

INCINERATOR WITH A SMOKE TREATING DEVICE

Technical field

5 The present invention relates to an incinerator with a smoke treating device, and more particular, to an incinerator for burning paper articles.

Background

10 Nowadays, incinerators for burning and decomposing articles, such as rubbish etc., with combustion under high temperature are widely used in many applications of modern society. In view of increasingly strict requirements of each country on controlling environmental pollution, the incinerator usually includes a smoke-treating system for treating the smoke generated from burning, before being discharged into
15 the atmosphere. Especially for the incinerator used for burning paper articles, the requirements on the smoke treating system thereof are relatively stricter, because a large amount of dust and particles will be generated during burning.

 CN201391874Y discloses a paper-burning device, including a water curtain
20 spraying cavity, a filtering cavity and a smoke eliminating cavity. However, such a device, which mainly functions dependent on a water curtain spraying system, is inefficient on treating black smoke, especially that containing fine dust and particles.

 CN2576342Y discloses an electrostatic black smoke purifier used in a temple
25 incinerator, which includes a spray tower and a honeycomb-shaped electrostatic-smoke removing and black-smoke-water filtering device located thereafter. However, in this purifier, the smoke treated in the spray tower will carry a great amount of water spray, which will easily cause short-circuit failures for the honeycomb-shaped electrostatic-smoke removing and black-smoke-water filtering device with high
30 voltage when the water spray enters into the device.

CN 201680395U discloses a dust-removing equipment for treating high temperature black smoke in a bamako, mainly comprising a mechanical cooler, a Venturi dust remover, a cyclone plate dust-removing purifying column, a demister, an electrostatic ion purifier and a centrifugal fan, etc. Although the equipment may
5 improve the purifying capability to some extent, there still exists an instance that visible white smoke caused by condensed vapor due to an extremely low temperature in the smoke will be emitted from the equipment.

Therefore, there is a need to provide an improved incinerator, which can solve
10 the above-mentioned technical problems.

Summary

The present invention provides an incinerator, comprising a burning cavity and a
15 smoke treating device for receiving and treating the smoke generated from the burning cavity. The smoke treating device comprises an exhaust catalyst, a Venturi scrubber, a cyclone scrubber, a cyclone water remover, an electrostatic dust remover, and a draft fan, all of them being located along the flowing direction of the smoke in this order. Moreover, the smoke treating device further comprises a heat exchanger
20 with a hot cavity arranged between the exhaust catalyst and the Venturi scrubber and a cool cavity arranged between the draft fan and the discharging port of the smoke treating device.

In such an arrangement, the temperature of high-temperature smoke from the
25 burning cavity is firstly reduced in the hot cavity of the heat exchanger, so that the smoke flowing through each part downstream, such as the Venturi scrubber, the cyclone scrubber, the cyclone water remover, the electrostatic dust remover and the draft fan etc., is no longer in high temperature, and thus the chance of failures of these parts due to high temperature is reduced. Moreover, the temperature of the smoke is
30 elevated in the cool cavity of the heat exchanger before the smoke is discharged to the

atmosphere. Therefore, visible white smoke caused by condensed vapor due to the extremely low temperature of smoke can be avoided.

5 In one embodiment, the inlet of the hot cavity is arranged in the upper portion of the heat exchanger, and the inlet of the cool cavity is arranged in the lower portion of the heat exchanger. Preferably, the inlet of the hot cavity and that of the cool cavity are arranged along the diagonal line.

10 In one embodiment, the Venturi scrubber comprises a first segment with a fixed diameter, a second segment with a diameter being relatively gradually reduced, and a third segment with a diameter being suddenly increased up to the above-mentioned fixed diameter. At the upstream of the second segment of the Venturi scrubber, there is a nozzle arranged for spraying water.

15 In one embodiment, a circulating tank is arranged under the cyclone scrubber to receive the water drained from the cyclone scrubber for the reuse of water. Preferably, the cyclone water remover is provided above the cyclone scrubber and communicates therewith. Thereby, water from the cyclone water remover will spontaneously flow into the circulating tank by means of gravity, thus achieving the reuse of water.

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In one embodiment, the smoke treating device further comprises a bypass passage which connects to the burning cavity and directly communicates with the atmosphere. A valve that can be opened and closed is provided in the bypass passage. If the temperature in the burning cavity is extremely high, the valve will be opened so
25 that the smoke directly flows into the bypass passage.

In order to enhance the blending effect, a vane blender is arranged in the cyclone scrubber. Additionally, a vane-type spoiler may be arranged in the cyclone water remover.

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The electrostatic dust remover comprises an electrostatic generator and electrode plates, above which a nozzle for cleaning is provided.

5 The incinerator of the present invention is simple in structure, and can obtain a satisfactory effect in treating smoke. It is especially used for burning paper articles, such as joss paper etc.

Brief description of the drawings

10 In the following, embodiments of the present invention will be described in detail with reference to the accompanying drawings.

Fig. 1 schematically shows the structure of an incinerator according to the present invention.

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Detailed description of the invention

As shown in Fig. 1, the incinerator 100 according to the present invention includes a burning cavity 1. Articles to be incinerated, for example, those made of
20 papers, may be delivered into the burning cavity 1, where they are burned under a high temperature. In the burning cavity 1, a temperature sensor (not shown) may be provided to control the burning temperature. An ash cart 2 is arranged below the burning cavity 1, and is separated from the burning cavity 1 through a grid barrier. The ash cart 2 may be for example removable, so that it can be removed for cleaning
25 or replacement after it is full of ash.

The incinerator 100 according to the present invention further includes a smoke treating device, which will be described in detail below.

30 As shown in Fig. 1, the burning cavity 1 is connected to an exhaust passage 15 at

the top thereof. Under the low pressure generated from a draft fan 9 (will be described in detail below) which is arranged at the downstream of the exhaust passage 15, the high-temperature smoke and ash generated from the burning cavity 1 will flow into the exhaust passage 15. An exhaust catalyst 3, made from ceramic material and coated with a rare-earth layer, is placed in the exhaust passage 15. The exhaust catalyst 3 is mainly used for decomposing or absorbing carbon monoxide in the smoke. However, persons skilled in the art can understand that, it is also feasible for the exhaust catalyst 3 to decompose or absorb other components in the smoke through appropriately modifying the present invention. In order to increase the efficiency, the exhaust catalyst 3 is preferably made into a shape of honeycomb.

A heat exchanger 4 is provided at the downstream of the exhaust catalyst 3, wherein a plurality of thermal ducts divides the heat exchanger 4 into two parts, i.e., a hot cavity 17 and a cool cavity 18. Specifically, the hot cavity 17 occupies the space within the thermal ducts, and the cool cavity 18 occupies the space between the thermal ducts and the housing of the heat exchanger 4. The inlet of the hot cavity 17 is arranged in the upper part of the heat exchanger 4, and that of the cool cavity 18 is arranged in the lower part of the heat exchanger 4. Preferably, the inlet of the hot cavity 17 and that of the cool cavity 18 are arranged along a diagonal line.

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The smoke from the burning cavity 1 flows along the direction of the arrow in Fig. 1, and enters into the hot cavity 17 of the heat exchanger 4, where heat exchange occurs so that the temperature of the smoke is reduced. Thus, during the subsequent process the smoke is no longer under high temperature, which will be advantageous for extending the lifetime of each of subsequent components in the smoke treating device.

A Venturi scrubber 5 is provided at the downstream of the heat exchanger 4. The Venturi scrubber 5 is a substantially circular duct, comprising a first segment with a fixed diameter, a second segment with a diameter being relatively gradually reduced,

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and a third segment with a diameter being suddenly increased to the above-mentioned fixed diameter. For persons skilled in the art, it is easy to understand that the diameters of the second segment and the third segment may be varied as needed in actual applications. A nozzle (not shown) connecting with a pump 11 is provided at the upstream of the second segment. In this case, polluting components in the smoke will be sufficiently blended with the water sprayed from the nozzle. Thereby, the polluting components like the flying ash will be transferred from the smoke to water.

A cyclone scrubber 6 of a substantially cylinder with a nozzle placed therein is further provided at the downstream of the Venturi scrubber 5. A circulating tank 10 is placed under the cyclone scrubber 6. In this way, the water drained from the cyclone scrubber 6 will flow into the circulating tank 10, wherein the circulating tank 10 may include a sediment cavity and a clean-water cavity, which are separated by a water blocking plate and a sink. On the clean-water cavity there are a clean water inlet and a pump inlet, and on the sediment cavity there are a deposit outlet and a scum outlet. In addition, the circulating tank 10 are provided with two pumps 11, which respectively connect to the nozzle in the Venturi scrubber 5 and that in the cyclone scrubber 5, so as to pump the water from the circulating tank 10 to these nozzles, thus achieving the reuse of water.

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To improve the blending effect, a plurality of passive vane blenders, for example, may be provided in the cyclone scrubber 6.

At the downstream of the cyclone scrubber 6, there is a cyclone water remover 7, which can remove the water in the smoke by means of centrifugal force. To facilitate the water removal, a vane-type spoiler may be arranged in the cyclone water remover 7. The cyclone water remover 7 communicates with the cyclone scrubber 6, and is preferably placed above the cyclone scrubber 6. In this way, water from the cyclone water remover 7 will spontaneously flow into the cyclone scrubber 6 by means of gravity, and then into the circulating tank 10 for reuse.

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An electrostatic dust remover 8, comprising a high-voltage electrostatic generator and electrode plates, is arranged at the downstream of the cyclone water remover 7. Since the water in the smoke has been substantially removed in the cyclone water remover 7, it is the thus-obtained dry and clean smoke that flows into the electrostatic dust remover 8, thus increasing the efficiency of removing fine dusts. Additionally, since the water in the smoke has been substantially removed, the chances of short-circuit failure in the electrostatic dust remover 8 are therefore significantly reduced.

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In one embodiment, a nozzle for automatic cleaning, which connects with the pump 11, may be arranged above the electrode plates, so as to periodically clean the electrostatic dust remover 8.

15 The smoke treated by the static dust remover 8 enters into the cool cavity 18 of the heat exchanger 4, and then flows to the atmosphere via the outlet. The temperature of the smoke is increased at the cool cavity 18 of the heat exchanger 4 through heat exchange, thus avoiding the presence of visible white smoke caused by the condensed vapor due to the extremely low temperature.

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According to the present invention, a draft fan 9 is arranged at the upstream of the cool cavity 18 of the heat exchanger 4. Therefore, the fan 9 will not be exposed to the high-temperature smoke, and thus possibility of failures thereof is significantly reduced. Meanwhile, by selecting a proper operation level of the draft fan 9, it can be ensured that there is a sufficient air supply to the burning cavity 1, so as to reduce generation of the black smoke.

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According to one preferred embodiment, a bypass passage 20 directly communicating with the atmosphere is provided in the burning cavity 1, wherein a valve 12 is provided in the bypass passage 20. If the temperature in the burning cavity

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1 is extremely high, then the temperature sensor sends to a control unit (not shown) a signal, indicating to open the valve 12 and simultaneously stop the operation of the smoke treating device. At this moment, the smoke from the burning cavity 1 will be directly discharged into the atmosphere, so as to avoid the damage of the smoke
5 treating device due to the overheating.

The foregoing are only some preferred examples of the present invention, but not limits the scope of the present invention. Instead, those skilled in the art can, after reading the disclosure, make modifications, changes or omissions, which certainly fall
10 within the scope of the present invention. Therefore, the scope of the present invention should be defined by the claims.

Claims

1. An incinerator, comprising a burning cavity and a smoke treating device for receiving and treating the smoke generated from the burning cavity,

5 wherein said smoke treating device comprises an exhaust catalyst, a Venturi scrubber, a cyclone scrubber, a cyclone water remover, an electrostatic dust remover, and a draft fan, all of them being arranged along the flowing direction of the smoke in this order, and

 wherein said smoke treating device further comprises a heat exchanger with a hot
10 cavity arranged between the exhaust catalyst and the Venturi scrubber and a cool cavity arranged between the draft fan and the discharging port of the smoke treating device.

 2. The incinerator according to claim 1, wherein the inlet of said hot cavity is
15 arranged in the upper portion of said heat exchanger, and the inlet of the cool cavity is arranged in the lower portion of the heat exchanger, the inlet of the hot cavity and that of the cool cavity being arranged along the diagonal line.

 3. The incinerator according to claim 1 or 2, wherein said Venturi scrubber
20 comprises a first segment with a fixed diameter, a second segment with a diameter being relatively gradually reduced, and a third segment with a diameter being suddenly increased up to the above-mentioned fixed diameter, and at the upstream of the second segment of the Venturi scrubber there is a nozzle arranged for spraying water.

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 4. The incinerator according to claim 1 or 2, wherein a circulating tank is arranged under the cyclone scrubber to receive the water drained from the cyclone scrubber for the reuse of water.

30 5. The incinerator according to claim 4, wherein said cyclone water remover is

provided above the cyclone scrubber and communicates therewith.

6. The incinerator according to claim 1 or 2, wherein said smoke treating device further comprises a bypass passage which connects to the burning cavity and directly
5 communicates with the atmosphere, and a valve that can be opened and closed is provided in the bypass passage.

7. The incinerator according to claim 1 or 2, wherein a vane blender is arranged in said cyclone scrubber.
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8. The incinerator according to claim 1 or 2, wherein a vane-type spoiler may be arranged in the cyclone water remover.

9. The incinerator according to claim 1 or 2, wherein said electrostatic dust
15 remover comprises an electrostatic generator and electrode plates, above which a nozzle for cleaning is provided.

10. The incinerator according to claim 1 or 2, wherein said incinerator is used for burning paper articles.
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