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(54) SLAG DISCHARGE APPARATUS AND SLAG DISCHARGE METHOD

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(52) **U.S. Cl.**
CPC ***C10J 3/526*** (2013.01)

(57) **ABSTRACT**

The objective of the present invention is to facilitate passing of slag accumulated on a top face of a screen through openings in the screen. A combustor of a gasifier (**10**) that gasifies a carbonaceous feedstock is provided with a slag crusher (**20**) which discharges slag produced in and fallen from the combustor out of the gasifier (**10**). The slag crusher (**20**) comprises: a screen (**22**) which is provided transversely with respect to the fall direction of the slag and has a plurality of openings (**30**) to allow slag pieces that are smaller than the diameter of the openings (**30**) to pass through the screen (**22**); a spreader (**24**) which moves along the top face of the screen (**22**) and crushes the slag accumulated on the top face of the screen (**22**); and a nozzle (**26**) which spouts pressurized water onto the slag accumulated on the screen (**22**).

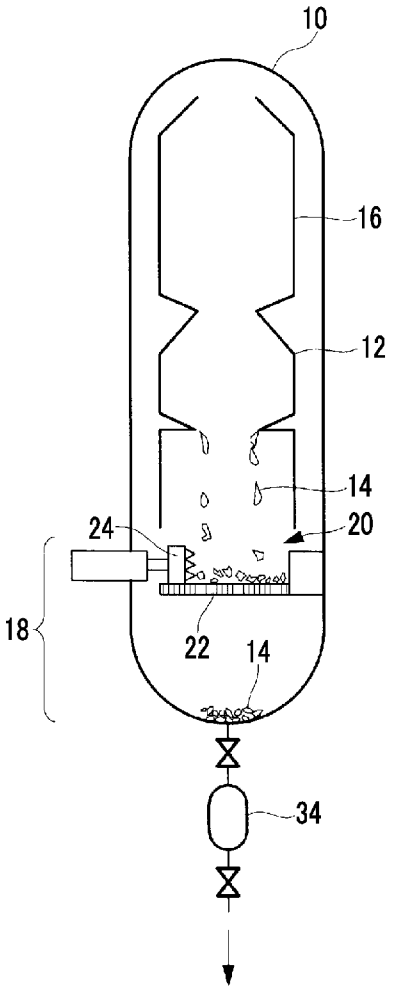


FIG. 1

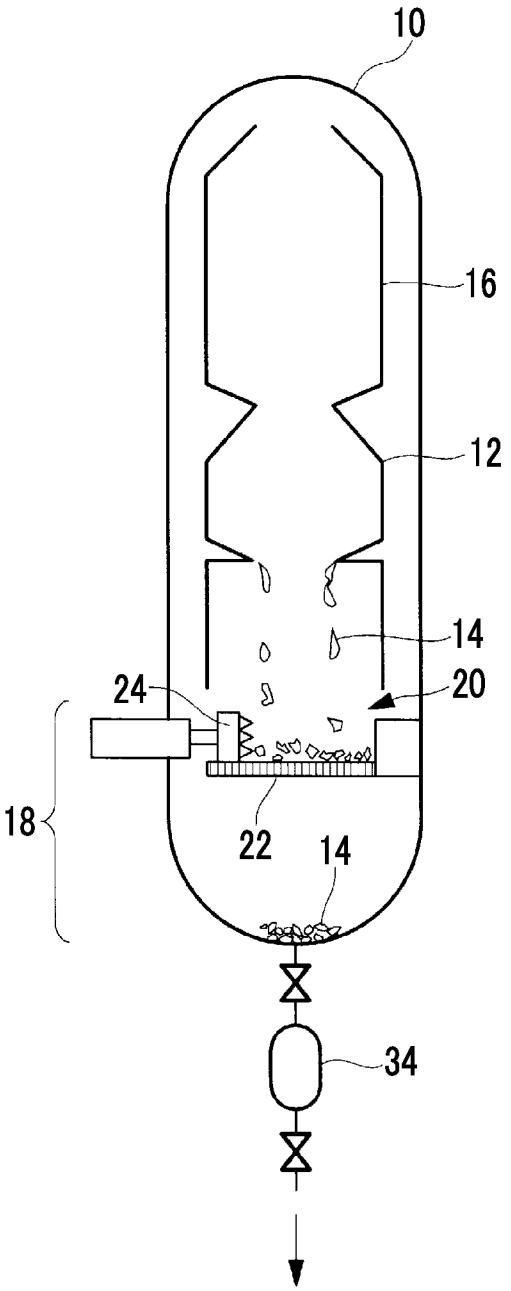


FIG. 2

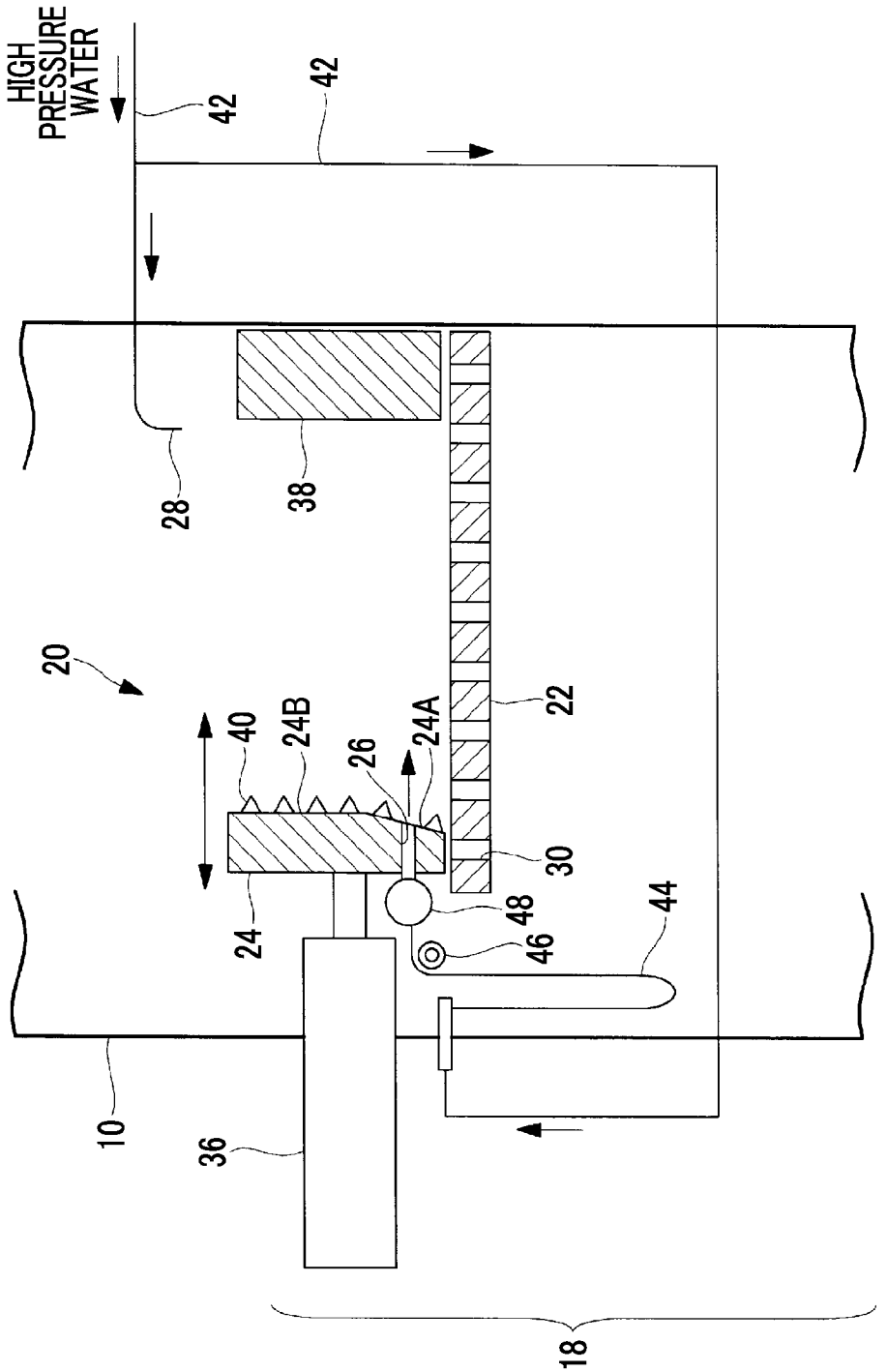

HIGH PRESSURE WATER
42
42
28
38
20
40
24B
26
24A
22
30
48
44
46
24
10
36
18

FIG. 3

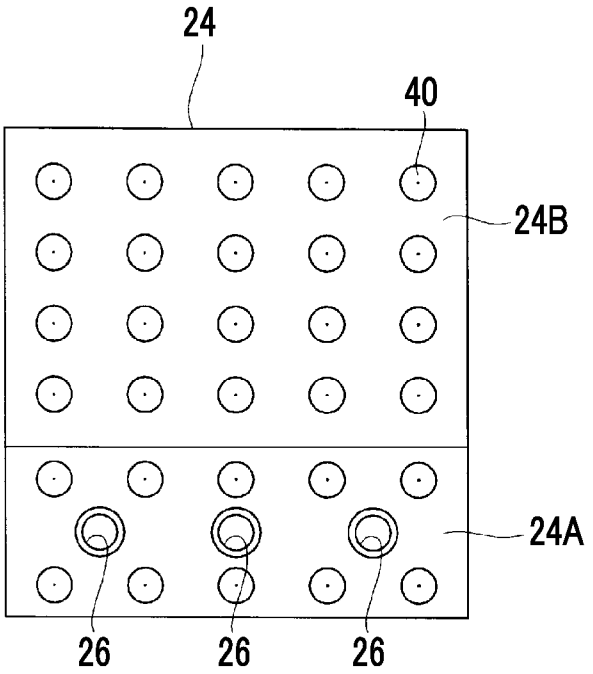


FIG. 4

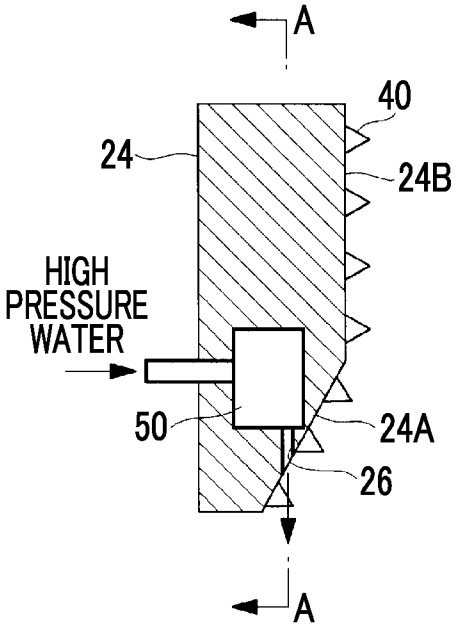


FIG. 5

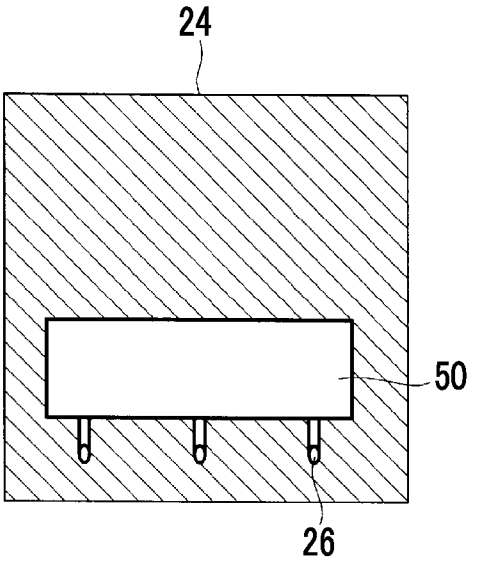


FIG. 6

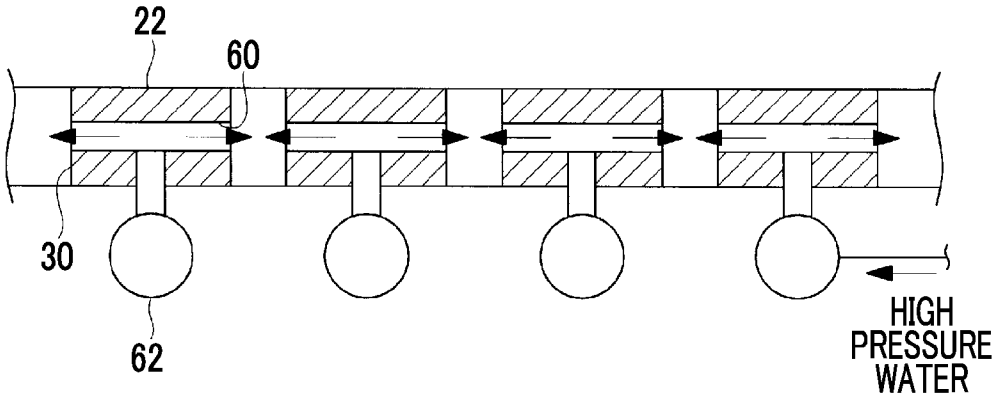


FIG. 7

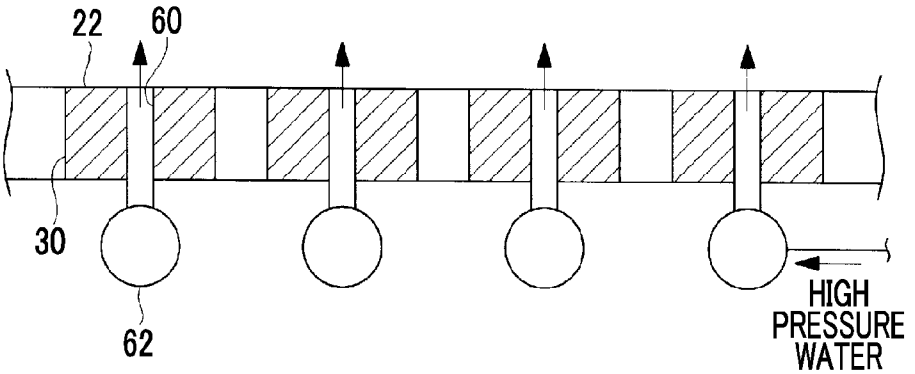


FIG. 8

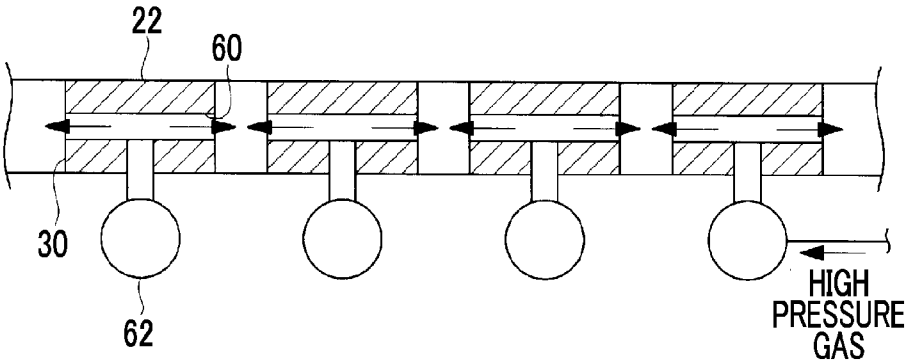


FIG. 9

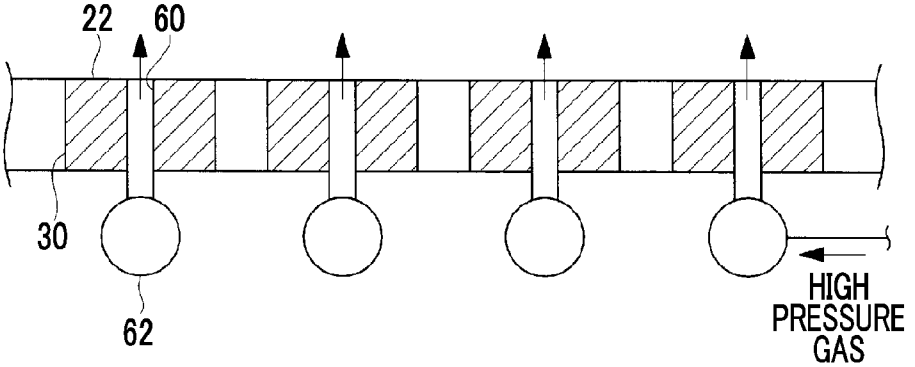


FIG. 10

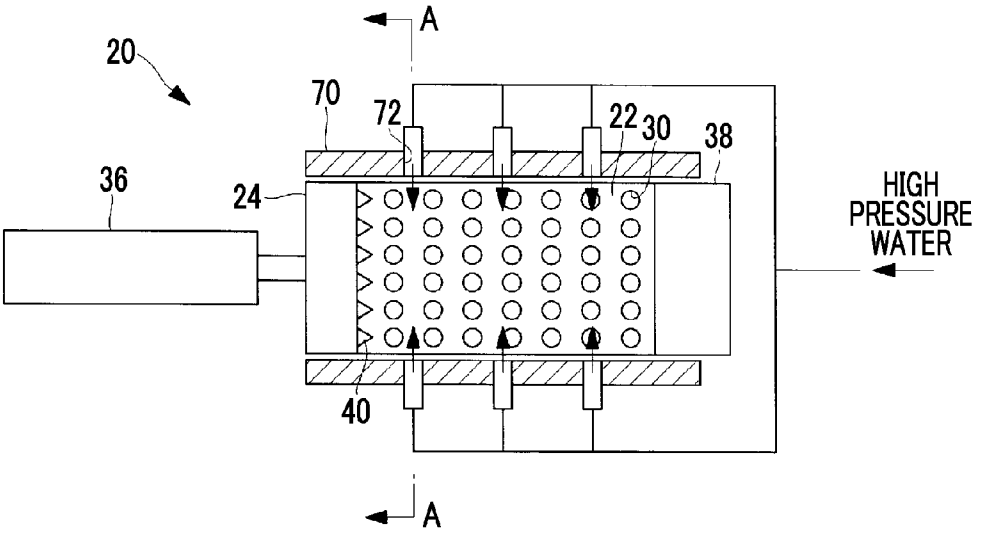
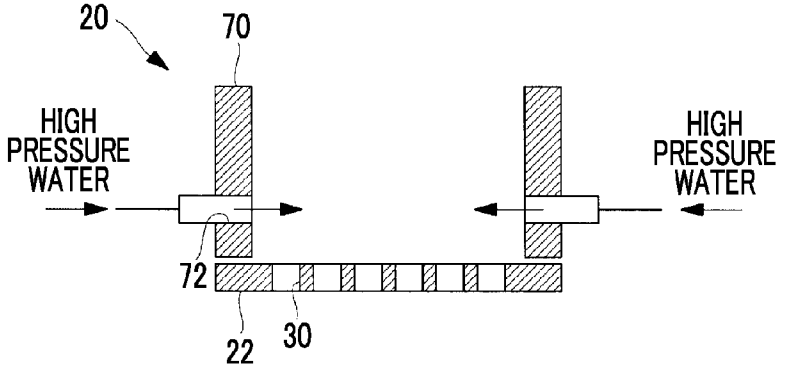

A
20
70
72
22
30
38
36
24
HIGH
PRESSURE
WATER
40
A

FIG. 11


20
70
HIGH
PRESSURE
WATER
HIGH
PRESSURE
WATER
72
22
30

SLAG DISCHARGE APPARATUS AND SLAG DISCHARGE METHOD

TECHNICAL FIELD

[0001] The present invention relates to a slag discharge apparatus and a slag discharge method.

BACKGROUND ART

[0002] An ash hopper, in which slag (molten slag) produced in and falling from a combustor is collected, is provided in a lower portion of a gasifier which gasifies a carbonaceous feedstock such as coal (PTLs 1 and 2).

[0003] A slag crusher which includes a screen and a spreader is provided in the ash hopper. The slag falling from the combustor is rapidly cooled by water so as to be solidified, and falls on a top face of the screen included in the slag crusher.

[0004] The screen is provided transversely with respect to the fall direction of the slag and includes a plurality of openings. Accordingly, slag pieces which are smaller than diameters of the openings pass through the screen, and fall to the lower portion of the ash hopper.

[0005] Meanwhile, slag pieces which are larger than the diameters of the openings, or a slag lump which is an accumulation of the slag pieces which are smaller than the diameters of the openings are accumulated on the top face of the screen. In the slag lump, slag pieces are combined by a friction force in particle layers or cross-linking due to powder pressure.

[0006] Accordingly, for example, the spreader provided on the top face of the screen is moved along the top face of the screen by a hydraulic cylinder, and the spreader crushes the slag by applying the slag accumulated on the top face of the screen so as to allow the slag to pass through the screen.

[0007] The slag, which falls from the openings of the screen to the lower portion of the ash hopper and is accumulated, is discharged from the gasifier out of a system via a lock hopper.

CITATION LIST

Patent Literature

[0008] [PTL 1] Japanese Unexamined Patent Application Publication No. H7-247484

[0009] [PTL 2] Japanese Unexamined Patent Application Publication No. H9-38510

SUMMARY OF INVENTION

Technical Problem

[0010] However, even when the spreader is operated, the accumulated slag may be not crushed, and the slag may not pass through the screen by only collecting the slag in the operating direction of the slag crusher.

[0011] In addition, an accumulation amount of the slag on the top face of the screen increases, the slag may not be discharged from the gasifier, and the inner portion of the ash hopper may be filled with the slag. In this case, the operation of the gasifier cannot be continued, and the gasifier is stopped.

[0012] The present invention is made in consideration of the above-described circumstances, and an object thereof is to provide a slag discharge apparatus and a slag discharge method capable of allowing the slag accumulated on the top face of the screen more easily to pass through the openings of the screen.

Solution to Problem

[0013] In order to solve the above-described problems, a slag discharge apparatus and a slag discharge method of the present invention adopt the following means.

[0014] According to a first aspect of the present invention, there is provided a slag discharge apparatus which is provided on a combustor of a gasifier gasifying a carbonaceous feedstock and discharges slag produced in and falling from the combustor out of the gasifier, comprising: a screen which is provided transversely with respect to the fall direction of the slag and has a plurality of openings to allow slag pieces which are smaller than diameters of the openings to pass through the screen; crushing means moving along a top face of the screen to crush the slag accumulated on the top face of the screen; and a spouting hole which spouts pressurized liquid onto the slag accumulated on the screen.

[0015] The slag discharge apparatus according to the present configuration is provided on a combustor of a gasifier gasifying the carbonaceous feedstock and discharges slag produced in and falling from the combustor out of the gasifier.

[0016] In addition, the slag discharge apparatus includes the screen which is provided transversely with respect to the fall direction of the slag and has the plurality of openings. The slag pieces, which are smaller than the diameters of the openings of the screen, pass through the openings so as to fall. Meanwhile, the slag, which does not pass through the openings and is accumulated on the top face of the screen, is crushed by the crushing means moving along the top face of the screen.

[0017] Here, the slag which is accumulated on the top face of the screen include a slag lump in which slag pieces smaller than the diameters of the openings are combined by a friction force or cross-linking due to powder pressure.

[0018] In order to remove the accumulated slag, the pressurized liquid is spouted from the spouting hole onto the slag accumulated on the top face of the screen. The combination due to the cross-linking is cut by spouting the pressurized liquid onto particles of the slag which are combined by the cross-linking. Accordingly, the slag is gently fluidized from a stationary state. In addition, for example, the liquid spouted onto the slag is water.

[0019] In addition, the slag which is easily fluidized is made to flow by the liquid spouted from the spouting hole. Accordingly, the slag falls along with the liquid from the openings of the screen without moving the crush means. In addition, the slag easily falls from the openings by moving the crushing means.

[0020] As described above, in the present configuration, the slag accumulated on the top face of the screen can easily be passed through the openings of the screen.

[0021] In the first aspect, preferably, the spouting hole is provided on a side wall of the screen which is erected in parallel with respect to an operating direction of the crushing means.

[0022] According to the present configuration, it is possible to easily and uniformly spout the pressurized liquid onto the accumulated slag.

[0023] In the first aspect, preferably, the spouting hole is provided in the crushing means.

[0024] According to the present configuration, since the pressurized liquid is more reliably spouted onto the slag crushed by the crushing means, it is possible to reliably crush the accumulated slag.

[0025] In the first aspect, preferably, the crushing means includes an inclined surface which is inclined forward with respect to a crushing direction of the slag.

[0026] According to the present configuration, since a downward force is applied to the accumulated slag, it is possible to more reliably crush the accumulated slag.

[0027] In the first aspect, preferably, the spouting hole is provided on the inclined surface, and spouts the liquid in the direction of the screen.

[0028] According to the present configuration, since the downward force is also added to the slag, which is crushed by the crushing means, due to the spouted liquid, it is possible to more reliably crush the accumulated slag.

[0029] In the first aspect, preferably, the spouting hole is provided in the screen.

[0030] According to the present configuration, it is possible to prevent the slag from being accumulated on the top face of the screen, and it is possible to easily and uniformly spout the pressurized liquid onto the accumulated slag.

[0031] In the first aspect, preferably, the spouting hole spouts gas instead of the liquid.

[0032] According to the present configuration, since gas is spouted from the top face of the screen in a state where the top face of the screen is filled with water, combination due to cross-linking of the slag is cut by rising of air bubbles. Accordingly, since the slag is fluidized, the slag accumulated on the top face of the screen more easily passes through the openings of the screen.

[0033] According to a second aspect of the present invention, there is provided a slag discharge method of using a slag discharge apparatus which is provided on a combustor of a gasifier gasifying a carbonaceous feedstock and discharges slag produced in and falling from the combustor out of the gasifier, comprising: a first step of spouting pressurized liquid from a spouting hole onto slag accumulated on a top face of a screen which is provided transversely with respect to the fall direction of the slag and has a plurality of openings; and a second step of moving crushing means for crushing the slag accumulated on the top face of the screen along the top face of the screen.

Advantageous Effects of Invention

[0034] According to the present invention, excellent effects are obtained in which slag accumulated on a top face of a screen can easily pass through openings of the screen.

BRIEF DESCRIPTION OF DRAWINGS

[0035] FIG. **1** is a longitudinal section view of a gasifier according to a first embodiment of the present invention.

[0036] FIG. **2** is a longitudinal section view of a slag crusher according to the first embodiment of the present invention.

[0037] FIG. **3** is a front view of a spreader according to the first embodiment of the present invention.

[0038] FIG. **4** is a longitudinal sectional view when a spreader according to a second embodiment of the present invention is viewed from a side.

[0039] FIG. **5** is a longitudinal sectional view when the spreader according to the second embodiment of the present invention is viewed from a front side.

[0040] FIG. **6** is a longitudinal section view of a screen according to a third embodiment of the present invention.

[0041] FIG. **7** is a longitudinal section view of a screen according to a modification example of the third embodiment of the present invention.

[0042] FIG. **8** is a longitudinal section view of a screen according to a fourth embodiment of the present invention.

[0043] FIG. **9** is a longitudinal section view of a screen according to a modification example of the fourth embodiment of the present invention.

[0044] FIG. **10** is a top view of a slag crusher according to a fifth embodiment of the present invention.

[0045] FIG. **11** is a longitudinal section view of a screen and a side wall according to the fifth embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0046] Hereinafter, embodiments of a slag discharge apparatus and a slag discharge method according to the present invention will be described with reference to the drawings.

First Embodiment

[0047] Hereinafter, a first embodiment of the present invention will be described.

[0048] FIG. **1** is a longitudinal section view of a gasifier **10** according to the first embodiment.

[0049] As carbonaceous feedstocks applied to the gasifier according to the first embodiment, there are wastes such as waste tires or plastics in addition to heavy fuels such as coal, petroleum coke, coal coke, asphalt, pitch, or oil shale. In the following embodiments, a case in which the gasified carbonaceous feedstock is coal will be described.

[0050] In the gasifier **10**, pulverized coal which is supplied from a coal supply device (not shown) and char which is recovered by dedusting device (not shown) react with an oxidizing agent in a combustor **12** under a high temperature atmosphere of approximately 1500° C. to 1800° C. which is an ash melting point or more. Accordingly, when the pulverized coal is combusted at a high temperature in the combustor **12**, coal gas which is combustible gas is generated, and slag **14** in which ash in the pulverized coal is melted is generated.

[0051] In addition, the high-temperature coal gas obtained by the high temperature combustion in the combustor **12** flows into a reductor **16** which is provided on the upper stage of the combustor **12**. The pulverized coal and the char are also supplied to the reductor **16**, the supplied pulverized coal and char are further gasified, and coal gas which is combustible gas is generated. In addition, the combustor **12** according to the first embodiment is an entrained bed type combustor. However, the combustor **12** is not limited to this, and may be a fluidized bed type combustor or a fixed bed type combustor.

[0052] An ash hopper **18**, which collects the slag **14** produced in and falling from the combustor **12**, is provided in the lower portion of the gasifier **10**.

[0053] The ash hopper **18** is provided with a slag crusher **20** which crushes the slag **14** and discharges the slag out of the gasifier **10**.

[0054] FIG. **2** is a longitudinal section view showing a configuration of the slag crusher **20** according to the first embodiment.

[0055] The slag crusher **20** is provided with a screen **22**, a spreader **24**, and a nozzle **26**.

[0056] The slag **14** falling from the combustor **12** is rapidly cooled by water (hereinafter, referred to as "ash hopper water") which is spouted from an ash hopper water-supply pipe **28** so as to be solidified, and the solidified slag falls to the top face of the screen **22** provided in the slag crusher **20**.

[0057] The screen **22** with a plurality of openings **30** is provided transversely with respect to the fall direction of the slag **14**, and slag pieces **14** which are smaller than diameters of the openings **30** pass through the screen. For example, the screen **22** is a plate-shaped member which includes the openings **30**.

[0058] The slag **14** passing through the openings **30** falls to the lower portion of the ash hopper **18** along with the ash hopper water. As shown in FIG. **1**, a lock hopper **34** is connected to the lower portion of the ash hopper **18**, and the slag **14** falling to the lower portion of the ash hopper **18** is discharged out of the system via the lock hopper **34**.

[0059] In addition, as an example, the gasifier **10** of FIG. **1** adopts a gravity falling method in which the slag **14** is discharged out of the system by making the slag **14** fall to the lock hopper **34**. However, the present invention is not limited to this, and a horizontal suction method may be adopted in which the slag **14** is extracted so as to be reused without causing the slag **14** to fall to the lock hopper **34**.

[0060] The spreader **24** is moved along the top face of the screen **22** by the hydraulic cylinder **36**, and crushes the slag **14** accumulated on the top face of the screen **22**. In addition, the position of the spreader **24** shown in FIG. **2** is a standby position before the spreader moves along the top face of the screen **22**.

[0061] A receiving plate **38** is provided on a side opposite to the standby position of the spreader **24**. That is, the spreader **24** moves from the standby position to the receiving plate **38**, and the slag **14** accumulated on the top face of the screen **22** is collected. In addition, the slag **14** is interposed between the spreader **24** and the receiving plate **38**, and the accumulated slag **14** is crushed. In addition, protrusion portions **40** are provided on a front surface of the spreader **24** so as to easily crush the slag **14**.

[0062] In addition, the spreader **24** according to the first embodiment is provided with an inclined surface **24**A which is inclined forward with respect to the crushing direction of the slag **14**. The inclined surface **24**A is provided on the lower portion of the spreader **24**. The spreader **24** collects the accumulated slag **14** mainly by the inclined surface **24**A. The portion above the inclined surface **24**A becomes a perpendicular surface **24**B perpendicular to the screen **22**.

[0063] In addition, the nozzle **26** is a spouting hole which spouts pressurized liquid onto the slag **14** accumulated on the screen **22**. The nozzle **26** according to the first embodiment is provided on the inclined surface **24**A of the spreader **24**. As shown in a front view of the spreader **24** of FIG. **3**, for example, the plurality of nozzles **26** are horizontally provided on the inclined surface **24**A.

[0064] For example, the pressurized liquid which is spouted from the nozzle **26** is water. However, the present invention is not limited to this, and the pressurized liquid may be liquid which can cut cross-linking of the slag **14** as described below. In addition, in descriptions below, the pressurized water is referred to as high pressure water. For example, the pressure of the high pressure water is 3 MPa to 5 MPa.

[0065] A water supply pipe **42**, through which the high pressure water is supplied to the ash hopper water-supply pipe **28**, is branched and connected to the nozzle **26**. More specifically, the branched water supply pipe **42** is connected to a high pressure hose **44**. The high pressure hose **44** has flexibility so as to correspond to the movement of the spreader **24**, and is supported by a high pressure hose receiver **46**.

[0066] The high pressure hose **44** is connected to a high pressure water header **48**. The high pressure water header supplies the plurality of nozzles **26** with the high pressure water.

[0067] Next, an operation of the slag crusher **20** according to the first embodiment will be described.

[0068] The slag **14** generated in the combustor **12** falls on the top face of the screen **22**.

[0069] In the slag **14** which falls on the top face of the screen **22**, slag pieces **14** which are smaller than the diameters of the openings **30** of the screen **22** pass through the openings **30**, and fall to the lower portion of the ash hopper **18**, that is, the lower portion of the gasifier **10**.

[0070] Meanwhile, slag pieces **14** which are larger than the diameters of the openings **30**, or slag lumps which are accumulations of the slag pieces **14** which are smaller than the diameters of the openings **30** cannot pass through the openings **30**, and are accumulated on the top face of the screen **22**.

[0071] Accordingly, the spreader **24** moves from the standby position to the receiving plate **38** along the top face of the screen **22** every fixed time interval. Accordingly, the spreader **24** crushes the accumulated slag **14** such that the slag **14** easily passes through the openings **30**.

[0072] In addition, since the spreader **24** according to the first embodiment applies a downward force to the accumulated slag **14** using the inclined surface **24**A, the accumulated slag **14** can be more reliably crushed.

[0073] However, the slag lumps, in which small slag pieces **14** are combined by cross-linking, are not crushed by the spreader **24**, do not pass through the openings **30**, and may be collected in the movement direction of the spreader **24**.

[0074] Accordingly, the high pressure water is spouted from the nozzles **26**, which are provided on the inclined surface **24**A of the spreader **24**, toward the slag **14**. Since the high pressure water is spouted to the particles of the slag **14** combined by cross-linking, the combination by cross-linking is cut. Accordingly, the slag **14** is gently fluidized from a stationary state.

[0075] In addition, since the nozzles **26** are provided on the inclined surface **24**A, the high pressure water is more reliably spouted to the slag **14** which is crushed by the spreader **24**. Accordingly, it is possible more reliably crush the accumulated slag **14**.

[0076] Moreover, a time interval of the emission of the high pressure water from the nozzles **26** may be the same as a time interval of the movement of the spreader **24**, or the emission of the high pressure water may be intermittently or continuously performed regardless of the time interval of the movement of the spreader **24**.

[0077] In addition, the slag **14**, which is easily fluidized, is made to flow by the high pressure water spouted from the nozzles **26**. Accordingly, the slag **14** falls from the openings **30** of the screen **22** along with the high pressure water without moving the spreader **24**. In addition, the slag **14** easily falls from the openings **30** even by moving spreader **24**.

[0078] As described above, the slag crusher **20** according to the first embodiment is provided with the screen **22** which is

provided transversely with respect to the fall direction of the slag **14** and has the plurality of openings to allow the slag pieces **14** which are smaller than diameters of the openings **30** to pass through the screen, the spreader **24** which moves along the top face of the screen **22** to crush the slag **14** accumulated on the top face of the screen **22**, and the nozzles **26** which spouts the high pressure water onto the slag **14** accumulated on the screen **22**.

[0079] Accordingly, the slag crusher **20** causes the slag **14** accumulated on the top face of the screen **22** to more easily pass through the openings **30** of the screen **22**. Therefore, even when the slag **14** is accumulated on the top face of the screen **22**, it is possible to more reliably discharge the slag **14** by the slag crusher **20**. As a result, it is possible to prevent the operation of the gasifier **10** from being stopped due to accumulation of the slag **14**, and a continuous operation of the gasifier **10** can be performed.

[0080] Moreover, in the slag crusher **20** according to the first embodiment, the nozzles **26** are provided on the inclined surface **24**A of the spreader **24**. However, the present invention is not limited to this, and the nozzles **26** may be provided on the perpendicular surface **24**B of the spreader **24**.

Second Embodiment

[0081] Hereinafter, a second embodiment of the present invention will be described.

[0082] Since the configuration of the gasifier **10** according to the second embodiment is the same as the configuration of the gasifier **10** according to the first embodiment shown in FIG. **1**, descriptions thereof are omitted.

[0083] FIG. **4** is a longitudinal sectional view when the spreader **24** according to the second embodiment is viewed from a side. FIG. **5** is a longitudinal sectional view when the spreader **24** according to the second embodiment is viewed from a front side, and is a section view taken along A-A in FIG. **4**. In addition, in FIGS. **4** and **5**, the same reference numerals as those of FIGS. **2** and **3** are assigned to the same configuration portions as those of FIGS. **2** and **3**, and descriptions thereof are omitted.

[0084] The nozzles **26** according to the second embodiment are provided on the inclined surface **24**A, and spouts high pressure water in the direction of the screen **22**.

[0085] For example, a header **50** is provided in the inner portion of the spreader **24**. The plurality of nozzles **26** facing downward are connected to the header **50**, and the high pressure water is spouted from the nozzles **26** to the top face of the screen **22**. Moreover, the time interval of the emission of the high pressure water from the nozzles **26** may be the same as the time interval of the movement of the spreader **24**, or the emission of the high pressure water may be intermittently or continuously performed regardless of the time interval of the movement of the spreader **24**. In addition, when the high pressure water header **48** is provided in the slag crusher **20**, the header **50** may not be provided.

[0086] Accordingly, in the slag crusher **20** according to the second embodiment, since the downward force is applied to the slag **14**, which is crushed by the spreader **24**, by the high pressure water, it is possible to more reliably crush the accumulated slag **14**.

Third Embodiment

[0087] Hereinafter, a third embodiment of the present invention will be described.

[0088] Since the configuration of the gasifier **10** according to the third embodiment is the same as the configuration of the gasifier **10** according to the first embodiment shown in FIG. **1**, descriptions thereof are omitted.

[0089] In the slag crusher **20** according to the third embodiment, nozzles **60** which spouts high pressure water are provided in the screen **22**.

[0090] FIG. **6** is an example of a longitudinal section view of the screen **22** according to the third embodiment of the present invention.

[0091] In the example of FIG. **6**, the nozzles **60**, to which the high pressure water is supplied via headers **62**, are provided on the side surface of the openings **30** of the screen **22**. The water supply pipe **42**, through which the high pressure water is supplied to the ash hopper water-supply pipe **28**, is branched, and is connected to the header **62**.

[0092] FIG. **7** is a longitudinal section view of the screen according to a modification example of the third embodiment.

[0093] In the example of FIG. **7**, the nozzles **60**, to which the high pressure water is supplied via the headers **62**, are provided on the top face of the screen **22**.

[0094] In addition, the time interval of the emission of the high pressure water from the nozzles **60** may be the same as the time interval of the movement of the spreader **24**, or the emission of the high pressure water may be intermittently or continuously performed regardless of the time interval of the movement of the spreader **24**.

[0095] In the slag crusher **20** according to the third embodiment, since the high pressure water is spouted to particles of the slag **14** combined by cross-linking, the combination by the cross-linking is cut. Accordingly, the accumulated slag **14** is easily fluidized.

[0096] Moreover, since the pressure water is spouted from the lower portion of the screen **22** toward the upper portion, it is possible to prevent the slag **14** from being accumulated on the top face of the screen **22**, and it is possible to easily and uniformly spout the pressurized liquid to the accumulated slag **14**.

Fourth Embodiment

[0097] Hereinafter, a fourth embodiment of the present invention will be described.

[0098] Since the configuration of the gasifier **10** according to the fourth embodiment is the same as the configuration of the gasifier **10** according to the first embodiment shown in FIG. **1**, descriptions thereof are omitted.

[0099] FIGS. **8** and **9** are longitudinal section views of the screen **22** according to the fourth embodiment. In addition, in FIGS. **8** and **9**, the same reference numerals as those of FIGS. **6** and **7** are assigned to the same configuration portions as those of FIGS. **6** and **7**, and descriptions thereof are omitted.

[0100] In this screen **22** according to the fourth embodiment, high pressure gas (hereinafter, referred to as "high pressure gas") instead of the high pressure water is spouted from the nozzles **60**. Accordingly, the headers **62** are connected to the high pressure gas supply pipe **42** through which the high pressure gas is supplied.

[0101] Moreover, the time interval of the emission of the high pressure gas from the nozzles **60** may be the same as the time interval of the movement of the spreader **24**, or the emission of the high pressure gas may be intermittently or continuously performed regardless of the time interval of the movement of the spreader **24**.

[0102] Due to the high pressure water spouted from the nozzles **60** provided in the spreader **24** or the water from the ash hopper water-supply pipe **28**, the top face of the screen **22** is filled with water.

[0103] In addition, in the slag crusher **20** according to the fourth embodiment, since the gas is spouted from the top face of the screen **22** in the state where the top face of the screen **22** is filled with water, air bubbles of the high pressure gas rise from the top face of the screen **22**. The combination of the slag **14** by cross-linking is cut by the rising of the air bubbles. Accordingly, since the slag **14** is fluidized, the slag **14** accumulated on the top face of the screen **22** more easily passes through the openings **30** of the screen **22**.

Fifth Embodiment

[0104] Hereinafter, a fifth embodiment of the present invention will be described.

[0105] Since the configuration of the gasifier **10** according to the fifth embodiment is the same as the configuration of the gasifier **10** according to the first embodiment shown in FIG. **1**, descriptions thereof are omitted.

[0106] FIG. **10** is a top view of the slag crusher **20** according to the fifth embodiment.

[0107] FIG. **11** is a longitudinal section view of the screen **22** and side walls **70** according to the fifth embodiment, and is a sectional view taken along A-A in FIG. **10**. In addition, in FIGS. **10** and **11**, the same reference numerals as those of FIGS. **2** and **3** are assigned to the same configuration portions as those of FIGS. **2** and **3**, and descriptions thereof are omitted.

[0108] The slag crusher **20** according to the fifth embodiment includes nozzles **72** which spout high pressure water at the side walls **70** of the screen **22** which are erected in parallel with respect to the operation direction of the spreader **24**.

[0109] As shown in FIG. **11**, for example, the nozzles **72** are provided in the lower portions of the side walls **70**.

[0110] In the slag crusher **20** according to the fifth embodiment, it is possible to easily and uniformly spout the high pressure water to the accumulated slag **14**. In addition, since the nozzles **72** are provided on the side walls **70**, it is possible to easily install the nozzles **70** on the slag crusher **20**.

[0111] In addition, the high pressure water spouted from the nozzles **72** may be also used as the ash hopper water.

[0112] Hereinbefore, the present invention is described using the embodiments. However, the technical scope of the present invention is not limited to the scope described in the embodiments. Various modifications or improvements are added to the embodiments within a scope which does not depart from the gist of the present invention, and aspects to which modifications or improvements are added are also included in the technical scope of the present invention. In addition, the plurality of embodiments may be combined.

[0113] For example, in the embodiments, the aspect in which the spreader **24** moves toward the receiving plate **38** is described. However, the present invention is not limited to this, and an aspect may be adopted in which the spreader **24** is provided instead of the receiving plate **38** and a pair of spreaders **24** moves along the top face of the screen **22** to crush the slag **14**.

REFERENCE SIGNS LIST

[0114] **10**: gasifier
[0115] **12**: combustor
[0116] **14**: slag
[0117] **20**: slag crusher
[0118] **22**: screen
[0119] **24**: spreader
[0120] **24**A: inclined surface
[0121] **26**: nozzle
[0122] **30**: opening
[0123] **60**: nozzle
[0124] **70**: side wall
[0125] **72**: nozzle

1-8. (canceled)

9. A slag discharge device which is provided on a combustor of a gasifier gasifying a carbon containing fuel and discharges slag produced in and falling from the combustor out of the gasifier, comprising:

a screen which is provided transversely with respect to the fall direction of the slag and has a plurality of openings to allow slag pieces which are smaller than diameters of the openings to pass through the screen;

crushing means moving along a top face of the screen to crush the slag accumulated on the top face of the screen; and

an emitting hole which emits liquid, which is pressurized, fluidizes the slag accumulated on the screen, and allows the slag to pass through the openings, onto the slag.

10. The slag discharge device according to claim **9**,

wherein the emitting hole is provided on a side wall of the screen which is erected in parallel with respect to an operating direction of the crushing means.

11. The slag discharge device according to claim **9**,

wherein the emitting hole is provided in the crushing means.

12. The slag discharge device according to claim **9**,

wherein the crushing means includes an inclined surface which is inclined forward with respect to a crushing direction of the slag.

13. The slag discharge device according to claim **12**,

wherein the emitting hole is provided on the inclined surface, and emits the liquid in the direction of the screen.

14. The slag discharge device according to claim **9**,

wherein the emitting hole is provided in the screen.

15. The slag discharge device according to claim **14**,

wherein the emitting hole emits gas instead of the liquid.

16. A slag discharge method of using a slag discharge device which is provided on a combustor of a gasifier gasifying a carbon containing fuel and discharges slag produced in and falling from the combustor out of the gasifier, comprising:

a first step of emitting liquid, which is pressurized from an emitting hole, fluidizes the slag, and causes the slag to pass through a plurality of openings, onto the slag accumulated on a top face of a screen which is provided transversely with respect to the fall direction of the slag and has the plurality of openings; and

a second step of moving crushing means for crushing the slag accumulated on the top face of the screen along the top face of the screen.

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