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Amended claims in accordance with Rule 137(2) EPC.

(54) INCINERATION PLANT FOR SOLID MATERIAL

(57) The present invention relates to an incineration plant for solid material having
- a combustion material inlet (1) through which solid material can be introduced,
- a feed shaft (2) in which the solid material is introduced and which leads to
- a combustion chamber (3) in which the solid material is combusted,
- a combustion grate (4) with which the solid material and combusted solid material can be conveyed through the combustion chamber (3),
- a primary air supply (5) below the top of the combustion grate (4).

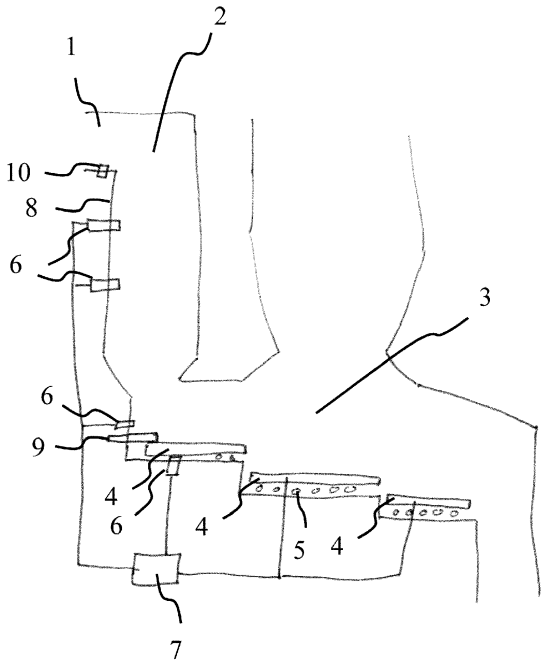

Fig. 1

EP 3 754 255 A1

Description

[0001] The present invention relates to an incineration plant for solid material such as waste or biomass, the incineration plant having 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 a combustion chamber in which the solid material is combusted, 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.

[0002] The combustion grate is usually arranged within a lower section of the combustion chamber. The solid material 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.

[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 or roller grate.

[0004] Additionally, nozzles may be arranged above the combustion grate with which secondary air, tertiary air for afterburning or an oxygen poor carrier gas can be provided to the combustion gases.

[0005] At least one empty pass may be arranged downstream of the combustion chamber extending vertically or horizontally, wherein the flue gases flow from the combustion chamber through the at least one empty pass to a heat recovery steam generator. In particular, two, three or more parallel empty passes may be embodied.

[0006] The 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.

[0007] The walls of the combustion chamber, 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.

[0008] 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.

[0009] In order to dry (dehumidify) the solid material prior to its combustion it is known to provide primary air and/or recirculation gases (German: Rezigas) to the solid material provided through the combustion material inlet. If primary air is used to dry the solid material, the oxygen comprised in the primary air may have undesired effects for the following combustion.

[0010] In view of this, it is an object of the present invention to provide an incineration plant and a method for operating an incineration plant, with which the drying (dehumidifying) of the solid material can be enhanced.

[0011] This object is achieved by an incineration plant and by a method for operating the incineration plant with the features of the respective independent claims. Preferred embodiments of the invention are described in the sub claims and in the whole description, wherein single features of the preferred embodiments can be combined with each other in a technically meaningful manner.

[0012] The object is achieved in particular in that a dehumidifying medium supply is embodied with which a dehumidifying medium can be supplied to the solid material prior to the combustion, and in that the dehumidifying medium supply is connected to a source of superheated steam.

[0013] The object is also achieved by a method for operating an incineration plant, in particular for operating an inventive incineration plant, comprising the following steps:

- Introducing solid material through a combustion material inlet into a feed shaft,
- Guiding the solid material through the feed shaft to a combustion chamber,
- Combusting the solid material in the combustion chamber,
- Conveying the solid material and combusted solid material on a combustion grate through the combustion chamber,
- Dehumidifying the solid material prior to the combustion by supplying superheated steam to the solid material.

[0014] With other word, the invention suggests that superheated (water) steam is used to dehumidify (dry) the solid material introduced through the combustion material inlet. The superheated steam has a temperature between 101°C and 500°C at a pressure of 1 bar. As the superheated steam has a comparatively high diffusion coefficient regarding the provided solid material (i.e. waste or biomass), a highly effective dehumidifying/drying of the solid material is possible without providing oxygen or other gases influencing the following combustion.

[0015] The superheated steam is provided at one or multiple locations in such a way that the superheated steam contacts the solid material prior to its combustion.

[0016] For example, the dehumidifying medium supply may be arranged at least partly within a wall of the feed shaft, so that the superheated steam is provided directly into the feed shaft, so that the solid material which advances through the feed shaft is directly contacted with the superheated steam. In particular, the superheated steam may be provided at multiple locations along the feed shaft. Also, the superheated steam may be provided from one or more sides of the feed shaft. Accordingly, the multiple dehumidifying medium supplies are arranged above each other and/or on different side walls of the feed shaft.

[0017] Additionally or alternatively, the superheated steam is provided at the end/bottom of the preferably vertically arranged feed shaft, so that the provided superheated steam is provided in a kind of counter flow to the solid material introduced into the feed shaft. This way the heat transfer yield is enhanced. In particular, the superheated steam is provided near (in particular above or below) a pusher at the bottom/end of the feed shaft, which is arranged next to the combustion grate. Such a pusher is usually arranged in such a way, that the solid material guided through the feed shaft can be pushed onto the combustion grate.

[0018] It is also possible that the superheated steam is provided from below a first section and/or a second section of the combustion grate, wherein the dehumidifying medium supply below the first and/or second section of the combustion grate is preferably also arranged below the feed shaft. This way the solid material already arranged on the combustion grate can be (further) dehumidified, wherein the excess superheated steam is further used for dehumidifying within the feed shaft.

[0019] The dehumidifying medium supply may be embodied as pipe with one or multiple outlet(s) through which the superheated steam is supplied. The pipe is at least indirectly connected to the source for the superheated steam. The outlet(s) may be embodied as nozzle in order to provide a desired flow behavior of the provided superheated steam.

[0020] In particular, in case of an air (gas) cooled combustion grate the source of superheated steam may be a steam turbine, from which at least slightly overheated steam is withdrawn (German: Abzapfdampf). Alternatively, the air cooled combustion grate may be connected to a heat exchanger so that the air heated in the combustion grate is used for heating/superheated water/steam.

[0021] In case the combustion grate is water cooled (cooling medium) the thermal energy absorbed by the water within the combustion grate may be used to provide/produce the superheated steam preferably directly. Alternatively, the thermal energy of the cooling medium may be provided to a superheater (heat exchanger) in order to heat/superheat the water/steam to be used to dehumidify the solid material.

[0022] In order to control the amount of superheated steam in an open loop or closed loop manner (German: Steuern oder Regeln) it is suggested that at least one sensor for measuring the humidity of the solid material is embodied. For example, a sensor may be arranged at the combustion material inlet in order to measure the initial humidity of the provided solid material. Alternatively or additionally, a sensor may be arranged at the end/bottom of the feed shaft in order to measure the humidity of the solid material at the front of the combustion grate. Preferably, the difference between a first humidity at a first location and a second humidity at a second location is used in order to control the amount of provided superheated steam.

[0023] In particular, a control unit is provided in order to operate the incineration plant according to the suggested method.

[0024] The invention and the technical background are explained with regard to the figure, which schematically shows an incineration plant.

[0025] The incineration plant for waste (as the to be combusted solid material) comprises a material inlet 1, a feed shaft 2 guiding the provided waste to a combustion chamber 3. At the bottom of the combustion chamber 3 a combustion grate 4 is arranged, with which the solid material and combusted solid material can be conveyed from the bottom of the feed shaft 2 to an outlet. For combusting the solid material on top of the combustion grate 4 primary air supplies 5 are arranged below the combustion grate 4. Additionally, a pusher 9 is arranged below the feed shaft 2, wherein the pusher 9 is used to push the solid material onto the combustion grate 4.

[0026] The combustion grate 4 is water cooled and connected to a source 7 of superheated steam. The superheated steam generated with the thermal energy derived from the combustion grate 4 is provided to dehumidifying medium supplies 6, which are arranged in a wall 8 of the feed shaft 2, above the pusher 9 and below a first section of the combustion grate 4. By providing superheated steam to the waste (solid material) prior to its combustion the waste is effectively dehumidified.

[0027] Additionally, a sensor 10 is arranged at the material inlet 1, with which the humidity of the provided waste can be measured. It is also possible that an additional sensor is arranged below the feed shaft 2, so that a difference between the humidity of the provided waste and the dehumidified waste prior to its combustion can be measured in order to control the amount of superheated steam to be supplied at least indirectly into the feed shaft 2.

Reference sings

[0028]

1	material inlet
2	feed shaft
3	combustion chamber
4	combustion grate
5	primary air supply
6	dehumidifying medium supply
7	source of superheated steam
8	wall
9	pusher
10	sensor

Claims

1. Incineration plant for solid material having

- a combustion material inlet (1) through which solid material can be introduced,

- a feed shaft (2) in which the solid material is introduced and which leads to
- a combustion chamber (3) in which the solid material is combusted,
- a combustion grate (4) with which the solid material and combusted solid material can be conveyed through the combustion chamber (3),
- a primary air supply (5) below the top of the combustion grate (4),

characterized in that
at least one dehumidifying medium supply (6) is embodied with which a dehumidifying medium can be supplied to the solid material prior to the combustion, and **in that** the dehumidifying medium supply (6) is connected to a source (7) of superheated steam.

2. Incineration plant according to claim 1, wherein the dehumidifying medium supply (6) is arranged within a wall (8) of the feed shaft (2).

3. Incineration plant according to claim 1 and 2, wherein the dehumidifying supply (6) is arranged below or above a pusher (9) below the feed shaft (2).

4. Incineration plant according to one of the preceding claims, wherein the dehumidifying medium supply (6) is arranged below the combustion grate (4) in an area below the feed shaft (2).

5. Incineration plant according to one of the preceding claims, wherein the combustion grate (4) comprises a cooling arrangement, wherein the cooling arrangement is connected to the source (7) of the superheated steam.

6. Incineration plant according to claim 5, wherein a heat exchanger is embodied to produce the superheated steam.

7. Incineration plant according to one of the preceding claims, wherein at least one sensor (10) for measuring the humidity of the solid material is embodied.

8. Method for operating an incineration plant, comprising the following steps:

- Introducing solid material through a combustion material inlet (1) into a feed shaft (2),
- Guiding the solid material through the feed shaft (2) to a combustion chamber (3),
- Combusting the solid material in the combustion chamber (3),
- Conveying the solid material and combusted solid material on a combustion grate (4) through the combustion chamber (3),
- Dehumidifying the solid material prior to the combustion by supplying superheated steam to the solid material.

9. Method according to claim 8, wherein the superheated steam is supplied into the feed shaft (2).

10. Method according to one of the preceding claims, wherein the superheated steam is supplied from below or from above a pusher (9) below the feed shaft (2).

11. Method according to one of the preceding claims, wherein the superheated steam is supplied from beneath the combustion grate (4) in an area below the feed shaft (2).

12. Method according to one of the preceding claims, wherein the combustion grate (4) is cooled by a cooling medium and wherein the thermal energy absorbed by the cooling medium within the combustion grate (4) is used to provide the superheated steam.

13. Method according to one of the preceding claims, wherein the humidity of the solid material is measured and the measured humidity is used to control the supply of superheated steam.

14. Method according one of the preceding claims, wherein the supplied superheated steam has a temperature between 101° C and 500° C.

Amended claims in accordance with Rule 137(2) EPC.

1. Incineration plant for solid material having

- a combustion material inlet (1) through which solid material can be introduced,
- a feed shaft (2) in which the solid material is introduced and which leads to
- a combustion chamber (3) in which the solid material is combusted,
- a combustion grate (4) with which the solid material and combusted solid material can be conveyed through the combustion chamber (3),
- a primary air supply (5) below the top of the combustion grate (4),
- at least one dehumidifying medium supply (6) is embodied with which a dehumidifying medium can be supplied to the solid material prior to the combustion,

characterized in that
the incineration plant comprises a source (7) of superheated steam and **in that** the dehumidifying medium supply (6) is connected to the source (7) of superheated steam.

2. Incineration plant according to claim 1, wherein the dehumidifying medium supply (6) is arranged within a wall (8) of the feed shaft (2).

3. Incineration plant according to claim 1 and 2, wherein the dehumidifying supply (6) is arranged below or above a pusher (9) below the feed shaft (2).

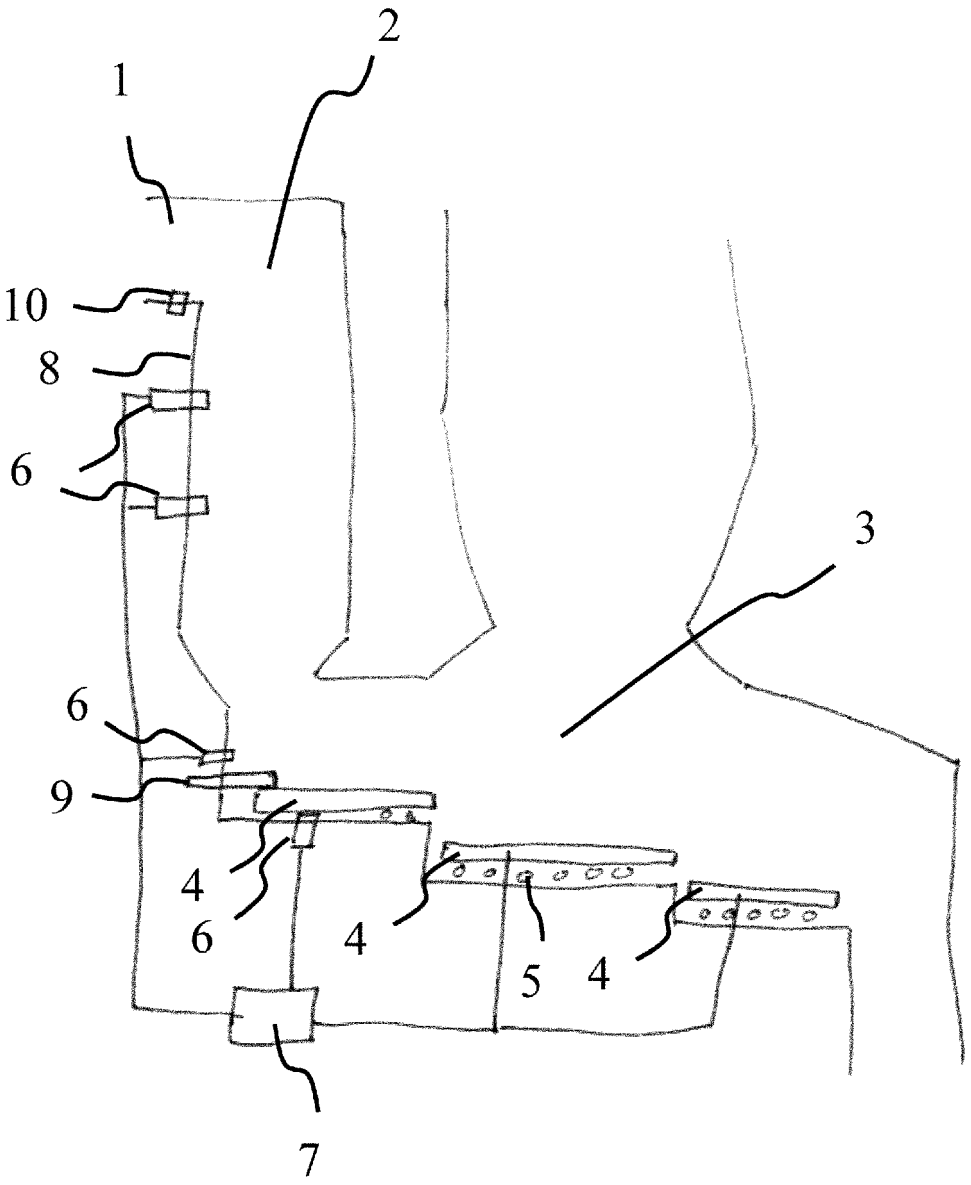

Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 19 18 0989

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 1 417 423 A (VON ROLL AG) 12 November 1965 (1965-11-12) * page 3, line 4 - page 5, line 15 * * figures 1, 2 * -----	1,2,4,7	INV. F23G5/05 F23H3/02 F23L1/02
A	FR 2 962 190 A1 (LUCAS JEAN MARIE GABRIEL CHARLES [FR]) 6 January 2012 (2012-01-06) * page 5, line 167 - page 8, line 240 * * figure 1 * -----	1-14	
A	WO 2009/038103 A1 (BIOMASS ENERGY CORP [JP]; SAKAI MASAYASU [JP]; YOKOI TADASHI [JP]) 26 March 2009 (2009-03-26) * figures 1-5 and the appurtenant passage of the description * -----	1-14	

TECHNICAL FIELDS SEARCHED (IPC)

F23G
F23H
F23L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 November 2019	Rudolf, Andreas

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82