

DESCRIPTION

STOKER FURNACE

5 TECHNICAL FIELD

[0001]

The present disclosure relates to a stoker furnace.

Priority is claimed on Japanese Patent Application No. 2019-216540, filed November 29, 2019, the content of which is incorporated herein by reference.

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BACKGROUND ART

[0002]

Stoker furnaces have been widely used as devices for incinerating waste (materials to be incinerated). For example, as described in Patent Document 1, a stoker
15 furnace includes a main combustion chamber which includes a drying stage, a combustion stage, and a post-combustion stage arranged in order from upstream toward downstream in the conveying direction, a feeder which supplies materials to be incinerated into the drying stage in the main combustion chamber, and a boiler in which exhaust gas generated in the main combustion chamber is discharged.

20 [0003]

In the main combustion chamber, a flame is formed due to the combustion of materials to be incinerated. The exhaust gas generated due to the flame is discharged to the outside through the boiler located above the combustion stage.

[Related Art Documents]

25 [Patent Documents]

[0004]

[Patent Document 1]

Japanese Patent No. 6030913

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SUMMARY OF INVENTION

Problem to be solved by the Invention

[0005]

However, like the device described in Patent Document 1, when a position in which the flame is formed and a position of the boiler in a horizontal direction are the same, sufficient heat of the flame does not reach a region outside the flame (that is, a region on the drying stage side or a region on the post-combustion stage side). Thus, drying and post-combustion are less likely to be promoted. As a result, there is a concern that the efficiency of the device decreases due to an increase in NO_x and an increase in amount of unburned gas.

15 [0006]

The present disclosure is made to solve the above problems, and an object of the present disclosure is to provide a stoker furnace capable of performing an operation with higher efficiency by optimizing a position in which the flame is formed.

20 Means for Solving the Problem

[0007]

In order to achieve the above problem, a stoker furnace according to the present disclosure includes: a furnace body defining a processing space which includes a drying stage, a combusting stage and a post-combusting stage arranged in a conveying direction and in which drying, combustion and post-combustion are performed respectively by

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conveying materials to be incinerated therein; a feeder which supplies materials to be incinerated into the drying stage of the furnace body; a boiler which extends upward from the furnace body and discharges exhaust gas generated in the processing space; and a gas circulation unit through which a part of the exhaust gas is extracted and which includes a first gas port through which the part of the exhaust gas is sprayed into the processing space, in which a center axis of the boiler is disposed at a position deviated and different from a position of the combustion stage in the conveying direction, and the first gas port is configured to spray the exhaust gas from a side located to be shifted in an opposite direction to a deviation direction of the boiler from the position of the combustion stage in the conveying direction such that a flame formed in the processing space grows to be away from the boiler in the conveying direction.

Effects of the Invention

[0008]

According to a stoker furnace of the present disclosure, it is possible to perform an operation with higher efficiency by optimizing a position in which the flame is formed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is an overall view showing a configuration of an incinerator system according to a first embodiment of the present disclosure.

Fig. 2 is a cross-sectional view showing a configuration of a stoker furnace according to the first embodiment of the present disclosure.

Fig. 3 is a plan view showing the configuration of the stoker furnace according

to the first embodiment of the present disclosure.

Fig. 4 is a cross-sectional view showing a configuration of a stoker furnace according to a second embodiment of the present disclosure.

Fig. 5 is a plan view showing the configuration of the stoker furnace according
5 to the second embodiment of the present disclosure.

Fig. 6 is a cross-sectional view showing a configuration of a stoker furnace according to a third embodiment of the present disclosure.

Fig. 7 is a cross-sectional view showing a configuration of a stoker furnace according to a fourth embodiment of the present disclosure.

10 Fig. 8 is a cross-sectional view showing a configuration of a stoker furnace according to a fifth embodiment of the present disclosure.

EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0010]

15 <First embodiment>

(Configuration of incinerator system)

A configuration of an incinerator system 100 and a stoker furnace 1 according to a first embodiment of the present disclosure is described below with reference to Figs. 1 to 3. The incinerator system 100 is a facility for incinerating waste as materials to be
20 incinerated. As shown in Fig. 1, the incinerator system 100 includes the stoker furnace 1, an exhaust heat recovery boiler 8, a temperature reducing tower 9, a dust collector 11, and a chimney 12.

[0011]

The stoker furnace 1 combusts the materials to be incinerated while conveying
25 the materials to be incinerated. Exhaust gas is generated from the stoker furnace 1 with

combustion. This exhaust gas is sent to the exhaust heat recovery boiler 8 provided downstream of the stoker furnace 1. The exhaust heat recovery boiler 8 heats water by exchanging heat between the exhaust gas and water to generate steam. This steam is used in an external device (not shown). The exhaust gas which has passed through the exhaust heat recovery boiler 8 is cooled in the temperature reducing tower 9 and then sent to the dust collector 11. After the soot and dust are removed in the dust collector 11, the exhaust gas is discharged into the atmosphere through the chimney 12.

[0012]

(Configuration of stoker furnace)

The configuration of the stoker furnace 1 is described below. As shown in Fig. 1, the stoker furnace 1 includes a furnace body 10, a boiler 7 extending upward from the furnace body 10, a hopper 3 having materials to be incinerated temporarily stored therein, a feeder 31 which supplies materials to be incinerated from the hopper 3 into the furnace body 10, a stoker 6 provided at a bottom portion of the furnace body 10, wind boxes 2 provided below the stoker 6, a blower B1, a primary air line L1, a secondary air line L2, and a gas circulation unit 4 through which a part of the exhaust gas is extracted from the inside of the chimney 12 and circulated in the furnace body 10.

[0013]

A processing space V for combusting the materials to be incinerated is formed inside the furnace body 10. In this processing space V, the materials to be incinerated are conveyed in a conveying direction Da (refer to Fig. 2) by the stoker 6. In this embodiment, the conveying direction Da is a horizontal direction. On the other hand, it is also possible to take a direction inclined with respect to a horizontal plane as the conveying direction Da. The boiler 7 extends upward from an upper portion of the furnace body 10. Exhaust gas in the processing space V is sent to the exhaust heat

recovery boiler 8 through the boiler 7. The blower B1 and the wind boxes 2 are connected through the primary air line L1. Air is supplied to the wind boxes 2 through the primary air line L1 by driving the blower B1. Each of the wind boxes 2 supplies air into the processing space V. The blower B1 and the inside of the boiler 7 are connected through the secondary air line L2. Combustion air is supplied into the boiler 7 through the secondary air line L2.

[0014]

(Configuration of gas circulation unit)

The gas circulation unit 4 supplies the exhaust gas extracted from the inside of the chimney 12 into the processing space V, thereby adjusting a position, a shape, and a temperature of the flame F formed in the processing space V. The gas circulation unit 4 includes an exhaust gas circulation line L3, blowers B2 and B3, first gas ports 41, and second gas ports 42. An intermediate position of the chimney 12 and the processing space V are connected through the exhaust gas circulation line L3. The blowers B2 and B3 pump the exhaust gas in the exhaust gas circulation line L3 toward the processing space V. Exhaust gas is sprayed toward the flame F in the processing space V through the first gas ports 41 and the second gas ports 42.

[0015]

Referring to Fig. 2, the configuration of the furnace body 10 and the disposition of the first gas ports 41 and the second gas ports 42 are described in detail. As shown in the drawing, the processing space V in the furnace body 10 is defined by an upstream surface 10A located on an upstream side in the conveying direction Da, an upper surface 10B located above the wind boxes 2 across the processing space V, a downstream surface 10C located on a downstream side in the conveying direction Da, and the plurality of wind boxes 2.

[0016]

The wind boxes 2 form a bottom surface of the processing space V. The plurality of (for example, five) wind boxes 2 are arranged in the conveying direction Da. Of these wind boxes 2, two wind boxes 2 counting from the upstream side (that is, the hopper 3 side) in the conveying direction Da form a drying stage 21. One wind boxes 2 located downstream of the drying stage 21 forms a combustion stage 22 and two wind boxes 2 located further downstream form a post-combustion stage 23. The materials to be incinerated supplied from the hopper 3 are dried in the drying stage 21 before combustion. In the combustion stage 22 and the post-combustion stage 23, the dried materials to be incinerated are combusted. The combusted materials to be incinerated are discharged to the outside through a discharge chute 13 provided on the downstream side. The flame F formed by combustion is mainly formed above the combustion stage 22.

[0017]

The boiler 7 is disposed at a position deviated toward the downstream side (post-combustion stage 23 side) in the conveying direction Da using a center portion of the furnace body 10 as a reference. To be more specific, a center line O (center axis) of the boiler 7 is disposed at a position (non-overlapping position) different from a position of the combustion stage 22 in the conveying direction Da. More specifically, when a length of the processing space V in the conveying direction Da is 100%, the center line O is disposed at a position within 25% from the downstream surface 10C. In the following description, a direction in which the center line O of the boiler 7 is disposed using the center portion of the furnace body 10 as a reference may be simply referred to as a “deviation direction”.

[0018]

The first gas ports 41 are provided in the upstream surface 10A. Exhaust gas is sprayed toward downstream in the conveying direction Da through the first gas ports 41 from the upstream surface 10A located to be shifted in an opposite direction to the deviation direction of the boiler 7 from the center portion of the furnace body 10. To be more specific, in a flow of the gas sprayed from the first gas ports 41, a spraying direction is adjusted such that the gas passes above the flame F formed in the processing space V. Furthermore, as shown in Fig. 3, the plurality of first gas ports 41 are disposed at intervals in the horizontal direction (width direction Db) orthogonal to the conveying direction Da.

10 [0019]

As shown in Fig. 2, the second gas ports 42 are provided in the upper surface 10B. Exhaust gas is sprayed through the second gas ports 42 downward from the upper surface 10B. The second gas ports 42 are provided at a position above the combustion stage 22 or a position slightly deviated toward the post-combustion stage 23 side in the conveying direction Da. Furthermore, as shown in Fig. 3, the plurality of second gas ports 42 are arranged at intervals in the width direction Db described above. As shown in the drawing, the positions of the first gas port 41 and the second gas port 42 in the width direction Db are different from each other. That is to say, the first gas port 41 and the second gas port 42 do not overlap when viewed in the conveying direction Da. In addition, in other words, the first gas ports 41 and the second gas ports 42 are alternately disposed in the width direction Db.

[0020]

(Action and effects)

When the stoker furnace 1 described above is operated, first, the materials to be incinerated are supplied from the hopper 3 into the processing space V, the materials to

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be incinerated are dried while the wind is being blown from the wind box 2, and then the materials to be incinerated are ignited. In this state, the materials to be incinerated are conveyed toward downstream in the conveying direction Da by driving the stoker 6.

When conveyed, the materials to be incinerated are dried in the drying stage 21 and combusted in the combustion stage 22 and the post-combustion stage 23, and then discharged to the outside through the discharge chute 13. Here, the flame F formed by the combustion of the materials to be incinerated is formed above the combustion stage 22. In the drying stage 21, the materials to be incinerated are dried using the radiant heat of the flame F.

10 [0021]

Here, in this embodiment, a part of the exhaust gas is supplied above the flame F through the first gas port 41. Exhaust gas is sprayed into the processing space V from the drying stage 21 side through the first gas port. Due to a flow A1 of this exhaust gas (refer to Fig. 2), a secondary flow A2 from the combustion stage 22 side toward the drying stage 21 side is formed in the processing space V. Therefore, the flame F formed mainly in the combustion stage 22 is attracted by the secondary flow A2 and grows toward the drying stage 21 side to be away from the combustion stage 22. That is to say, the flame F grows in a direction in which the flame F is away from the boiler 7 in the conveying direction Da. The heat of the flame F promotes the drying of the materials to be incinerated in the drying stage 21. As a result, it is possible to realize reduction in an amount of NOx and reduction in an amount of unburned gas.

[0022]

Furthermore, according to the above configuration, the flame F is disturbed by spraying the exhaust gas from above the processing space V through the second gas port

25 42. When this disturbance is caused, a combustible gas reacts with oxygen and an

oxygen-deficient region in the flame F expands. That is to say, a fuel-rich region expands. As a result, an amount of generated NO_x can be further reduced. In addition, the second gas port 42 is provided at a position different from that of the first gas port 41 in the horizontal direction (width direction Db). As a result, the flow A1 of the exhaust gas sprayed from the first gas port 41 and a flow A3 of the exhaust gas sprayed from the second gas port 42 are less likely to interfere with each other. On the other hand, when these two flows A1 and A3 interfere with each other, it becomes difficult for either flow to reach the flame F. According to the above configuration, such a possibility can be reduced.

10 [0023]

<Second embodiment>

A second embodiment of the present disclosure is described below with reference to Figs. 4 and 5. Components that are the same as those of the first embodiment described above are denoted by the same reference numerals and detailed description thereof is omitted. As shown in Fig. 4, the furnace body 10 according to this embodiment further includes, in the upper surface 10B of the furnace body 10, a temperature detection unit 20 for detecting a temperature distribution in the processing space V, a plurality of second gas ports 42A and 42B, and a flow rate control unit 50.

[0024]

20 To be specific, it is preferable that a thermo camera be used as the temperature detection unit 20. Furthermore, as shown in Fig. 5, it is desirable that a plurality of (for example, two) temperature detection units 20 be provided at intervals in the width direction Db.

[0025]

25 The second gas ports 42A and 42B are arranged on the upper surface 10B at

intervals in the conveying direction Da. It is also possible to adopt a configuration in which three or more second gas ports are provided. The flow rate control unit 50 changes a flow rate distribution of the exhaust gas sprayed from the second gas ports 42A and 42B based on the temperature distribution detected by the temperature detection unit

5 20. To be more specific, a configuration in which the flow rate distribution is changed as described above by adjusting a degree of opening of a valve (not shown) for each of the two second gas ports 42A and 42B is adopted.

[0026]

According to the above configuration, for example, when a temperature in the processing space V on the post-combustion stage 23 side becomes relatively high, the

10 flame F can be moved toward the drying stage 21 side by relatively increasing a flow rate of the exhaust gas from the second gas port 42B on the combustion stage 23 side. On the other hand, when the temperature in the processing space V on the drying stage 21 side is relatively high (more specifically, when the temperature of the drying stage 21

15 becomes higher than an allowable value or when the temperature becomes higher than a temperature at which thermal NO_x is generated), the flame F can be moved toward the post-combustion stage 23 side by relatively increasing a flow rate of the exhaust gas from the second gas port 42A on the drying stage 21 side. As a result, the temperature distribution in the processing space V is optimized and amounts of NO_x and unburned

20 gas to be generated can be minimized. This can also extend a lifespan of the devices.

[0027]

<Third embodiment>

A third embodiment of the present disclosure is described below with reference to Fig. 6. Components that are the same as those of the above embodiments are denoted

25 by the same reference numerals and detailed description thereof is omitted. As shown

in the drawing, in this embodiment, in addition to the configuration of the first embodiment described above, the gas circulation unit 4 further includes a third gas port 43 through which a part of the exhaust gas is sprayed from a downstream surface 10C. The third gas port 43 is provided below a first gas port 41. Exhaust gas is sprayed
5 through the third gas port 43 into a processing space V from a side opposite to the first gas port 41. That is to say, a gas flow A4 sprayed from the third gas port 43 collides with the flame F in the processing space V from downstream in the conveying direction Da.

[0028]

10 According to the above configuration, the flame F can be further moved toward the first gas port 41 side (drying stage 21 side) using a fluid force of the flow A4 sprayed from the third gas port 43 in addition to a secondary flow A2 due to the exhaust gas sprayed from the first gas port 41. As a result, a position in which the flame F is formed in the processing space V is optimized and the drying processing in the drying stage 21 is
15 promoted. As a result, the amounts of NO_x and unburned gas to be generated can be further reduced.

[0029]

<Fourth embodiment>

A fourth embodiment of the present disclosure is described below with reference
20 to Fig. 7. Components that are the same as those of the embodiments described above are denoted by the same reference numerals and detailed description thereof is omitted. As shown in the drawing, in this embodiment, in an upper surface 10B of a furnace body 10, in addition to the temperature detection unit 20 described in the second embodiment, a second gas port 42C, a movement unit 70 which movably supports the second gas port
25 42C in the conveying direction Da, and a movement control unit 60 which operates the

movement unit 70 based on the detection result of the temperature detection unit 20 are provided.

[0030]

According to the above configuration, a position of a second gas port 42C in the conveying direction Da can be adjusted by the movement unit 70. The position of the second gas port 42C is adjusted (changed) based on a temperature distribution in a processing space V. Therefore, for example, when a temperature on a post-combustion stage 23 side in the processing space V becomes relatively high, the flame F can be moved toward the drying stage 21 side by moving the second gas port 42C toward the post-combustion stage 23 side. On the other hand, when a temperature on the drying stage 21 side in the processing space V becomes relatively high (more specifically, when the temperature of the drying stage 21 becomes higher than an allowable value or when the temperature becomes higher than a temperature at which thermal NO_x is generated), the flame F can be moved toward the post-combustion stage 23 side by moving the second gas port 42C toward the drying stage 21 side. As a result, a temperature distribution in the processing space V is optimized and amounts of NO_x and unburned gas to be generated can be minimized. Furthermore, this can also extend a lifespan of the devices.

[0031]

Instead of the configuration described in the fourth embodiment above, the movement unit 70 may support the second gas port 42C such that a direction in which the exhaust gas of the second gas port 42C is discharged can be changed in the conveying direction Da. The movement control unit 60 changes an angle of the second gas port 42C with respect to the upper surface 10B of the furnace body 10 and changes a direction in which the exhaust gas is discharged from the second gas port 42C in the conveying

direction Da based on the temperature distribution in the processing space V.

Furthermore, as in the fourth embodiment, when a temperature on the post-combustion stage 23 side in the processing space V becomes relatively high, the flame F can be moved toward the drying stage 21 side by changing the direction in which the exhaust gas is discharged from the second gas port 42C toward the post-combustion stage 23.

In addition, when a temperature on the drying stage 21 side in the processing space V becomes relatively high, the flame F can be moved toward the post-combustion stage 23 side by changing the direction in which the exhaust gas is discharged from the second gas port 42C toward the drying stage 21.

Also, it is also possible to combine the configuration described in the fourth embodiment with the configuration including the temperature detection unit 20 described in the second embodiment, the plurality of second gas ports 42A and 42B, and the flow rate control unit 50.

[0032]

<Fifth embodiment>

A fifth embodiment of the present disclosure is described below with reference to Fig. 8. Components that are the same as those of the embodiments described above are denoted by the same reference numerals and detailed description thereof is omitted.

As shown in the drawing, in this embodiment, unlike the embodiments described above,

a center line O (center axis) of a boiler 7B is disposed deviated toward a drying stage 21 side in the conveying direction Da. To be more specific, the center line O (center axis) of the boiler 7 is disposed at a position (non-overlapping position) different from that of a combustion stage 22 in the conveying direction Da. More specifically, when a length of a processing space V in the conveying direction Da is 100%, the center line O is disposed at a position within 30% from an upstream surface 10A'.

[0033]

Furthermore, a first gas port 41' is provided in a surface (downstream surface 10C') of a furnace body 10' on a post-combustion stage 23 side and exhaust gas is sprayed from the post-combustion stage 23 side toward a drying stage 21 side. In addition, a third gas port 43' is provided in a surface (upstream surface 10A') of the furnace body 10' on the drying stage 21 side. The third gas port 43' is provided below the first gas port 41'. Exhaust gas is sprayed into the processing space V through the third gas port 43' from a side opposite to the first gas port 41'. That is to say, a flow A4' of gas sprayed from the third gas port 43' collides with the flame F in the processing space V from upstream in the conveying direction Da.

[0034]

According to the above configuration, the center line O of the boiler 7B is provided deviated toward the drying stage 21 side. Furthermore, exhaust gas is sprayed into the processing space V from the post-combustion stage 23 side through the first gas port 41'. Due to a flow A1' of the exhaust gas, a secondary flow A2' from the combustion stage 22 side toward the post-combustion stage 23 side is formed in the processing space V. Therefore, the flame F formed mainly in the combustion stage 22 is attracted to the secondary flow A2' and grows toward the post-combustion stage 23 side to be away from the combustion stage 22. That is to say, the flame F grows in a direction in which the flame F is away from the boiler 7B in the conveying direction Da. The heat of the flame F promotes the post-combustion of the materials to be incinerated in the post-combustion stage 23. As a result, it is possible to achieve reduction of NO_x and reduction of unburned gas. In addition, the flame F can be further moved toward the first gas port 41' side (post-combustion stage 23 side) due to a fluid force of the exhaust gas flow A4' sprayed from the third gas port 43', in addition to the secondary

flow A2' due to the exhaust gas sprayed from the first gas port 41'. Thus, a position of the flame F formed in the processing space V is optimized and the post-combustion in the post-combustion stage 23 is promoted. As a result, amounts of NOx and unburned gas to be generated can be further reduced. The third gas port 43' is not essential for causing the flame F to be away from the combustion stage 22 and the position of the flame F can be optimized as described above even in a configuration including only the first gas port 41'.

[0035]

(Other embodiments)

Although the embodiments of the present disclosure have been described in detail above with reference to the drawings, the specific configuration is not limited to those of the above embodiments and may include design changes and the like within the scope of the present disclosure.

For example, it is also possible to add the configuration relating to the second gas port 42 described in at least one of the first embodiment, the second embodiment, and the fourth embodiment (or at least one of a configuration in which the flow rate distribution of the second gas ports 42A and 42B is changed and a configuration in which the second gas port 42C is moved in the conveying direction Da) to the configuration described in the fifth embodiment.

[0036]

<Supplementary note>

The stoker furnace 1 described in each embodiment is ascertained, for example, as follows.

[0037]

(1) The stoker furnace 1 according to a first aspect includes the furnace body 10

defining the processing space V in which the materials to be incinerated are conveyed in the conveying direction Da and which includes the combustion stage 22 in which the materials to be incinerated are combusted, the boiler 7 which extends upward from the furnace body 10 and discharges exhaust gas generated in the processing space V, and the first gas port 41 through which a part of the exhaust gas is sprayed into the processing space V, in which the center line O of the boiler 7 is disposed at a position deviated and different from a position of the combustion stage 22 in the conveying direction Da and the exhaust gas is sprayed above the flame F formed in the processing space V through the first gas port 41 from the side located to be shifted in an opposite direction to the deviation direction of the boiler 7 from the position of the combustion stage 22 in the conveying direction Da.

[0038]

According to the above configuration, the center axis (center line O) of the boiler 7 is provided offset to a position different from a position of the combustion stage 22. Furthermore, exhaust gas is sprayed through the first gas port 41 into the processing space V from the side located to be shifted in the opposite direction to the deviation direction of the boiler 7 from the position of the combustion stage 22. Due to the flow of the exhaust gas, the secondary flow toward the side located to be shifted in the opposite direction to the deviation direction of the boiler 7 from the position of the combustion stage 22 is formed in the processing space V. Therefore, the flame F formed mainly in the combustion stage 22 is attracted to the secondary flow and grows in the direction in which the flame F is away from the combustion stage 22. That is to say, the flame F grows in the direction in which the flame F is away from the boiler 7 in the conveying direction Da. The heat of the flame F promotes the drying of the materials to be incinerated in the drying stage 21 or the post-combustion in the post-combustion stage

23. As a result, it is possible to realize reduction of NO_x and reduction of unburned gas.

[0039]

(2) In the stoker furnace 1 according to a second aspect, the center axis (center line O) of the boiler 7 is disposed deviated toward the post-combustion stage 23 in the conveying direction Da, the first gas port 41 is provided on the drying stage 21 side of the furnace body 10, and the exhaust gas is sprayed from the drying stage 21 side toward the post-combustion stage 23 side through the first gas port 41.

[0040]

According to the above configuration, the center axis (center line O) of the boiler 7 is provided deviated toward the post-combustion stage 23 side. Furthermore, exhaust gas is sprayed into the processing space V from the drying stage 21 side through the first gas port 41. Due to the flow of the exhaust gas, the secondary flow from the combustion stage 22 side toward the drying stage 21 side is formed in the processing space V. Therefore, the flame F formed mainly in the combustion stage 22 is attracted to the secondary flow and grows toward the drying stage 21 side to be away from the combustion stage 22. That is to say, the flame F grows in the direction in which the flame F is away from the boiler 7 in the conveying direction Da. The heat of the flame F promotes the drying of the materials to be incinerated in the drying stage 21. As a result, it is possible to realize reduction of NO_x and reduction of unburned gas.

[0041]

(3) In the stoker furnace 1 according to the third aspect, the center axis (center line O) of the boiler 7B is disposed deviated toward the drying stage 21 side in the conveying direction Da, the first gas port 41' is provided on the post-combustion stage 23 side of the furnace body 10', and the exhaust gas is sprayed from the combustion

stage 23 side toward the drying stage 21 side through the first gas port 41'.

[0042]

According to the above configuration, the center axis (center line O) of the boiler 7B is provided deviated toward the drying stage 21 side. Furthermore, exhaust gas is sprayed into the processing space V from the post-combustion stage 23 side through the first gas port 41'. Due to the flow of the exhaust gas, the secondary flow from the combustion stage 22 side toward the post-combustion stage 23 side is formed in the processing space V. Therefore, the flame F formed mainly in the combustion stage 22 is attracted to the secondary flow and grows toward the post-combustion stage 23 side to be away from the combustion stage 22. That is to say, the flame F grows in the direction to be away from the boiler 7B in the conveying direction Da. The heat of the flame F promotes the post-combustion of the materials to be incinerated in the post-combustion stage 23. As a result, it is possible to realize reduction of NO_x and reduction of unburned gas.

[0043]

(4) In the stoker furnace 1 according to a fourth aspect, the gas circulation unit 4 further includes a second gas port 42 through which a part of the exhaust gas is extracted and sprayed into the processing space V from above and the second gas port 42 is provided at a position different from that of the first gas port 41 in the horizontal direction orthogonal to the conveying direction Da.

[0044]

According to the above configuration, the flame F is disturbed by spraying the exhaust gas from above the processing space V through the second gas port 42. An oxygen-deficient region in the flame F expands by causing this disturbance. That is to say, a fuel-rich region expands. As a result, an amount of NO_x to be generated can be

further reduced. In addition, the second gas port 42 is provided at a position different from that of the first gas port 41 in the horizontal direction. Thus, the flow of the exhaust gas sprayed from the first gas port 41 and the flow of the exhaust gas sprayed from the second gas port 42 are less likely to interfere with each other. On the other

5 hand, when these two flows interfere with each other, it becomes difficult for either flow to reach the flame F. According to the above configuration, such a possibility can be reduced.

[0045]

(5) The stoker furnace 1 according to a fifth aspect further includes the plurality

10 of second gas ports 42A and 42B arranged at intervals in the conveying direction Da, the temperature detection unit 20 which detects a temperature distribution in the processing space V, and the flow rate control unit 50 which changes a flow rate distribution of the exhaust gas sprayed from each of the plurality of second gas ports 42A and 42B based on the temperature distribution.

15 [0046]

According to the above configuration, the plurality of second gas ports 42A and 42B are arranged at intervals in the conveying direction Da and a distribution of a flow rate of the exhaust gas sprayed from these second gas ports 42A and 42B is adjusted (changed) based on the temperature distribution in the processing space V. Therefore,

20 for example, when a temperature on the post-combustion stage 23 side in the processing space V becomes relatively high, the flame F can be moved toward the drying stage side by relatively increasing the flow rate of the exhaust gas from the second gas port 42B on the post-combustion stage 23 side. Thus, the temperature distribution in the processing space V is optimized and the amounts of NO_x and unburned gas to be generated can be

25 minimized.

[0047]

(6) The stoker furnace 1 according to a sixth aspect further includes the movement unit 70 which moves the second gas port 42C in the conveying direction Da, the temperature detection unit 20 which detects a temperature distribution in the processing space V, and the movement control unit 60 which changes a position of the second gas port 42C or a direction in which the exhaust gas is sprayed from the second gas port 42C in the conveying direction Da by operating the movement unit 70 based on the temperature distribution.

[0048]

According to the above configuration, a position of the second gas port 42C in the conveying direction Da can be adjusted by the movement unit 70 or a direction in which the exhaust gas is sprayed from the second gas port 42C can be changed in the conveying direction Da. The movement control unit 60 adjusts (changes) the position of the second gas port 42C or the angle of the second gas port 42C with respect to the upper surface 10B of the furnace body 10 based on the temperature distribution in the processing space V. Therefore, when the temperature in the processing space V on the post-combustion stage 23 side becomes relatively high, the flame F can be moved toward the drying stage 21 side by moving the second gas port 42C toward the post-combustion stage 23 side or changing the direction in which the exhaust gas is sprayed from the second gas port 42C toward the post-combustion stage 23. Furthermore, when the temperature in the processing space V on the drying stage 21 side becomes relatively high, the flame F can be moved toward the post-combustion stage 23 side by moving the second gas port 42C toward the drying stage 21 side or changing the direction in which the exhaust gas is sprayed from the second gas port 42C toward the drying stage 21.

Thus, the temperature distribution in the processing space V is optimized and the

amounts of NO_x and unburned gas to be generated can be minimized.

[0049]

(7) In the stoker furnace 1 according to a seventh aspect, the gas circulation unit 4 further includes the third gas port 43 which is below the first gas port 41 and through which the exhaust gas is sprayed into the processing space V from the side opposite to the first gas port 41.

[0050]

According to the above configuration, in addition to the secondary flow of the exhaust gas sprayed from the first gas port 41, the flame F can be further moved toward the first gas port 41 side by a fluid force of the exhaust gas sprayed from the third gas port 43. Thus, the position in which the flame F is formed in the processing space V is optimized and the amounts of NO_x and unburned gas to be generated can be further reduced.

INDUSTRIAL APPLICABILITY

[0051]

The present invention relates to a stoker furnace as a device for incinerating waste. According to the present invention, it is possible to operate with higher efficiency by optimizing a position in which the flame is formed inside a furnace body.

Reference Symbols

[0052]

100 Incinerator system

1 Stoker furnace

2 Wind box

	3 Hopper
	4 Gas circulation unit
	6 Stoker
	7, 7B Boiler
5	8 Exhaust heat recovery boiler
	9 Temperature reducing tower
	10 Furnace body
	10A Upstream surface
	10B Upper surface
10	10C Downstream surface
	11 Dust collector
	12 Chimney
	13 Discharge chute
	20 Temperature detection unit
15	21 Drying stage
	22 Combustion stage
	23 Post-combustion stage
	31 Feeder
	41 First gas port
20	42, 42A, 42B, 42C Second gas port
	43 Third gas port
	50 Flow rate control unit
	60 Movement control unit
	70 Movement unit
25	B1, B2, B3 Blower

F Flame

L1 Primary air line

L2 Secondary air line

L3 Exhaust gas circulation line

5 O Center line (center axis)

V Processing space

CLAIMS

1. A stoker furnace, comprising:
 - a furnace body defining a processing space in which materials to be incinerated
 - 5 are conveyed in a conveying direction and which includes a combustion stage in which the materials to be incinerated are combusted;
 - a boiler which extends upward from the furnace body and discharges exhaust gas generated in the processing space; and
 - a first gas port through which a part of the exhaust gas is sprayed into the
 - 10 processing space,
 - wherein a center axis of the boiler is disposed at a position deviated and different from a position of the combustion stage in the conveying direction, and
 - the exhaust gas is sprayed above the flame formed in the processing space through the first gas port from a side located to be shifted in an opposite direction to a
 - 15 deviation direction of the boiler from the position of the combustion stage in the conveying direction.
2. The stoker furnace according to claim 1, wherein the center axis of the boiler is disposed deviated toward a post-combustion stage in the conveying direction, and
- 20 the first gas port is provided on a drying stage side of the furnace body and the exhaust gas is sprayed through the first gas port from the drying stage side toward the post-combustion stage side.
3. The stoker furnace according to claim 1, wherein the center axis of the boiler is
- 25 disposed deviated toward a drying stage side in the conveying direction, and

the first gas port is provided on a post-combustion stage side of the furnace body and the exhaust gas is sprayed through the first gas port from the post-combustion stage side toward the drying stage side.

- 5 4. The stoker furnace according to any one of claims 1 to 3, further comprising:
a second gas port through which a part of the exhaust gas is extracted and
sprayed into the processing space from above,
wherein the second gas port is provided at a position different from that of the
first gas port in a horizontal direction orthogonal to the conveying direction.

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5. The stoker furnace according to claim 4, further comprising:
a plurality of the second gas ports arranged at intervals in the conveying
direction;
a temperature detection unit which detects a temperature distribution in the
15 processing space; and

a flow rate control unit which changes a flow rate distribution of the exhaust gas
sprayed from each of the plurality of second gas ports based on the temperature
distribution.

- 20 6. The stoker furnace according to claim 4, further comprising:
a movement unit which moves the second gas port in the conveying direction;
a temperature detection unit which detects a temperature distribution in the
processing space; and

a movement control unit which changes a position of the second gas port or a
25 direction in which the exhaust gas is sprayed from the second gas port in the conveying

direction by operating the movement unit based on the temperature distribution.

7. The stoker furnace according to any one of claims 1 to 6, further comprising:

a third gas port which is below the first gas port and through which the exhaust

5 gas is sprayed into the processing space from a side opposite to the first gas port.