects of Invention

[0024] According to the present invention, the return ash deposited in the ash cooling tank can be discharged to the float tank via the first communicating portion, reducing adverse effects of the return ash on the driving unit.

[0025] In addition, when the torque of the driving unit becomes greater than or equal to a predetermined value, that is, when the ash is solidified and is not easily discharged, liquid can be supplied to the ash in the vicinity of the discharge opening to soften the solidified ash.

[0026] Due to the effects, the ash discharger can be continuously operated at low costs without providing any special mechanism such as a cutter.

Brief Description of Drawings

[0027]

FIG. 1 is a cross-sectional view illustrating an ash discharger according to an embodiment of the present invention.

FIG. 2 is a view in the direction of arrow II in FIG. 1, and is a front view of a discharge opening according to an embodiment of the present invention.

FIG. 3 is a cross-sectional view of an ash cooling tank and a float tank in a modification of an embodiment of the present invention.

FIG. 4 is a cross-sectional view of the ash cooling tank in a modification of an embodiment of the present invention.

Description of Embodiments

[0028] The following describes an ash discharger according to an embodiment of the present invention in detail with reference to drawings.

[0029] The ash discharger is provided in a garbage incinerator (for example, a stoker type incinerator) for that incinerates garbage. Specifically, the ash discharger is a device that cools ash produced by incinerating garbage in the garbage incinerator and discharges the cooled ash to a conveyor.

[0030] As illustrated in FIG. 1, an ash discharger 1 of the present embodiment includes: an ash introduction opening 2 into which ash A1 is introduced; an ash cooling tank 3 connected to the ash introduction opening 2; a scraper 4 that pushes the ash A2 introduced into the ash cooling tank 3; a driving unit 5 that drives the scraper 4 reciprocable ; a discharge opening 6 through which the ash A2 pushed by the scraper 4 is discharged, a communication pipe 7 (first communicating portion) having one end 7a connected to the ash cooling tank 3, a float tank 8 connected to the other end 7b of the communication pipe 7, and a control device 9.

[0031] The ash introduction opening 2 is a rectangular pipe that is connected to an ash chute of a garbage in-

cinerator and extends along the vertical direction. The shape of the ash introduction opening 2 is not limited thereto.

[0032] The ash cooling tank 3 is a tank connected to the lower side of the ash introduction opening 2 to cool the ash A2 introduced through the ash introduction opening 2.

[0033] The ash cooling tank 3 is filled with a liquid (for example, water). The height of a liquid surface "W" of the liquid can be appropriately set according to the shape of the ash cooling tank 3. The height of the liquid surface "W" of the present embodiment is set to be above a lower end 2a of the ash introduction opening 2. The height of the liquid surface "W" is adjusted by the control device 9.

[0034] A bottom surface 10 of the ash cooling tank 3 is formed so as to be lowest directly below the ash introduction opening 2.

[0035] The bottom surface 10 of the ash cooling tank 3 includes a first inclined surface 11 formed so as to gradually become higher from directly below the ash introduction opening 2 in a first direction D1 that is a horizontal direction. Here, the first direction D1 is a direction in which the ash A2 is discharged (toward the downstream side). In other words, the first inclined surface 11 is inclined upward in the discharge direction (toward the downstream side) of the ash "A".

[0036] The discharge opening 6 is a rectangular opening that is connected to the first inclined surface 11 and discharges the ash A2 pushed by the scraper 4. The discharge opening 6 is formed such that the lower end 6a of the discharge opening 6 is higher than the liquid surface "W" of the liquid. A drainage region "R" is provided between the lower end 6a of the discharge opening 6 and the liquid. The drainage region "R" is a region that is an upper portion of the first inclined surface 11 and is higher than the liquid surface "W" of the liquid. Ash A2a deposited in the drainage region "R" is not immersed in the liquid.

[0037] A conveyor "C" is disposed below the discharge opening 6. The conveyor "C" transports the ash A2 discharged through the discharge opening 6 to a device in a subsequent stage.

[0038] The bottom surface 10 of the ash cooling tank 3 includes a second inclined surface 12 that gradually becomes higher from directly below the ash introduction opening 2 in a second direction D2 that is opposite the first direction D1. The mechanisms for pushing the ash A2, such as the scraper 4 and the driving unit 5, are disposed above the second inclined surface 12.

[0039] The scraper 4 is a device that is disposed on the second direction D2 side with respect to the ash introduction opening 2, and pushes the ash A2 stored in the ash cooling tank 3. The scraper 4 is connected to a first central axis S1 that is orthogonal to the first direction D1 and extends in the horizontal direction. The scraper 4 includes a pivoting arm 14 that is rotatable around the first central axis S1, and a scraper body 15 connected to an end of the pivoting arm 14 on the side opposite to the first central axis S1 so as to be swingable around a second central axis S2.

[0040] The scraper body 15 is disposed such that a tip thereof contacts the bottom surface 10 of the ash cooling tank 3 in a width direction "WD" (horizontal direction orthogonal to the first direction D1, see FIG. 2). The scraper body 15 pushes the ash A2 toward the downstream side by pivoting the pivoting arm 14 in a first rotating direction R1. Pivoting of the pivoting arm 14 in a second rotating direction R2 opposite to the first rotating direction R1 retracts the tip of the scraper body 15 in the second direction D2.

[0041] As illustrated by a solid line in FIG. 1, in the most retracted state of the scraper body 15, the tip of the scraper body 15 is located directly below the ash introduction opening 2. As illustrated by a two-dot chain line in FIG. 1, in the most advanced state of the scraper body 15, the tip of the scraper body 15 is located at the downstream side of the position directly below the ash introduction opening 2.

[0042] The scraper 4 includes an auxiliary scraper 16 that is swingably connected to the scraper body 15. The auxiliary scraper 16 is connected to the scraper body 15 via a third central axis S3. The third central axis S3 is disposed near the second central axis S2 of the scraper body 15. A tip of the auxiliary scraper 16 contacts the second inclined surface 12 of the bottom surface 10 of the ash cooling tank 3 in the width direction "WD".

[0043] The auxiliary scraper 16 moves on the bottom surface 10 as the scraper body 15 moves.

[0044] The driving unit 5 is, for example, an electric motor. The driving unit 5 rotates the first central axis S1 in the first rotating direction R1 or the second rotating direction R2. The driving unit 5 is electrically connected to the control device 9. Information related to a torque of the driving unit 5 is inputted to the control device 9. The torque of the driving unit 5 increases when a load of the scraper 4 driven by the driving unit 5 increases.

[0045] The communication pipe 7 is a tubular member formed such that the one end 7a connected to the ash cooling tank 3 is connected to the second inclined surface 12 of the bottom surface 10 of the ash cooling tank 3, and the other end 7b is located lower than the one end 7a. The communication pipe 7 is disposed on the second direction D2 side with respect to the scraper 4. In other words, the communication pipe 7 is disposed on the side opposite to the discharge opening 6, across the scraper 4. The one end 7a of the communication pipe 7 is connected below the liquid surface "W".

[0046] The float tank 8 is a container connected to the other end 7b of the communication pipe 7. The float tank 8 is disposed so as to form the liquid surface "W" of liquid in an internal space of the float tank 8. An upper wall 8a of the float tank 8 is formed so as to be higher than the liquid surface "W". The liquid moves between the ash cooling tank 3 and the float tank 8 via only the communication pipe 7. The height of the liquid surface "W" in the ash cooling tank 3 is the same as the height of the

liquid surface "W" in the float tank 8.

[0047] A float tank discharge pipe 17 for discharging the liquid in the float tank 8 is provided in the lower portion of the float tank 8. The float tank discharge pipe 17is provide with a float tank valve 18. The float tank valve 18 is a valve that opens and closes the float tank discharge pipe 17.

[0048] An openable and closable opening lid 19 is provided on the upper wall 8a of the float tank 8. By opening the opening lid 19, the operator can access the inside of the float tank 8.

[0049] An overflow liquid receiver 21 is provided inside the float tank 8. The overflow liquid receiver 21 is formed to correspond to the set height of the liquid surface "W". In other words, when the height of the liquid surface "W" is higher than the set height, the liquid flows into the overflow liquid receiver 21 and is discharged into a sedimentation tank 23, preventing the liquid surface "W" from becoming higher than the set height.

[0050] A drainage pump 22 is connected to the overflow liquid receiver 21, and the sedimentation tank 23 is provided at a lower end of the drain 22. The liquid flowing into the overflow liquid receiver 21 is stored in the sedimentation tank 23.

[0051] The float tank 8 is provided with a liquid level gauge 24 for measuring the height of the liquid surface "W" in the float tank 8. The liquid level gauge 24 is electrically connected to the control device 9. The height of the liquid surface "W" measured by the liquid level gauge 24 is transmitted to the control device 9.

[0052] A sedimentation tank discharge pipe 25 for discharging sediment in the sedimentation tank 23 is provided on the lower side of the sedimentation tank 23. The sedimentation tank discharge pipe 25is provided with a sedimentation tank valve 26. The sedimentation tank valve 26 is a valve that opens and closes the sedimentation tank discharge pipe 25. By opening the sedimentation tank valve 26, the sediment deposited in the sedimentation tank 23 can be discharged.

[0053] The ash discharger 1 includes a first liquid supply device 27 that supplies liquid to the vicinity of the discharge opening 6. Specifically, the first liquid supply device 27 sprays the liquid onto the ash A2a deposited in the drainage region "R" of the ash cooling tank 3. The first liquid supply device 27 includes a circulation liquid injection nozzle 28 disposed above the discharge opening 6, a circulation liquid line 29 that connects the circulation liquid injection nozzle 28 to the sedimentation tank 23, and a circulation pump 30 provided in the circulation liquid line 29 to circulate the liquid in the sedimentation tank 23 to the circulation liquid injection nozzle 28. Since the liquid stored in the sedimentation tank 23 is the liquid flowing into the overflow liquid receiver 21, the first liquid supply device 27 substantially circulates the liquid inside the float tank 8 to the circulation liquid injection nozzle 28. Liquid may also be supplied to the first liquid supply device 27 from other sources.

[0054] As illustrated in FIG. 2, the circulation liquid injection nozzle 28 includes a body portion 31 that extends in the width direction, and a plurality of nozzle portions 32 formed on the body portion 31 to spray liquid "WS". The nozzle portions 32 of the circulation liquid injection nozzle 28 are oriented so as to spray liquid to the drainage region "R".

[0055] The circulation pump 30 is electrically connected to the control device 9. The control device 9 can control the circulation pump 30. By operating the circulation pump 30 under control of the control device 9, the liquid in the sedimentation tank 23 is supplied to the circulation liquid injection nozzle 28, and is sprayed onto the ash A2a deposited in the drainage region "R".

[0056] The ash discharger 1 includes a second liquid supply device 34 that supplies liquid to the ash cooling tank 3. The second liquid supply device 34 includes a liquid tank 35 that stores a liquid (for example, water) therein, an injection nozzle 36 that injects the liquid in the liquid tank 35 into the ash cooling tank 3, and an electric valve 37 provided on the injection nozzle 36. The electric valve 37 is electrically connected to the control device 9. The control device 9 can control the electric valve 37. By controlling the electric valve 37 under control of the control device 9, the liquid in the liquid tank 35 is injected into the ash cooling tank 3 via the injection nozzle 36.

[0057] The control device 9 includes a liquid surface control unit 92 that controls the second liquid supply device 34 based on the height of the liquid surface "W" measured by the liquid level gauge 24 to supply liquid to the ash cooling tank 3, and a liquid spray unit 91 that controls the first liquid supply device 27 based on the torque of the driving unit 5 to spray the liquid onto the ash A2a deposited in the drainage region "R".

[0058] When the height of the liquid surface "W" measured by the liquid level gauge 24 drops from a predetermined liquid level, the liquid surface control unit 92 performs control to open the electric valve 37 of the second liquid supply device 34, that is, controls the valve opening.

[0059] The liquid spray unit 91 receives information related to the torque from the driving unit 5, and performs control to actuate the circulation pump 30 when the torque of the driving unit 5 is equal to or greater than a predetermined value.

[0060] Next, the action of the second liquid supply device 34 of the ash discharger 1 according to the present embodiment will be described.

[0061] The ash A2 fed into the ash cooling tank 3 through the ash introduction opening 2 is cooled with a liquid. The ash A2 cooled in the ash cooling tank 3 is pushed by the scraper 4 in the first direction D1 and conveyed to the conveyor "C". At this time, the liquid inside the ash cooling tank 3 is also discharged along with the ash A2.

[0062] The liquid surface control unit 92 of the control device 9 controls the second liquid supply device 34 based on the height of the liquid surface "W" measured

by the liquid level gauge 24 to control the height of the liquid surface "W". Specifically, when liquid is discharged from the discharge opening 6 or the float tank discharge pipe 17 and the height of the liquid surface "W" decreases from the predetermined liquid level, the control device 9 controls and opens the electric valve 37 of the second liquid supply device 34, thereby injecting the liquid in the liquid tank 35 into the ash cooling tank 3 via the injection nozzle 36. Thereafter, when the height of the liquid surface "W" rises to the predetermined liquid level, the control device 9 controls and closes the electric valve 37, thereby stopping injection of the liquid from the liquid tank 35.

[0063] Next, the operation of the communication pipe 7 and the auxiliary scraper 16 of the ash discharger 1 according to the present embodiment will be described.

[0064] When the scraper 4 retracts, return ash A3 moves on the second inclined surface 12 on the second direction D2 side with respect to the scraper 4. The return ash A3 is ash that, when the scraper 4 retracts, enters the second direction D2 side with respect to the scraper 4 through a gap or the like between the scraper 4 and the bottom surface 10.

[0065] Since the communication pipe 7 is formed in the ash cooling tank 3 of the ash discharger 1 according to the present embodiment, the return ash A3 is introduced into the float tank 8 via the communication pipe 7. The return ash A3 deposited in the float tank 8 can be discharged as appropriate via the float tank discharge pipe 17 by opening the float tank valve 18.

[0066] Furthermore, the scraper body 15 moves in the first direction R1, thereby causing the auxiliary scraper 16 to push back the return ash A3 in the first direction D1. The scraper body 15 retracts in the second direction R2, thereby causing the auxiliary scraper 16 to guide the return ash A3 to the communication pipe 7. Because the one end 7a of the communication pipe 7 is inclined above the other end 7b, the return ash A3 guided by the communication pipe 7 moves to the float tank 8.

[0067] Next, the action of the first liquid supply device 27 of the ash discharger 1 according to the present embodiment will be described.

[0068] When the torque of the driving unit 5 is larger than the predetermined value, the control device 9 actuates the circulation pump 30 of the first liquid supply device 27. As a result, the liquid "WS" is sprayed from the circulation liquid injection nozzle 28 to soften the ash A2a deposited in the drainage region "R". Thereafter, when the torque of the driving unit 5 becomes smaller than the predetermined value, the control device 9 stops the circulation pump 30 of the first liquid supply device 27, and in turn, stops spraying of the liquid "WS" from the circulation liquid injection nozzle 28.

[0069] According to the embodiment described above, since the return ash A3 deposited on the second inclined surface 12 is discharged into the float tank 8 via the communication pipe 7, adverse effects of the return ash A3 on the scraper 4 and the driving unit 5 can be suppressed. Accordingly, the scraper 4 can be smoothly operated without being inhibited by the return ash A3.

[0070] In addition, the circulation liquid injection nozzle 28 may be oriented toward the drainage region "R" (near the discharge opening 6) where the solidified ash A2a deposits easily, such that the solidified ash A2a is softened to suppress a reduction in the ash discharge capability. In particular, the ash can be efficiently carried out by spraying the liquid in the drainage region "R" where the ash A2a is easily solidified.

[0071] As described above, the stability of the continuous operation of the ash discharger 1 can be improved.

[0072] In addition, since the opening lid 19 is provided on the upper wall 8a of the float tank 8, the amount of the return ash A3 accumulated in the float tank 8 can be checked. In addition, when a certain amount of return ash A3 is accumulated, the float tank valve 18 can be opened to discharge the return ash A3 while continuing operation.

[0073] At this time, the liquid surface "W" decreases, but the control device 9 controls the second liquid supply device 34 so as to raise the height of the liquid surface "W" to the predetermined liquid level and keep that level.

[0074] In addition, by opening the opening lid 19 of the float tank 8, the inside of the communication pipe 7 and the float tank 8 can be easily cleaned.

[0075] Additionally, since the ash cooling tank 3 communicates with the float tank 8 only via the communication pipe 7, the liquid surface "W" in ash cooling tank 3 is physically separated from the liquid surface "W" in the float tank 8. As a result, scum (floating ash) floating near the liquid surface "W" in the ash cooling tank 3 does not easily enter into the float tank 8. Therefore, the risk of the liquid level measurement being inhibited due to contamination of the liquid level gauge 24 or the like is reduced.

[Modified example]

[0076] The following describes a modification of an embodiment of the present invention in detail with reference to drawings. Note that, in the modification, differences from the above-described embodiment will be mainly described, and description of similarities will be omitted.

[0077] As illustrated in FIG. 3, the ash cooling tank 3 and the float tank 8 in the modification communicate with each other via an opening 40 (second communicating portion) formed in a partition wall 39 partitioning the ash cooling tank 3 and the float tank 8, in addition to the communication pipe 7. The opening 40 is formed to connect the liquid surface "W" in the ash cooling tank 3 to the liquid surface "W" in the float tank 8. The opening 40 is formed such that a lower end 40a of the opening 40 is lower than the liquid surface "W", and an upper end 40b is higher than the liquid surface "W".

[0078] The ash cooling tank 3 and the float tank 8 of the modified example in the modification communicate with each other via the communication pipe 7 as well as

the opening 40 formed in the vicinity of the liquid surface "W".

[0079] According to this modification, because the liquid surface "W" in the ash cooling tank 3 is not physically separated from the liquid surface "W" in the float tank 8, the scum floating on the liquid surface "W" in the ash cooling tank 3 enters into the float tank 8. However, the scum can be safely and easily removed by opening the opening lid 19 while continuing operation.

[0080] An embodiment and a modification of the present invention have been described above in detail with reference to the drawings, but the specific configurations are not limited to the embodiment and the modification, and also include design changes and the like that do not deviate from the scope of the present invention.

[0081] Note that the first liquid supply device 27 according to the present embodiment is configured to circulate the liquid in the sedimentation tank 23 (float tank 8) to the circulation liquid injection nozzle 28, but the present invention is not limited thereto. For example, as illustrated in FIG. 4, it may be a first liquid supply device 27B that circulates the liquid stored in the ash cooling tank 3 to the circulation liquid injection nozzle 28. Also In this case, similar to the first liquid supply device 27, the first liquid supply device 27B is controlled by the control device 9.

Industrial Applicability

[0082] According to the present invention, the return ash deposited in the ash cooling tank can be discharged to the float tank via the first communicating portion, reducing adverse effects of the return ash on the driving unit.

[0083] In addition, when the torque of the driving unit becomes greater than or equal to a predetermined value, that is, when the ash is solidified and is not easily discharged, liquid can be supplied to the ash in the vicinity of the discharge opening to soften the solidified ash.

[0084] Due to the effects, the ash discharger can be continuously operated at low costs without providing any special mechanism such as a cutter.

Reference Signs List

[0085]

1 Ash discharger
2 Ash introduction opening
3 Ash cooling tank
4 Scraper
5 Driving unit
6 Discharge opening
7 Communication pipe (first communicating portion)
8 Float tank
8a Upper wall
9 Control device
10 Bottom surface
11 First inclined surface (inclined surface)
12 Second inclined surface
14 Pivoting arm
15 Scraper body
16 Auxiliary scraper
17 Float tank discharge pipe
18 Float tank valve
19 Opening lid
21 Overflow liquid receiver
22 Drainage pump
23 Sedimentation tank
24 Liquid level gauge
25 Sedimentation tank discharge pipe
26 Sedimentation tank valve
27, 27B First liquid supply device
28 Circulation liquid injection nozzle
29 Circulation liquid line
30 Circulation pump
31 Body portion
32 Nozzle portion
34 Second liquid supply device
35 Liquid tank
36 Injection nozzle
37 Electric valve
39 Partition wall
40 Opening (second communicating portion)
91 Liquid spray unit
92 Liquid surface level control unit
A Ash
C Conveyor
R Drainage region
S1 First central axis
S2 Second central axis
S3 Third central axis
W Liquid surface level

Claims

1. An ash discharger comprising:

an ash introduction opening through which ash incinerated in a garbage incinerator is introduced;
an ash cooling tank connected to a lower side of the ash introduction opening, the ash cooling tank including an inclined surface inclined upward toward a downstream side, and being filled with a liquid above a lower end of the ash introduction opening;
a scraper that pushes the ash introduced into the ash cooling tank toward the downstream side;
a driving unit that retractably drives the scraper;
a discharge opening connected to the inclined surface through which the ash pushed by the scraper is discharged;

a first communicating portion including one end connected to the ash cooling tank below a liquid surface of the liquid in the ash cooling tank at a side opposite to the discharge opening across the scraper, the first communicating portion being inclined downward from the ash cooling tank;
a float tank connected to the other end of the first communicating portion;
a liquid level gauge that measures a liquid level in the float tank;
a first liquid supply device that supplies the liquid to a vicinity of the discharge opening;
a second liquid supply device that supplies the liquid to the ash cooling tank; and
a control device that controls the first liquid supply device and the second liquid supply device based on information from the liquid level gauge and information related to a torque of the driving unit, wherein
when the liquid surface has dropped from a predetermined liquid level, the control device controls the second liquid supply device to supply the liquid to the predetermined liquid level based on the information from the liquid level gauge, and
when the torque is equal to or greater than a predetermined value, the control device controls the first liquid supply device to supply the liquid to the vicinity of the discharge opening based on the information related to the torque.

2. The ash discharger according to claim 1, wherein the first liquid supply device includes:

a circulation liquid injection nozzle disposed above the discharge opening, the circulation liquid injection nozzle spraying the liquid to a drainage region of the ash cooling tank; and
a circulation pump that circulates the liquid in the ash cooling tank or the float tank to the circulation liquid injection nozzle.

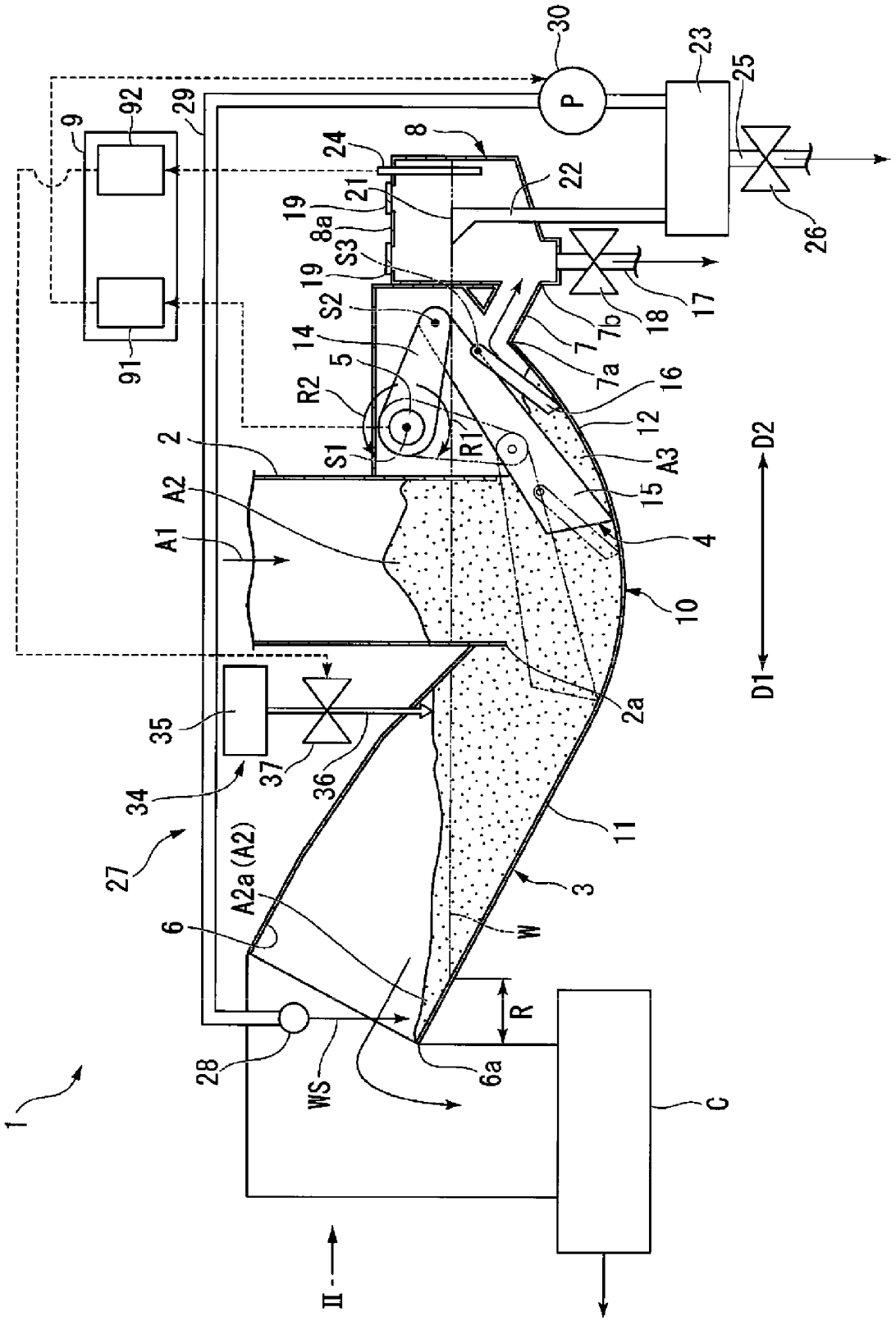
3. The ash discharger according to claim 2, wherein the scraper includes:

a scraper body that pushes the ash; and
an auxiliary scraper connected to the scraper body, the auxiliary scraper guiding return ash of the ash to the first communicating portion.

4. The ash discharger according to claim 3, further comprising an openable opening lid provided on an upper side of the float tank, wherein
opening the opening lid enables cleaning of an inside of the float tank.

5. The ash discharger according to any one of claims 1 to 4, wherein
the first communicating portion is a pipe that communicates the ash cooling tank with the float tank, and the ash cooling tank communicates with the float tank only via the pipe.

6. The ash discharger according to any one of claims 1 to 4, further comprising a second communicating portion formed to connect the liquid surface in the ash cooling tank to a liquid surface in the float tank.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35
36
37
91
92
A1
A2
A2a (A2)
A3
C
D1
D2
II
P
R
R1
R2
S1
S2
S3
W
WS

FIG. 1

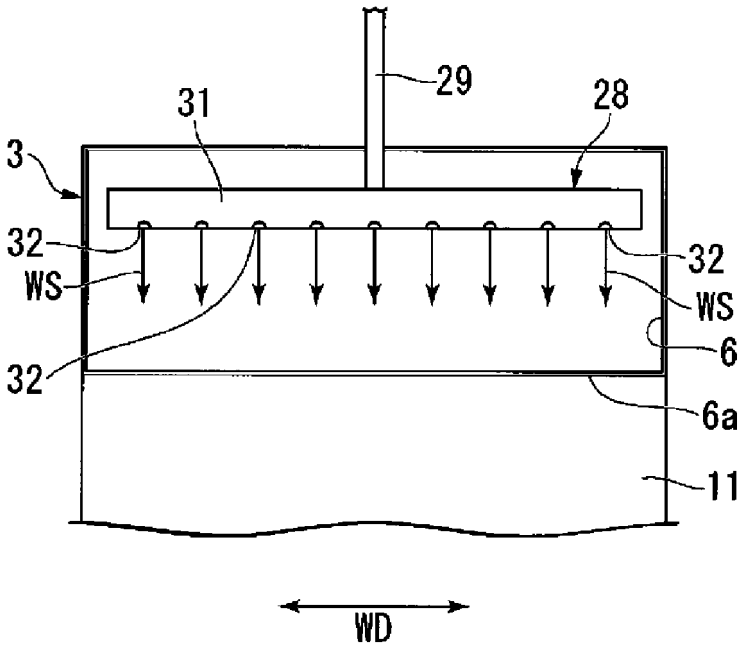

FIG. 2

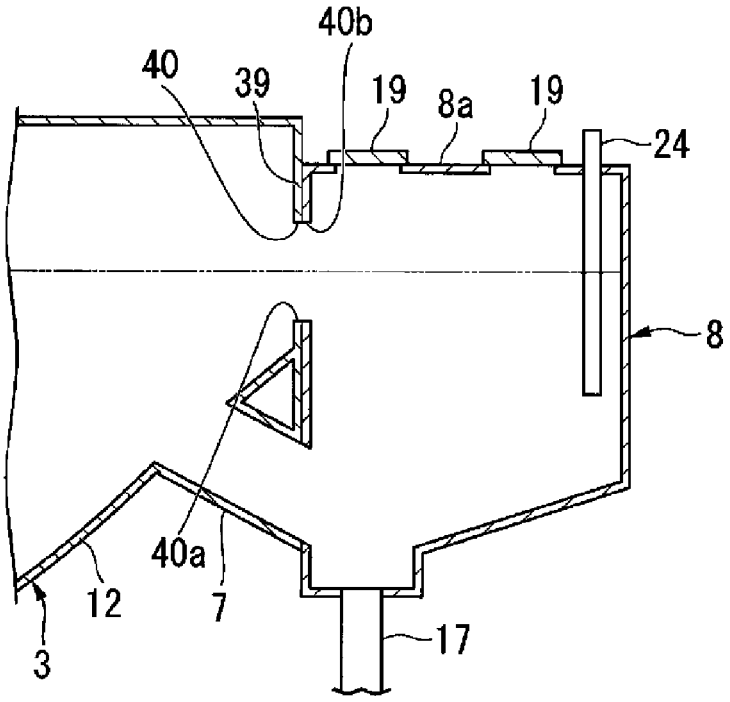

FIG. 3

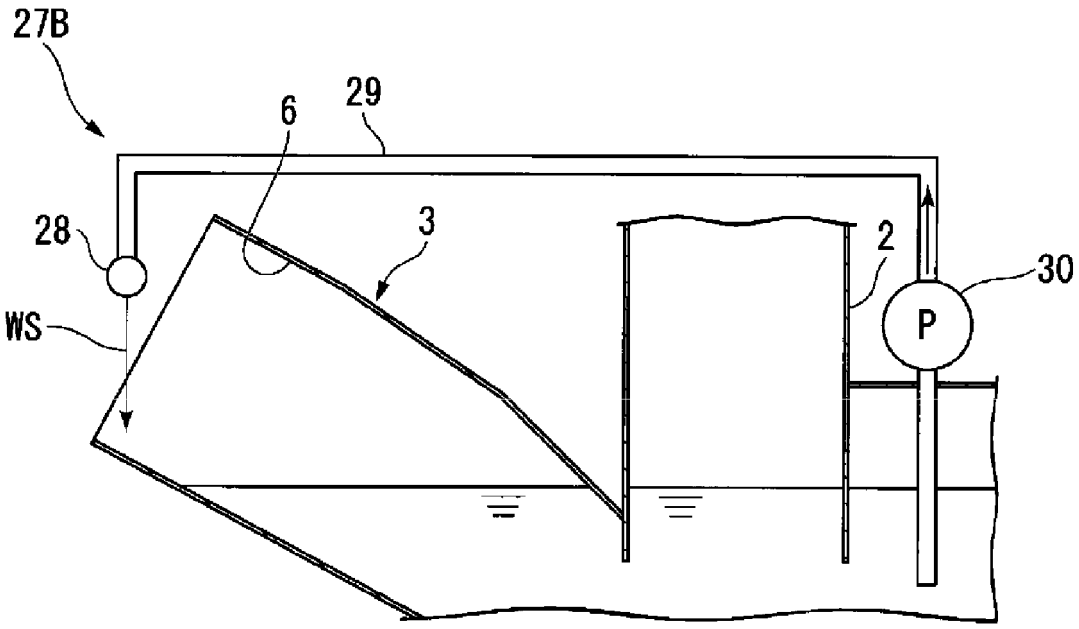

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/004662

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. F23J1/02(2006.01)i, F23J1/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. F23J1/02, F23J1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 016169/1977 (Laid-open No. 111679/1978) (MITSUBISHI HEAVY INDUSTRIES, LTD.) 06 September 1978, page 1, line 2 to page 4, line 4, fig. 1-2 (Family: none)	1-6
Y	JP 11-166712 A (SUMITOMO HEAVY INDUSTRIES, LTD.) 22 June 1999, paragraphs [0005], [0014]-[0016], fig. 1-3 (Family: none)	1-6

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 April 2019 (08.04.2019)	16 April 2019 (16.04.2019)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/004662

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 08-261438 A (MARTIN GMBH FUER UMWELT- UND ENERGIETECHNIK) 11 October 1996, paragraph [0021], fig. 3 & US 5711233 A, column 5, line 55 to column 6, line 12, fig. 3 & EP 740110 A2 & DE 19508488 A	2-6
Y	JP 2002-257319 A (MITSUBISHI HEAVY INDUSTRIES, LTD.) 11 September 2002, paragraph [0015], fig. 2 (Family: none)	2-6
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 062236/1975 (Laid-open No. 142778/1976) (NKK CORP.) 17 November 1976, page 4, lines 4-7, fig. 2 (Family: none)	3-6
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 154768/1984 (Laid-open No. 069639/1986) (KAWASAKI HEAVY INDUSTRIES, LTD.) 13 May 1986, page 6, line 19 to page 9, line 12, fig. 1-3 (Family: none)	4-6
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 142782/1985 (Laid-open No. 052735/1987) (NKK CORP.) 02 April 1987, page 4, line 17 to page 9, line 19, fig. 1-6 (Family: none)	6
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 020799/1984 (Laid-open No. 132537/1985) (KAWASAKI HEAVY INDUSTRIES, LTD.) 04 September 1985, entire text, all drawings (Family: none)	1-6

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2018022206 A **[0002]**
- JP H08261438 B **[0005]**
- JP H085049 B **[0005]**