Method for incinerating waste and apparatus for carrying out a method of such kind

[01] The invention relates to a method for incinerating waste on a combustion grate of a furnace and an apparatus for carrying out a method of such kind.

[02] A notable feature of waste incineration plants is that only low concentrations of CO_2 are present in the waste gases. This is advantageous in one respect. On the other hand, the separation of the residual CO_2 is complex and cost-intensive, as relatively large quantities of gas have to be treated. These large volumes of flue gas require the use of sophisticated flue gas treatment plants, for which components for separating carbon dioxide are not normally cost-effective.

[03] The oxygen enrichment of the primary combustion air described in the prior art does result in a reduction in the quantity of flue gas. But the enrichment of the combustion air is limited, as the substitution of atmospheric oxygen with pure oxygen due to the increased adiabatic combustion temperature constitutes a high thermal load for the plant. Moreover, regulation is difficult because allowance must be made for the delayed reaction of the entire plant to a change in the oxygen supply.

[04] The object underlying the invention is therefore to further develop a method for incinerating waste in such a manner that the separation of the CO_2 in the flue gas is simplified. An apparatus for carrying out a method for incinerating waste on a combustion grate of a furnace is also to be developed further.

[05] This object is solved with a method having the features of Claim 1 and an apparatus having the features of Claim 12.

[06] The method according to the invention provides that when waste is incinerated on a combustion grate of a furnace, oxygen is added to the combustion with a carrier gas as an oxygen-carrier gas mixture, and the carrier gas is recirculated gas from the

furnace with a CO_2 concentration from 10 to 99%. Accordingly, an oxygen-carrier gas mixture is added to the incineration, and in this oxygen-carrier gas mixture the carrier gas itself contains a carrier gas mixture that includes 10 to 95% CO_2. The consequence of this is that ultimately oxygen is supplied to the incineration with CO_2 and possibly with other gases. The effect of this is that the concentration of CO_2 in the waste gas of the incineration plant increases and it becomes easier to regulate the plant by means of the supplied gases.

[07] The consequence of this is that due to the higher concentration of CO2 in the waste gas the it becomes easier to separate the CO_2 from the waste gas. In addition, the quantities of flue gas are reduced, since the carrier gas is extracted from the flue gas. The combustion temperatures can also remain in a permissible range for the components.

[08] DE 102 13 788 B4 and DE 102 13 790 already describe waste incineration plants with combustion regulation that includes oxygen enrichment of the primary combustion air up to 25 vol% to 40 vol%.

[09] In this context, the oxygen enrichment of the primary air is used to improve the quality of the slag by raising the temperatures in the combustion bed due to the higher oxygen component, thereby sintering the slag. It was thus possible to achieve better binding of the harmful substances.

[10] However, methods of such kind are complicated from both the regulation and process engineering perspectives, and the improved slag quality often does not justify the expense.

[11] For the purpose of the method according to the invention, it is advantageous if the oxygen-carrier gas mixture is added with an oxygen concentration from 5 to 40% and preferably from 16 to 40%. This means that more than half of the oxygen-carrier gas mixture is carrier gas.

[12] The oxygen and in particular the oxygen-carrier gas mixture may be supplied to both the primary combustion and the secondary combustion, and it is therefore suggested that at least a fraction of the oxygen be added to the primary combustion and/or the secondary combustion.

[13] Since the concentration of CO_2 in the gas recirculated from the furnace is at a level from 10 to 99%, the carrier gas contains yet another gas fraction, which is preferably air and in particular atmospheric air. The recirculated gas can contain an extremely high quantity of CO_2, and the CO_2 gas from the separation can have a degree of purity from 80 to 99% CO_2. Before the recirculated gas is added to the combustion, it may be adjusted to the needs of the operation, and mixed with air for example. This makes it possible to adjust the CO_2 content individually. In practice, the gas added to the furnace may contain between 30 and 84% CO_2. This makes it possible to maintain a minimum O_2 content of 16%, in order to keep the combustion going.

[14] A particularly preferred variant provides that the recirculated gas is extracted from the furnace after the waste gas has undergone treatment.

[15] It is particularly advantageous if the recirculated gas is supplied to the primary combustion.

[16] In order to influence the incineration on the combustion grate, and preferably to regulate it as well, it is suggested that the concentration of gas fractions in the oxygen-carrier gas mixture be varied.

[17] If the combustion grate has multiple zones, the concentration of the gas fractions in the oxygen-carrier gas mixture in the zones may be varied in order to influence the incineration on the combustion grate. The concentration of the gas fractions in the oxygen-carrier mixture is preferably varied even in the zones, in order to regulate the incineration on the combustion grate.

[18] The method according to the invention makes it possible to supply at least a part of the waste gas from the furnace to a post-processing step, in which the CO_2 is separated.

[19] The apparatus according to the invention provides that recirculation gas feed lines with a port for recirculation gas and/or oxygen feed lines with a port for oxygen and/or an air line with a port for air are arranged underneath the combustion grate. This makes it possible to combine recirculation gas and/or oxygen and/or air or also to introduce them to the incineration separately immediately below the combustion grate.

[20] It is also advantageous if an incineration plant of such kind has at least one secondary air feed above the combustion grate, which includes a port for air and/or recirculation gas, a valve and a secondary air nozzle in the flow direction, wherein an oxygen feed line with a port for oxygen is arranged between the valve and the secondary air nozzle.

[21] This makes it possible to supply recirculation gas and/or oxygen and/or air as the primary combustion gas and/or as the secondary combustion gas depending on the requirements profile.

[22] In the long term, this makes it possible to supply oxygen from hydrogen production to the incineration plant, and to simplify the separation of CO_2 in the flue gas by increased the CO_2 content and reducing the nitrogen fraction in the flue gas.

[23] An exemplary embodiment is represented in the drawing and will be explained in greater detail in the following text. In the drawing

Fig. 1 is a schematic cross-sectional representation of an incineration plant, and

Fig. 2 is a diagram of the plant and the material flows.

[24] The furnace shown in Figure 1 has a combustion grate 2, to which primary air feed lines 3 to 6 lead. These primary air feed lines 3 to 6 lead to individual zones 7 to 10

of the combustion grate 2. Besides the primary air feed lines 3 to 6, recirculation gas feed lines 11 to 14 are located under the combustion grate 2. The primary air feed lines 3 to 6 have a port 15 for primary air, the recirculation gas feed lines 11 to 14 have a port 16 for recirculation gas, and the oxygen feed lines 17 to 20 have a port 21 for oxygen.

[25] Valves 22 to 24 (numbered for exemplary purposes only) in the primary air feed lines 3 to 6, in the recirculation gas feed lines 11 to 14 and in the oxygen feed lines 17 to 20 make it possible to supply different gases to the combustion grate 2, tuned highly selectively to the individual zones 7 to 10.

[26] Above the combustion grate 2, the waste gas flue 25 is furnished with secondary air feed lines 26 to 29, which have a separate or common port 30, 31 for air and/or recirculation gas. Each secondary air feed line includes a valve 32 to 35 to allow the supply of air and/or recirculation gas to be adjusted or regulated. The air and/or the recirculation gas are fed in controlled manner via valves 32 to 35 to secondary air nozzles 36 to 39, via which the secondary air reaches the waste gas flue 25. Oxygen feed lines 40 to 43 are arranged between each of the valves 32 to 35 and the secondary air nozzles 36 to 39, and each feed line has a port 44, 45 for oxygen.

[27] In this way, secondary air in the waste gas flue 25 can also be supplied as air and/or recirculation gas via the nozzles 36 to 39.

[28] When the furnace 1 is in use, waste 46 is incinerated on the combustion grate 2, and during the incineration oxygen is forwarded to the combustion grate 2 via lines 17 to 20 and oxygen is forwarded to the waste gas flue 25 via lines 40 to 43. This oxygen is supplied together with recirculation gas, which can be added via ports 16, 30 and 31.

[29] Figure 2 is a schematic representation of the method according to the invention. Fuel 50 is supplied to the furnace 1, and the flue gases 51 are forwarded to heat recovery 52 and from there to waste gas purification 53. From waste gas purification 53, the waste gas 51 passes to post-treatment 54, in which CO_2 can be separated. After the post-treatment 54, at least a portion of the waste gas is returned to the furnace 1. Waste gas

streams 55 and 56 from waste gas purification 53 or from heat recovery 52 may be fed to this waste gas stream from post-processing 54 for firing 51. A feed line 57 for air and a feed line 58 for oxygen are also provided.

Claims:

1. Method for incinerating waste (46) on a combustion grate (2) of a furnace (1), in which oxygen is added to the combustion with a carrier gas as an oxygen-carrier gas mixture, ***characterized in that*** the carrier gas is recirculated gas from the furnace (1) with a CO_2 concentration from 10 to 99%.

2. Method according to Claim 1, ***characterized in that*** the oxygen-carrier gas mixture is supplied with an oxygen concentration from 5 to 40% and preferably from 16 to 40%.

3. Method according to any one of the preceding claims, ***characterized in that*** at least some of the oxygen is supplied to the primary combustion.

4. Method according to any one of the preceding claims, ***characterized in that*** at least some of the oxygen is supplied to the secondary combustion.

5. Method according to any one of the preceding claims, ***characterized in that*** the carrier gas contains air, in particular atmospheric air.

6. Method according to any one of the preceding claims, ***characterized in that*** the recirculated gas is extracted from the furnace (1) after a treatment of the waste gas (51).

7. Method according to any one of the preceding claims, ***characterized in that*** the recirculated gas is fed to the primary combustion.

8. Method according to any one of the preceding claims, ***characterized in that*** the concentration of the gas fractions in the oxygen-carrier gas mixture is varied in order to influence the incineration on the combustion grate (2).

9. Method according to any one of the preceding claims, ***characterized in that*** the combustion grate (2) has multiple zones (7 to 10), and the concentration of the

gas fractions in the oxygen-carrier gas mixture is varied in the zones (7 to 10) in order to influence the incineration on the combustion grate (2).

10. Method according to any one of the preceding claims, ***characterized in that*** the combustion grate (2) has multiple zones (7 to 10), and the concentration of the gas fractions in the oxygen-carrier gas mixture is varied in the zones (7 to 10) in order to regulate the incineration on the combustion grate (2).

11. Method according to any one of the preceding claims, ***characterized in that*** at least some of the waste gas (51) from the furnace (1) is fed to post-processing (54), in which CO_2 is separated.

12. Apparatus for carrying out a method according to any one of the preceding claims, including a furnace (1) with a combustion grate (2), which is equipped with primary air feed lines (3 to 6) to individual zones (7 to 10) of the combustion grate (2), ***characterized in that*** recirculation gas feed lines (11 to 14) with a port (16) for recirculation gas and oxygen feed lines (17 to 20) with a port (21) for oxygen are arranged underneath the combustion grate (2).

13. Apparatus, in particular according to Claim 12, having at least one secondary air feed line (26 to 29) above the combustion grate (2), ***characterized in that*** the secondary air feed line (26 bis 29) has a port (30, 31) for air and/or recirculation gas, a valve (32 to 35) and a secondary air nozzle (36 to 39) in the flow direction, and an oxygen feed line (40 to 43) with a port (44, 45) for oxygen is arranged between the valve (32 to 35) and the secondary air nozzle (36 to 39).

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