Abstract:
The present invention relates to a treatment for reactivating light ashes, obtained from the combustion of fossil fuels or from the co-combustion therewith of CDR or biomasses inside dust phase boilers. The light ashes conveyed by the combustion fumes and kept by electrostatic precipitators or by baghouse filters are extracted therefrom and sent to the integrated system allowing the reactivation thereof with respect to the post-combustion, before being made to recirculate in the combustion chamber through the boiler burners. Said reactivation treatment of the ashes is obtained by making them to transit inside an accumulation system in contact with air at a suitable temperature and for a determined time period, so as to obtain the chemisorption of the oxygen available in the gaseous current by the carbon of the unburnt portion. The integrated system allows reducing the percentage of unburnt matter in the light ashes and transforming them from waste into raw material which can be re-used in the cement and concrete industry.
INTEGRATED SYSTEM FOR REACTIVATING AND RECIRCULATING LIGHT ASHES WITH HIGH UNBURNT MATTER CONTENT

DESCRIPTION

Field of the invention

The present invention relates to an apparatus and to a method for treating ashes, particularly suitable to be used for light ashes obtained from the combustion of fossil fuels or from the co-combustion therewith of CDR or biomasses inside dust phase boilers, for example in energy production plants and the like.

Background of the invention

The laws in force regulating the use of light ashes in the cement and concrete production impose limits on the granulometry thereof and on their percentage content of unburnt matter. The limit values are determined and imposed in order not to alter the features of the obtained final product.

For producing cement, it is necessary to draw on the wealth of natural resources, above all limestone and pozzolan, which are obtained from special pits. The limestone and pozzolan, mixed to other mineral components, are burnt in the ovens of the cement works, to obtain the cement clinker which, properly ground, becomes real cement.

The production of one ton of clinker produces about one ton of CO2. The light ashes of good quality, that is with a percentage of unburnt matter lower than 5% in weight, can be added to the cement clinker until a percentage of 30%. Millions of tons of CO2 can be saved each year by performing this replacement.

The percentage of unburnt matter present in the light ashes produced inside the boilers with solid fuel can vary very much according to the type of used fuel, to the presence of co-combustion with bio-masses and/or CDR and to the combustion system as a whole. When the unburnt matter content of light ashes exceeds the allowed limit, they cannot be re-used and are destined to the waste dump, with huge handling costs and non-advantage for the environment.
The problem of the unburnt matter in the ashes has emphasized particularly upon adopting the so-called "low-Nox" combustion strategies. Under such conditions, processes of thermal deactivation of the carbon residue take place, determined by the exposure to high temperatures. In fact, such exposure to high temperatures under slightly oxidizing conditions, if not even reducing conditions, represents a condition which fosters hardening processes of carbon residues and a consequent thermal deactivation.

A possible answer to the problem of the unburnt matter in the ashes is represented by the processes for re-combusting a portion of light ashes by means of the direct recirculation thereof in the combustion chamber. However, studies related to the re-combustion of the percentage of unburnt matter in the both light and heavy ash demonstrate that the tout-court re-combustion processes reveal to be only marginally effective, as the thermal deactivation of the carbon residue makes the residual reactivity of the same extremely reduced during the re-combustion phase.

**Summary of the invention**

Therefore, the technical problem placed and solved by the present invention is to provide an apparatus and method for treating light ashes allowing to obviate the drawbacks mentioned above with reference to the known art and in particular allowing a substantial reduction in the level of unburnt matter present therein in an effective way but with low costs, thus allowing a subsequent important re-use of the ashes themselves for industrial purposes and in particular in the cement and concrete production.

Such problem is solved by an apparatus according to claim 1 and by a method according to claim 22.

Preferred features of the present invention are present in the claims depending from the same.

The present invention provides some important advantages. The main advantage consists in the fact that it succeeds in overcoming the drawbacks of
the known art processes mentioned above as it allows an important reactivation of the light ashes and therefore a wide conversion of the carbon contained therein into a subsequent re-entering the boiler.

In particular, the invention obtains:

- a drastic reduction in the unburnt matter content in the light ashes, thus by increasing the quality thereof and by transforming them from waste into re-selling product, with huge gain on behalf of the handling company of the original plant (for example an electric plant) even in terms of non-put to waste dump;

- environmental advantages deriving from the conversion of waste destined to the discharge into raw material which can be used in the cement and concrete industry and consequent saving of CO2 released into the environment in the production process of the cement itself.

The invention results to be particularly advantageous if associated to the recirculating system illustrated in WO 2006/005574, herein incorporated by means of this reference, by succeeding in this case to obtain as unique product of the combustion only light ash of high quality.

By summarizing the detailed description of preferred embodiments shown hereinafter, a system for reactivating the unburnt matter existing in the light ashes and for recirculating the same in the combustion chamber to end the process of oxidizing the so-activated carbon is provided.

The proposed used system is mainly constituted by:

- a system for collecting the light ashes outletting from the apparatuses for treating combustion fumes before the expulsion of the same to the flue - in presence of electrostatic precipitators for treating the combustion fumes, said recovery system is connected exclusively to the separator fields which have ashes with a higher unburnt matter content;

- a possible concentration apparatus for concentrating the ashes with higher
unburnt matter content, particularly advantageous if there are mechanical filtration systems for treating the combustion fumes;

- a device/apparatus for reactivating the ashes - depending upon the fact the reactivation process takes place continuously or discontinuously, said apparatus can consist of

  - a metallic conveyor enclosed in a metallic hermetic container, on the conveyor belt thereof the fluid or fixed bed is formed or
  - a storage tank with the same function;

- means for feeding hot air to the reactivation device/apparatus and means for sucking from the latter and for treating the so-sucked air;

- a possible duct connecting between the reactivation device/apparatus and the fume duct for the disposal of the air downstream of the reactivation process;

- a system for conveying the treated ash to the combustion chamber;

- an adjusting and control system, able to guarantee that the operations take place automatically, as it will be described hereinafter in the operation description portion.

Other advantages, features and application modes of the present invention will result evident from the following detailed description of some embodiments, shown by way of example and not for limitative purposes. The figures of the enclosed drawings will be referred to, wherein:

- figure 1 shows a schematic representation of a configuration of a plant incorporating a first preferred embodiment of the reactivation apparatus according to the present invention, by referring in particular to a plant equipped with electrofilters;

- figure 2 shows an embodiment variant with respect to the configuration of figure 1, wherein a preventive treatment for concentrating the ashes with
high unburnt matter content is provided;

- figure 3 shows a schematic representation of a configuration of a plant incorporating a second preferred embodiment of the reactivation apparatus according to the present invention, also in this case by referring to a plant equipped with electrofilter; and

- figure 4 shows an additional schematic representation of a configuration of a plant incorporating the embodiment variant of the reactivation apparatus of figure 2, by referring in particular to a plant equipped with baghouse filters.

By referring at first to figure 1, an apparatus for reactivating light ashes aimed at recirculating the same in the combustion chamber which has generated them in order to reduce the whole unburnt matter content of said ashes is designated as a whole with 1.

Such apparatus 1 is represented and will be described as integrated in a plant 100 for producing energy, for example a power plant, based upon the combustion of fossil fuels and/or upon the co-combustion therewith of CDR or biomasses.

In known way, the plant 100 comprises the above-mentioned combustion chamber, designated with 101 and constituted, for example, by a boiler of dust phase type.

Still in known way, the boiler 101 is connected to an air/fume exchanger 102 with separated environments, aimed at cooling the second ones and bearing in particular a fume side 104 and a corresponding cooling air side 103.

Still in known way, the exchanger 102 is connected, on the fume side 104, to a filtration system 105 aimed at eliminating from the flow the fumes of the volatile ashes entrained therefrom. In the present example, such filtration system is of electrostatic precipitation type and it has seven outlet stage, one thereof designated by way of example with 106.

Part of light ashes outletting from the filtration stages of the device 105, and in
particular those fallen onto the first three stages, are fed, by means of an ash conveying line 108 of the plant 100, known too, to a device 107 for storing the light ashes.

By sake of simplicity, the additional (known) units of the plant 100 - for example the fume outlet flue - have not been represented and they will be not further described.

Still by referring to figure 1 and following the flow of collecting, reactivating and recirculating the light ashes, the apparatus 1 of the present embodiment first of all comprises means for collecting the light ashes which have deposited in the last four stages of the electrostatic precipitator 105. In the present example such collecting means provides then four dedicated collecting lines, one for each stage and designated with the reference numbers 210-240, respectively.

The system of the present embodiment is then configured as a deviation on the main line 108 for conveying the light ashes outletting from the combustion chamber at the stages of the electrostatic precipitator, the ashes thereof typically have a high unburnt matter content. As it is known, in fact, the last stages of the precipitator have ashes with this feature. In any way, in general terms a collection and analysis of the ashes of each stage during planning allow detecting in simple way and with certainty, case by case, which stages or fields of the electrostatic precipitator have to be connected to the above-mentioned collecting lines.

By turning to the description of the present embodiment example, the above-mentioned dedicated collecting lines 210-240 converge to a common line 2, the latter in communication with means for feeding conveying air, generally designated with 3. Based upon a preferred embodiment, it is possible connecting the line 2 to the above-mentioned main recovery line 108 of the plant 100, by using the pushing force thereof, both under positive pressure or under sucking by means of dedicated exhauster, as schematically designated in figure 1.
The common line 2, in turn, converges to an additional line 4 for conveying ashes which has, both upstream and downstream of the flow of the line 2 with respect to the direction of the main flow of the ashes extracted from the precipitator 105, first and second means for adjusting and/or cutting off the flow rate, respectively designated with 41 and 42. In particular, the conveying line 4 is connected at a first end next to the first adjusting and/or cutting-off means 41 to the main conveying line 108 of the light ashes of the plant 100 which flows into the storage device 107. The other end of the line 4, downstream of the flow of the line 2 and of the second adjusting and/or cutting-off means 42, on the contrary is connected to the inlet of a device for separating the ashes 5, for example of cyclone type, apt to separate the conveying air current from the ashes and to feed said air, by means of an outlet line 6, preferably equipped too with adjusting and/o cutting-off means 61, to the main conveying line 108 of the plant 100.

The device 5 of course has then an additional outlet feeding the remaining ashes, by means of an additional line 7 and in case by means of interposing a system 71 for dosing/feeding, for example a rotocell, to a reactivation device of the fluid or fixed bed type designated as a whole with 8. Advantageously, the feeding of the ashes to the device 8 can take place continuously.

In the present embodiment, the reactivation device 8 comprises a conveyor belt 81 whereupon said fluid or fixed bed is implemented and which preferably has a plurality of through slots. The belt 81 is enclosed in a casing 83 having a plurality of side openings 82, connected to means for feeding reactivation hot air 9 whereabout it will be spoken shortly, and one or more openings 84 on the upper portion, connected to means for extracting the reactivation air 18 whereabout it will be spoken later.

The belt 81 can be implemented according to the teaching of EP 0 252 967 or of EP 0 931 981, herein incorporated too by means of this reference.

The device 8 is associated to the above-mentioned means for feeding
reactivation hot air, designated as a whole with 9 and having a plurality of lines for feeding said hot air, arranged below the belt 81 and each one corresponding to a side opening 82 of the related casing 83. In the present example said lines are six, they are designated with the reference numerals 11-16, respectively, and preferably they have each one respective means for cutting off and/or adjusting the flow rate (one thereof designated by way of example with 121).

Preferably, the air fed by means 9 is at temperature comprised in a range of about 300-500 °C. Such air can be collected from the outer environment and be brought at the wished temperature of in a specific exchanger, not illustrated in the present example, and then sent to the device 8 in case by means of a fan designated with 10. Preferably, where possible, the hot air necessary at the inlet of the device 8 is collected by the line of the pre-heated combustion air outletting the air/fume exchanger 102.

The whole arrangement is so that the hot air fed by the lines 11-16 crosses transversally the ash layer lying on the belt 81 passing through the dedicated slots of the latter and thus implementing a fixed or fluid bed according to the crossing speed of the ash layer.

The apparatus 1 and/or the device 8 preferably incorporate a system for controlling the residence time of the ashes on the belt 81. Alternatively, such residence time is determined in advance by the specific prearrangement of the portions.

A far as the general operating principles of the reactivation device 8 are concerned, it is to be noted as follows.

The technology underlying the invention is the combustion development by means of a sequence of elementary stages. In the simpler formulation of a half-detailed kinetic scheme of the carbon combustion, the elementary processes related to the following reactions have to be taken into consideration:
(i) \( \text{Cf} + O_2 \rightarrow \text{C(O)} \)

(reaction of formation of oxidised surface complexes of carbon by the effect of the chemical adsorption of the atmospherical oxygen)

(ii) \( \text{C(O)} + O_2 \rightarrow \text{CO}, \text{CO}_2 + \text{C(O)} \)

(exchange reaction of oxidised surface complexes), and

(iii) \( \text{C(O)} \rightarrow \text{CO}, \text{CO}_2 + \text{Cf} \)

(reaction of desorption of the surface oxides with formation of CO and CO2).

The desorption process of the oxidised surface complexes of the reaction (iii) is slow at moderate temperatures, to become extremely fast at high temperatures, characteristic of carbon combustion systems.

The reactivation treatment which takes place in the device 8 fosters the chemisorption of the oxygen available in the gaseous current by the unburnt carbon, according to the reaction (i). Such chemisorption, once obtained, remains stable. In such way the unburnt carbon, if it should find at the temperature conditions typical of the combustion chamber, would burn with the same initial reactivity, according to reactions (ii) and (iii), in order to complete the oxidising process of the so-activated carbon.

Therefore, the concept underlying the invention is to make a pre-oxidation of the fraction of volatile ashes with higher unburnt matter content, before re-entering the combustion chamber, with the purpose of re-entering the latter ashes containing already widely oxidised carbon. The pre-oxidation can take place effectively with relatively fast kinetics already at temperatures in the order of 300-500 °C in a dedicated apparatus like indeed the device 8. The re-entering the boiler of so pre-conditioned ashes makes much quicker the kinetics for converting the carbon into ash as one starts from a more widely pre-oxidised char.

By proceeding in this way, the difficulty of making the process of formation of oxidised surface complexes of the carbon to take place in the boiler is
overcome, difficulty linked to the fact that the residence times available for the ashes in crossing the flame region are very limited.

Going back to the description of the specific embodiment example considered herein, it will be appreciated that the position of the hot air inlets on the casing 83 and the pressure delta implemented between the lower and upper area with respect to the conveyor belt 81 allow the air transit through the belt itself and the ash layer, improving the air/ash contact and increasing the oxygen chemisorption efficiency.

A system for extracting the reactivation air which has crossed the ash layer on the conveyor belt 81 is associated to the device 8 too. Such extraction device, designated as a whole with 18, in turn can be associated to sucking means 201 provided on an air sucking line 20. Between the means 18 and the line 20 a dedusting device 19 can be interposed, in case connected, for the disposal of the ashes separated by the air flow, to the above-mentioned line 7 inletting the device 8.

Even on each one of the last lines introduces herein, and in particular the line 20 and the tracts interposed between the device 18 and the deduster 19 and between this one and the line 7, corresponding means for cutting off and/or adjusting the flow rate can be provided.

From the sucking line 20, the extracted air can be fed to the fume duct of the plant 100 in order to be expelled through the flue, or fed directly into the atmosphere or even be sent to the air case of the plant 100 for the inlet in the combustion chamber 101.

The reactivation device 8 has a main discharge place 85, preferably with hopper and arranged at the end of the belt 81, downstream of the flow of ashes, which converges on an outlet line 21.

The line 21 can have means for cutting off and/or adjusting the flow rate, for example a rotocell 23 in case water cooled to improve the performances.
thereof. At last, the outlet line 21 converges on a final conveying line 24 which feeds the reactivated ashes to the combustion chamber 101, preferably at the level of the intermediate burner plane and typically by means of a pneumatic conveying. Naturally, also this latter line 24 can have respective means for cutting off and/or adjusting the related flow rate.

The above-mentioned choice of the place for inleting the reactivated ashes in the combustion chamber is dictated by the need of allowing an adequate residence time in the latter allowing to complete the oxidation of the pretreated unburnt matter, before the entrainment made by the combustion fumes for the lighter particles and before falling by gravity onto the boiler bottom for those particles which escape from the entrainment of the combustion fumes.

The embodiment of figure 3 differs from the one just described for the different construction of the reactivation device, herein designated with 80. Such device 80 comprises a storage tank implementing the above-mentioned fluid or fixed bed of ashes by means of the reactivation air current. The device 80 typically works discontinuously. Means for feeding reactivation hot air 9 and in case means for implementing the necessary pushing force, for example pressing fans 10, for inletting such air, wholly analogous to those already illustrated, are associated to the device 80.

The device 80 provides an upper air outlet in communication with a possible dedusting device 19, according to modes substantially analogous to those already described by referring to the first embodiment.

The device 80 further provides a lower ash outlet on an outlet line 211 analogous to the already described line 21.

The embodiment of figure 2 differs instead from the one of figure 1 for the presence of a classifying/separating device 25 interposed between the already introduced device 5 and the inlet to the reactivation device 8 and downstream thereof the powder outlet of the already introduced dedusting device 19 converges.
The separating device 25 is associated to an ash outlet line with low unburnt matter content 26, in case equipped with means for adjusting/cutting off the related flow rate and preferably connected to the main conveying line 108 of the plant 100.

The presence of the separating device 25 is particularly important even when the main plant 100 has a filtering system of mechanical type, for example a baghouse filter, instead of an electrostatic precipitator.

In fact, as already above reminded, it is known that in the electrostatic precipitators a selection of ashes with high unburnt matter content, which are found in the last fields with respect to the running direction of the fumes, can already be determined, being the ash resistivity proportional to the percentage of the contained unburnt matter. In the filters wherein the captation takes place instead mechanically, this separation is not found and the unburnt matter results to be diluted on the total flow rate of the captated ash. In case of mechanical filtering systems it results then advisable providing a concentration phase of the higher ash fraction of unburnt matter. In this way the flow rate of ash to be reactivated at a higher unburnt matter percentage, allowing to optimize the dimensioning of the reactivation and recirculation system in the boiler.

Figure 4 refers to such different plant configuration, wherein such baghouse filter is designated with 109. In this case, an ash feeding from each one of the outlet stages of the baghouse filter 109 itself is provided, which in the represented example are four and designated with the reference numbers 110-113, respectively. Still in the represented example, four dedicated collecting lines are then provided, respectively designated with the reference numbers 30-33.

The device 25 makes a suitable classification of the ash with higher unburnt matter content, to avoid the treatment of huge flow rates of light ash. Such device 25 can be of thboelectric, aeraulic or equivalent type allowing to select
the ash flow to be reactivated, by separating it from that to be sent to the storage silo 107.

As already mentioned previously, in all embodiments considered herein an adjusting and controlling system could be provided, able to guarantee that the operations are carried out automatically.

At this point it will be better appreciated that the invention provides, according to the embodiments illustrated above, an apparatus for recovering, activating and recirculating in the combustion chamber light ashes captated by the system for treating the fumes.

It will be appreciated that, being the reactivation air flow rate comparable to the flow rate of the ash to be treated and however reduced, both the choice of how handling the reactivation air downstream of the latter and wherefrom it is to be collected depends exclusively upon the plant easiness requirements. Furthermore, thanks to the few oxygen quantities necessary to the reactivation of the unburnt matter, the reactivation air current can even be vitiated and with thermal waste resulted from the process, which makes the proposed application a little expensive in terms of investments and additional operating costs.

It will be even understood that the ash reactivation not necessarily takes place by means of the extraction thereof from the system for filtering the combustion fumes, but in principle in any stage subsequent to the extraction thereof from the combustion environment and before the possible re-entering therein for completing the combustion, such as for example downstream of the silo for collecting light ashes.

Furthermore, the ash conveying can even be of mechanical, instead pneumatical, type, for example a mechanical conveying of the ashes, both outletting from the systems for treating the fumes and partially as far as the combustion chamber can be provided.

At last, it will be understood that the invention object is also a reactivation
method preferably implemented in correspondence to the operating modes of the apparatus and of the plant described above and defined in the following claims.

The present invention has been so far described by referring to preferred embodiments. It is to be meant that other embodiments could exist belonging to the same inventive core, as defined by the protection scope of the claims reported hereinafter.
CLAIMS

1. A reactivation apparatus (1) with respect to the combustion of light ashes entrained by a stream of combustion fumes or anyhow extracted from a combustion environment, which light ashes are of the type produced, for instance, in the combustion chamber (101) of an energy production plant (100), which apparatus (1) comprises:

- means (21-24) for collecting said light ashes;
- a reactivation device (8; 80), forming a fluid or fixed bed of ash; and
- means (9, 10, 11-16) for feeding hot reactivation air through said ash bed,

the overall arrangement being such as to allow, within said reactivation device (8), a reaction of formation of oxidised surface complexes of Carbon contained in the ashes, by effect of chemical adsorption thereby of Oxygen present in the reactivation air, thus facilitating a subsequent completion of combustion in the combustion environment.

2. The apparatus (1) according to claim 1, wherein said reactivation device (8) comprises a conveyor belt (81) onto which said fluid or fixed bed is created.

3. The apparatus (1) according to the preceding claim, wherein said conveyor belt (81) has a plurality of slots apt to foster transit of reactivation air fed by said feeding means (9, 10, 11-16) through the ash bed lying thereon.

4. The apparatus (1) according to claim 2 or 3, wherein said conveyor belt (81) has a casing (83).

5. The apparatus (1) according to claim 1, wherein said reactivation device (80) comprises a storage tank in which said fluid or fixed bed is formed.

6. The apparatus (1) according to any one of the preceding claims, comprising means for cutting off and/or adjusting the flow rate of ash inlet to said reactivation device (8; 80).

7. The apparatus (1) according to any one of the preceding claims, wherein said means (9, 10, 11-16) for feeding hot reactivation air comprises a plurality
of lines (11-16) for feeding reactivation air.

8. The apparatus (1) according to any one of the preceding claims, wherein said means (9, 10, 11-16) for feeding hot reactivation air comprises means for in-line heating of air to a predetermined temperature, preferably comprised in a range of about 300-500 °C.

9. The apparatus (1) according to any one of the preceding claims, comprising means for connecting said reactivation air feeding means (9, 11-16) with an air/fumes exchanger (102) of the main energy production plant (100) for the collecting of combustion air downstream of said exchanger (102).

10. The apparatus (1) according to any one of the preceding claims, wherein said means (210-240, 2, 4) for collecting light ashes is connected or connectible to a filtration system (105) of the energy production plant (100).

11. The apparatus (1) according to any one of the preceding claims, further comprising means (25) for separating the fraction of ashes having a higher unburnt matter content, arranged upstream of said reactivation device (8; 80).

12. The apparatus (1) according to any one of the preceding claims, comprising an air-assisted conveying system (2, 4) for air-conveying light ashes to be reactivated to said reactivation device (8; 80).

13. The apparatus (1) according to the preceding claim, comprising means (5) for dedusting the conveying air and means (6) for re-feeding the dedusted conveying air to a conveying system (108) of the main plant (100).

14. The apparatus (1) according to any one of the preceding claims, comprising means (21, 24; 211) for feeding the reactivated ashes outlet from said reactivation device (8; 80) to the combustion chamber (101) of the energy production plant (100).

15. Energy production plant (100), for instance a power plant or part thereof, comprising a reactivation apparatus (1) for the reactivation of light ashes according to any one of the preceding claims.

16. The plant (100) according to the preceding claim, comprising a filtration
system (105; 109) connected to said means (210-240, 4; 30-33) for collecting light ashes of said reactivation apparatus (1).

17. The plant (100) according to the preceding claim, wherein said filtration system (105) is of electrostatic type, preferably of electrostatic precipitation type.

18. The plant (100) according to claim 16, wherein said filtration system (109) is of mechanical type, preferably of baghouse filter type.

19. The plant (1) according to any one of the claims 16 to 18, comprising an air/fumes exchanger (102) connected to said means (9, 11-16) for feeding reactivation air of said reactivation apparatus (1).

20. The plant (1) according to any one of the claims 16 to 19, comprising a combustion chamber (101) connected to means (21, 24) for feeding the reactivated ashes outlet from said reactivation device (8; 80).

21. The plant (100) according to any one of the claims 16 to 20, comprising means (21, 24) for feeding the reactivated ashes outlet from said reactivation device (8; 80) to the intermediate burner plane of the combustion chamber (101).

22. A reactivation method with respect to the combustion of light ashes entrained by a stream of combustion fumes or anyhow extracted from a combustion environment, which light ashes are of the type produced for instance in the combustion chamber (101) of an energy production plant (100), which method provides the arranging of said ashes in the form of a fluid or fixed bed, and the feeding through the latter of hot reactivation air, so as to allow a reaction of formation of oxidised surface complexes of Carbon contained in the ashes, by effect of the chemical adsorption thereby of Oxygen present in the reactivation air, thus facilitating a subsequent completion of the combustion in the combustion environment.

23. The method according to claim 22, providing the option of cutting off and/or adjusting the flow rate of ashes forming said fluid or fixed bed.
24. The method according to claim 22 or 23, providing a heating of reactivation air to a predetermined temperature, preferably comprised in a range of about 300-500 °C.

25. The method according to any one of the claims 22 to 24, providing the collecting of said reactivation air downstream of the air/fumes exchanger (102) of the main energy production plant (100).

26. The method according to any one of the claims 22 to 25, wherein the ashes to be reactivated are collected from a filtration system (105) of the energy production plant (100).

27. The method according to any one of the claims 22 to 26, providing, upstream of the actual reactivation step, a stage of separation of the fraction of ashes having higher unburnt matter content.

28. The method according to any one of the claims 22 to 28, providing an air-assisted conveying of light ashes to be reactivated.

29. The method according to the preceding claim, providing a stage of conveying air dedusting and a re-feeding of the dedusted air to the main energy production plant (100, 107).

30. The method according to any one of the claims 22 to 29, providing the utilization of a pre-existing air-assisted conveying system (108) in the plant (100) for ash collecting and conveying.

31. The method according to any one of the claims 22 to 30, providing a mechanical conveying of light ashes to be reactivated.

32. The method according to any one of the claims 22 to 31, providing a feeding of the reactivated ashes to the combustion chamber (101) of the energy production plant (100).

33. The method according to the preceding claim, wherein the reactivated ashes are fed to the intermediate burner plane of the combustion chamber (101).
34. The method according to any one of the claims 22 to 33, providing the use of an apparatus according to any one of the claims 1 to 14 and/or of a plant according to any one of the claims 15 to 21.