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(54) **INCINERATION PLANT**

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Description

[0001] The present invention relates to an incineration plant for solid material (i.e. waste or biomass) having a combustion chamber in which the solid material is combusted and which is partly delimited by a front ceiling, a combustion grate with which the solid material and combusted solid material can be conveyed through the combustion chamber, a primary air supply below the top of the combustion grate, a first pass arranged above the combustion chamber, the combustion chamber and the first pass forming a transition region between the combustion chamber and the first pass such that a center flow arrangement is embodied. The incineration plant may also comprise a combustion material inlet through which solid material can be introduced, a feed shaft in which the solid material is introduced and which leads to the combustion chamber.

[0002] The combustion grate is usually arranged within a lower section of the combustion chamber. The solid material (i.e. waste) and combusted solid material can be conveyed by the combustion grate through the combustion chamber from an end of the combustion material feed shaft to a slag container. Primary air is supplied from below the combustion grate to the solid material arranged on the combustion grate, so that the solid material arranged on the combustion grate is combusted with the primary air. The main process steps on the grate (in the direction of travel of the solid waste) are: drying of the waste, devolatilization, combustion, afterburning of the solid residues (mainly ash and slag). The solid material and combusted solid material conveyed by the combustion grate is also referred to as solid material bed.

[0003] The combustion grate is preferably embodied as reciprocating grate, but it is also possible that the combustion grate is embodied in a different way, for example as vibrating grate, travelling grate or roller grate.

[0004] Additionally, nozzles may be arranged above the combustion grate within the combustion chamber and/or within the first pass, with which nozzle(s) secondary air, tertiary air for afterburning or an oxygen poor carrier gas can be provided to the combustion gases.

[0005] The first pass (in German: erster Zug) is to be understood that part of the incineration plant above the combustion grate, in which the combustion gases from the combustion chamber advance upwards, wherein secondary air, tertiary air for afterburning or other gases may be added to the combustion gases in the first pass.

[0006] Principally, three different designs of the arrangement of the first pass in relation to the combustion chamber can be distinguished in incineration plants with grate firing. The nomenclature derives from the flow direction of the flue gases/combustion gases in relation to the direction of travel of the solid material bed, namely: parallel flow (also called unidirectional current flow or co-current flow, in German: Gleichstromfeuerung), counter flow (also called countercurrent flow, in German: Gegenstromfeuerung) and center flow (also called medium cur-

rent flow, in German: Mittelstromfeuerung).

[0007] In a parallel flow arrangement (which is not covered by the present invention), primary combustion gases and waste are guided in a co-current flow through the combustion chamber. Accordingly, the transition region between the combustion chamber and the first pass is located at the end of the combustion grate. Only a comparatively low amount of energy is exchanged between the combustion gases and the waste on the grate. The advantage of parallel flow concepts is that the flue-gas has the longest residence time in the ignition area and that it must pass through the maximum temperature.

[0008] In case of a counter flow arrangement (which is also not covered by the present invention), primary combustion gases and waste are guided in a countercurrent flow arrangement through the combustion chamber and the transition region between the combustion chamber and the first pass is located at the front of the combustion grate. In this case, the hot flue-gases facilitate drying and ignition of the waste.

[0009] In case of a center-flow arrangement the transition region between the combustion chamber and the first pass is located above the middle of the combustion grate. With such an arrangement the composition of solid waste may vary considerably and thus a compromise for a wide feed value spectrum is given. Such a center flow arrangement is also characterized in that combustion gases from the first section of the solid material bed need to flow along the direction of travel of the combustion grate in order to flow into the first pass and that combustion gases from the last section of the solid material bed need to flow against the direction of travel of the solid material bed in order to flow into the first pass.

[0010] The present invention relates to these center-flow arrangements only. Accordingly, the present invention relates to incineration plants, in which the transition region between the combustion chamber and the first pass is located above the middle of the combustion grate.

[0011] In order that flue gases emerging from the solid material bed on the first section of the combustion grate (in which drying and eventually devolatilization occurs) the combustion chamber of a center-flow arrangement comprises a front (upper) ceiling, which is in particular horizontally oriented or inclined slightly upwards towards the first pass. This front ceiling is delimiting the combustion chamber at the beginning/front of the combustion chamber in the direction of travel of the solid waste. Accordingly, the front ceiling is arranged above a first section of the combustion grate in case of a center flow furnace.

[0012] In order that flue gases emerging from the combusted solid waste on the last section of the combustion grate (in which afterburning and cooling occurs) the combustion chamber of a center-flow arrangement usually comprises a rear (upper) ceiling, which is in particular inclined upwards towards the first pass. This rear ceiling is delimiting the combustion chamber at the end of the combustion chamber in the direction of travel of the solid

waste. Accordingly, the rear ceiling is arranged above a last section of the combustion grate in case of a center flow furnace.

[0013] In a preferred embodiment the transition region may embody a constriction, meaning that the cross section of the combustion chamber in a vertical direction decreases towards the constriction and that the cross section of the first pass increases in a vertical direction above the constriction.

[0014] At least one empty pass may be arranged downstream of the first pass extending vertically or horizontally, wherein the flue gases flow from the first pass through the at least one empty pass to a heat recovery steam generator.

[0015] A heat recovery steam generator downstream of the empty pass may be arranged (in sections) vertically and/or horizontally, wherein also an oblique orientation is possible.

[0016] The walls of the combustion chamber, the first pass, the empty pass(es) and the heat generator are usually equipped with heat exchangers (i.e. tubes), wherein the heat exchange medium of the heat exchangers is in particular provided to one common boiler drum. The walls of the combustion chamber are usually lined with refractory bricks, while the wall of the first pass is usually directly formed by tubes, wherein adjacent tubes are interconnected by metallic sheets (also called fins).

[0017] A flue gas purification device downstream of the heat recovery steam generator may comprise elements for dedusting, scrubbing and/or desulfurization (such as SCR or SNCR) of the flue gas. A chimney may be arranged downstream of the flue gas purification device.

[0018] An incineration plant with the above described features is known from WO2020187637A1. In such a center flow furnaces depositions on the walls of the first pass have to be elaborately removed. An incineration plant with the features according to the preamble of claim 1 is known from DE 196 48 639A1.

[0019] Accordingly, it is an object of the present invention to overcome the drawbacks of the prior art and in particular to provide an incineration plant, which needs to be maintained less regularly.

[0020] This object is achieved with an incineration plant according to the independent claim. Preferred embodiments of the incineration plant are disclosed in the subclaims and in the above and below description, wherein single features of the preferred embodiments can be combined with each other in a technical meaningful manner.

[0021] The object is in particular achieved with an incineration plant as described above, wherein a protrusion is embodied in the transition region, which extends downwards below the front ceiling.

[0022] It has been found that by such a protrusion the depositions on the wall of the first pass are reduced. It is believed that by the protrusion a vortex like flow of the flue gases/combustion gases from the drying/devolatilization area of the solid material bed of the combustion

grate is produced, so that these flue gases (which might comprise i.e. aerosols and other components, which are to be removed elaborately from the wall of the first pass after its deposition) do not directly flow into the first pass, but are deflected downwards towards the combustion grate. This way, the effort for removing depositions from the walls of the first pass can be reduced.

[0023] With other words, by having at least one protrusion in the transition region the combustion chamber is (virtually) divided in a vortex chamber at the front of the combustion chamber (viewed in the direction of travel of the solid waste) and a main combustion chamber, in which the combustion and afterburning occurs. Accordingly, the at least one protrusion is arranged in such a way in the transition region that flue gases from the first part of the combustion grate are forced in a downward oriented flow and preferable in a vortex flow.

[0024] The transition region is partly embodied by the combustion chamber and partly embodied by the first pass. Accordingly, the projection may be attached to or embodied by a wall section of the primary pass. But, preferably, the protrusion might be arranged at the front ceiling or may be part of the front ceiling. In any case the protrusion needs to extend downwards below the neighboring section of the front ceiling so that combustion gases/flue gases from the first section of the solid material bed are deflected downwards or even into a vortex like stream.

[0025] Principally, it would be sufficient, that there is one protrusion or that there are multiple protrusions arranged beside each other along the width of the primary combustion chamber. Preferably, there is exactly one protrusion, which extends over the whole width of the primary combustion chamber. This way a single (in cross sectional view) nose shaped deflection wall is formed, so that all flue gases from the first section of the combustion grate are deflected downwards.

[0026] In a preferred embodiment, the protrusion has its greatest cross section at its base near the front ceiling, while the cross section of the protrusion decreases to a tip of the protrusion.

[0027] As long as the protrusion extends downwards from the adjacent section of the front wall, the protrusion may also extend in the direction of travel of the combustion grate, so that the tip of the protrusion is arranged below a constriction of the transition region. Alternatively, the protrusion may also extend against the direction of travel of the combustion grate.

[0028] In order to supply secondary air or other process gases to the flue gases of the first section of the solid material bed, at least one nozzle may be arranged within the protrusion. If multiple protrusions are embodied, one nozzle may be arranged within each protrusion. Preferably, multiple nozzles are provided, which are arranged besides each other in the exactly one protrusion extending over the whole width of the primary combustion chamber. By injecting secondary air or other process gases a free-jet of the secondary air or of process gas is pro-

duced, which free-jet enhances the deflection of the flue gases induced by the protrusion. Depending on the injection parameters (for example cross section of the nozzle or pressure of the gas) of the free-jet the penetration depth of the free-jet may be set. The resulting free-jet decreases in velocity while its mass enhances by sucking in the surrounding flue gases.

[0029] The at least one nozzle may be oriented in such a way, that the resulting free-jet is oriented backwards towards a combustion chamber inlet (which inlet might be embodied by the outlet of the feed shaft to the combustion chamber). It is also possible that the nozzle is oriented in such a way that the resulting free-jet is oriented downwards. Nevertheless, the nozzle may be oriented in any direction in between, so that the free-jet has an angle between 0° and 90° to a vertical plane. Most preferably, the nozzle is oriented 40° to 50° in relation to the vertical plane.

[0030] For deflecting the flue gases downwardly efficiently, it has been found that the projection protrudes over the neighboring/adjacent parts of the front ceiling by at least 0,5 m, preferably by at least 1 m, which might depend on the size of the combustion chamber. In a relative relation the projection has such an extension downwards that the height of the primary combustion chamber (measured from the top of the combustion grate straightly upwards until the ceiling) along the direction of travel of the combustion grate is reduced by the protrusion by at least 10 %, preferable by at least 20 %. Accordingly, the height of the combustion chamber at the maximum extension of the protrusion is at least 10% less than the height of the combustion chamber in front of the protrusion.

[0031] The invention and the technical background will now be described with regard to the figure.

[0032] The figure depicts schematically a combustion chamber 1 and a first pass 4 of an incineration plant for waste. At the bottom of the combustion chamber 1 a combustion grate 2 is arranged, with which the waste can be conveyed from a combustion chamber inlet (on the left side of the figure) to a (not shown) slag container on the right lower side of the combustion chamber 1. Primary air is supplied from below the combustion grate 2 by a primary air supply 3. Secondary air can be supplied into the combustion chamber 1 by secondary nozzles 8. The front section of the combustion chamber 1 is delimited by a front ceiling 8.

[0033] The combustion chamber 1 and the first pass 4 define a transition region 5. The first pass 4 is arranged above the middle of the combustion grate 3, thereby embodying a center flow type incineration plant.

[0034] One protrusion 6 extending over the whole width of the combustion chamber 1 is formed in the transition region 5. The protrusion 6 extends downwards below the front ceiling 7, so that combustion gases from the solid material bed in the first section of the combustion chamber 1 are deflected downwards and eventually into a vortex flow. This way aerosols and other components

of the flue gas from the first section of the solid material bed on top of the combustion grate 3 are forced downwardly into the main combustion area of the combustion chamber 1. This way depositions on the walls of the first pass 4 are reduced.

Claims

1. Incineration plant for solid material having
 - a combustion chamber (1) in which the solid material is combusted and which is partly delimited by a front ceiling (7),
 - a combustion grate (2) with which the solid material and combusted solid material can be conveyed through the combustion chamber (1),
 - a primary air supply (3) below the top of the combustion grate (2),
 - a first pass (4) arranged above the combustion chamber (1), the combustion chamber (1) and the first pass (4) forming a transition region (5) between the combustion chamber (1) and the first pass (4) such that a center flow arrangement is embodied,

characterized in that

a protrusion (6) is embodied in the transition region (5) which extends downwards below the front ceiling (7).

2. Incineration plant according to claim 1, wherein the protrusion (6) extends over the whole width of the combustion chamber (1).
3. Incineration plant according to claim 1 or 2, wherein at least one nozzle (8) is arranged within the protrusion (6).
4. Incineration plant according to claim 3, wherein the at least one nozzle (8) is directed backwards towards a combustion chamber inlet.
5. Incineration plant according to claim 3 or 4, wherein the at least one nozzle (8) is directed downwards.
6. Incineration plant according to one of the preceding claims, wherein the protrusion (6) protrudes at least 0,5 m, preferably at least 1 m downwards from the adjacent part of the front ceiling (7).
7. Incineration plant according to one of the preceding claims, wherein the protrusion (6) has such an extension that the height of the combustion chamber (1) along the direction of travel of the combustion grate (2) is reduced by the protrusion by at least 10%.

Patentansprüche

1. Verbrennungsanlage für Feststoffe mit

- einer Brennkammer (1), in der der Feststoff verbrannt wird und die teilweise durch eine vordere Decke (7) begrenzt ist, 5
- einem Verbrennungsrost (2), mit dem der Feststoff und der verbrannte Feststoff durch die Brennkammer (1) befördert werden können, 10
- einer Primärluftzufuhr (3) unterhalb der Oberseite des Verbrennungsrostes (2),
- einem oberhalb der Brennkammer (1) angeordneten ersten Zug (4), wobei die Brennkammer (1) und der erste Zug (4) einen Übergangsbereich (5) zwischen der Brennkammer (1) und dem ersten Zug (4) bilden, so dass eine Mittenströmung ausgebildet ist, 15

dadurch gekennzeichnet, 20

dass in dem Übergangsbereich (5) ein Vorsprung (6) ausgebildet ist, der sich unterhalb der vorderen Decke (7) nach unten erstreckt.

2. Verbrennungsanlage nach Anspruch 1, wobei sich der Vorsprung (6) über die gesamte Breite der Brennkammer (1) erstreckt. 25

3. Verbrennungsanlage nach Anspruch 1 oder 2, wobei innerhalb des Vorsprungs (6) mindestens eine Düse (8) angeordnet ist. 30

4. Verbrennungsanlage nach Anspruch 3, wobei die mindestens eine Düse (8) nach hinten zu einem Brennkammereinlass gerichtet ist. 35

5. Verbrennungsanlage nach Anspruch 3 oder 4, wobei die mindestens eine Düse (8) nach unten gerichtet ist. 40

6. Verbrennungsanlage nach einem der vorhergehenden Ansprüche, wobei der Vorsprung (6) mindestens 0,5 m, vorzugsweise mindestens 1 m, von dem angrenzenden Teil der vorderen Decke (7) nach unten ragt. 45

7. Verbrennungsanlage nach einem der vorhergehenden Ansprüche, wobei der Vorsprung (6) eine solche Ausdehnung aufweist, dass die Höhe der Brennkammer (1) entlang der Laufrichtung des Verbrennungsrostes (2) durch den Vorsprung um mindestens 10 % verringert wird. 50

Revendications 55

1. Installation d'incinération de matériau solide ayant

- une chambre de combustion (1) dans laquelle le matériau solide est brûlé et qui est partiellement délimitée par un plafond avant (7),
- une grille de combustion (2) avec laquelle le matériau solide et le matériau solide brûlé peuvent être acheminés à travers la chambre de combustion (1),
- une alimentation en air primaire (3) au-dessous de la partie supérieure de la grille de combustion (2),
- un premier passage (4) agencé au-dessus de la chambre de combustion (1), la chambre de combustion (1) et le premier passage formant une région de transition (5) entre la chambre de combustion (1) et le premier passage (4) de telle sorte qu'un agencement de flux central est mis en oeuvre,

caractérisée en ce que

une saillie (6) est mise en oeuvre dans la région de transition (5) qui s'étend vers le bas au-dessous du plafond avant (7).

2. Installation d'incinération selon la revendication 1, dans laquelle la saillie (6) s'étend sur la largeur totale de la chambre de combustion (1).

3. Installation d'incinération selon la revendication 1 ou 2, dans laquelle au moins une buse (8) est agencée à l'intérieur de la saillie (6).

4. Installation d'incinération selon la revendication 3, dans laquelle au moins une buse (8) est dirigée vers l'arrière en direction d'une entrée de chambre de combustion.

5. Installation d'incinération selon la revendication 3 ou 4, dans laquelle l'au moins une buse (8) est dirigée vers le bas.

6. Installation d'incinération selon l'une quelconque des revendications précédentes, dans laquelle la saillie (6) fait saillie d'au moins 0,5 m, de préférence d'au moins 1 m vers le bas à partir de la partie adjacente du plafond avant (7).

7. Installation d'incinération selon l'une quelconque des revendications précédentes, dans laquelle la saillie (6) a une extension telle que la hauteur de la chambre de combustion (1) dans la direction de déplacement de la grille de combustion (2) est réduite par la saillie d'au moins 10 %.

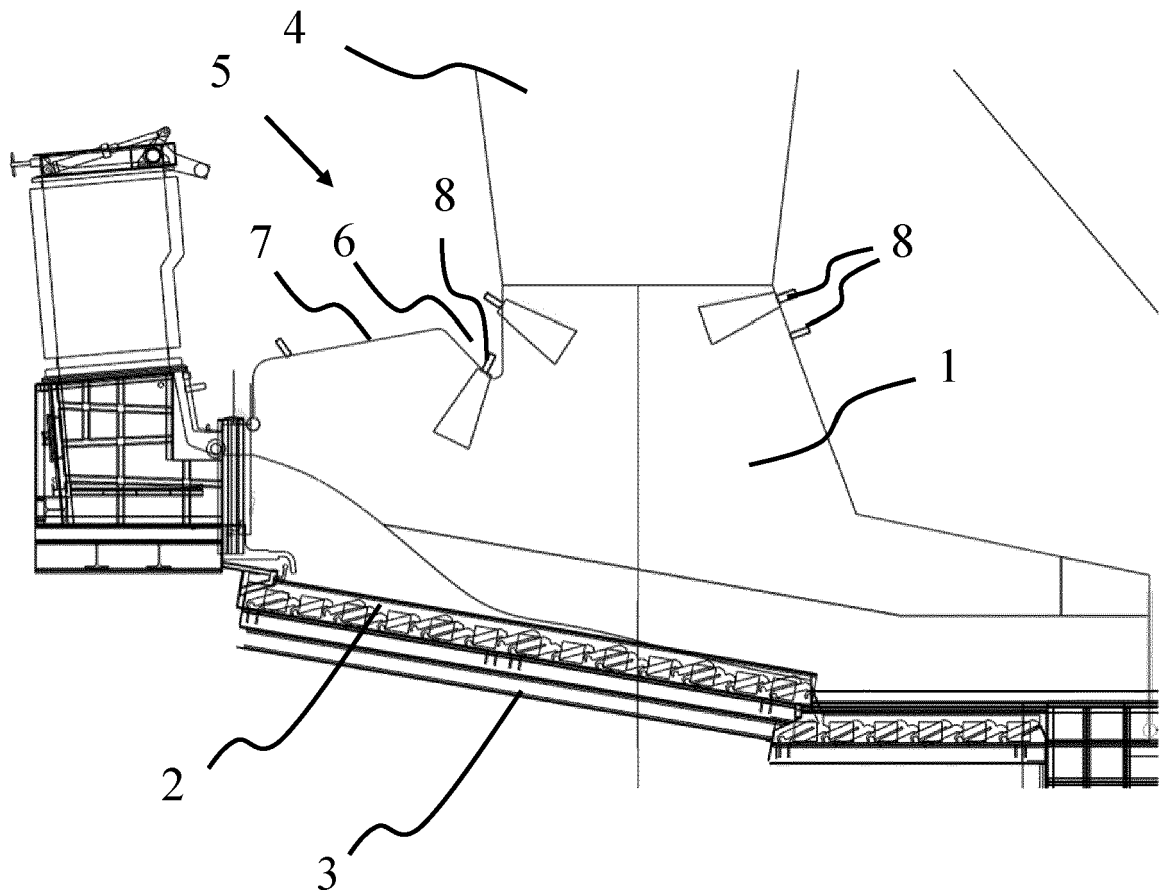


Fig. 1

REFERENCES CITED IN THE DESCRIPTION

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