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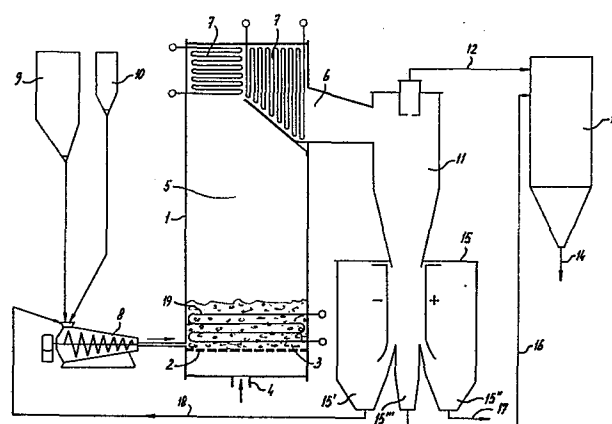
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54 Method and apparatus for fluidized bed combustion of a fuel.

57 Air (4) is passed through a bed (3) of particulate material for fluidizing the bed (3) and for providing combustion air for the fuel, whereafter air together with the combustion gases and particles entrained in said gases pass through a room (5) above the bed to an exhaust (6), and subsequently the solid particles are separated from the air-combustion gases flow by passing the gas flow from the exhaust (6) into a cyclone (11) in which the solid particles are separated and the carbon particles and/or particles containing carbon are electrically charged by friction whereafter said particles are passed through an electrostatic separator (15) so that the carbon particles and/or particles containing carbon drop off the separator (15) at the side of the one electrode and the ash particles at the other side, whereafter first mentioned particles are returned into the bed (3).



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Method and apparatus for fluidized bed combustion of a fuel.

The invention relates to a method for fluidized bed combustion of a fuel in which air is passed through a bed of particulate material consisting at least partially of particles of the fuel, which material is supplied through a supply means, and which air serves as well for fluidizing the bed as for providing combustion air for the fuel, whereafter air together with the combustion gases and said particles entrained in said gases pass through a room above the bed to an exhaust and subsequently the solid particles are separated from the air-combustion gases flow and the solid particles are returned in the bed.

The application of a fluidised bed has been recognized already for a long time as an attractive means for generating heat. The bed of particulate material comprises mostly a mixture of an inert material, a combustible material such as bituminous coal having a high sulphur content and an absorbent material for absorbing the sulphur which is liberated as a result of the combustion of the fuel. As a result of passing air through the bed the bed is fluidized whereby the combustion of the fuel is promoted. The advantages of said method are i.a. an outstanding heat transfer, a substantially uniform bed-temperature, a combustion at a relative low temperature, easy handling of the combustible materials, a decreased attack of and formation of deposits in the boiler, a decrease of the dimensions of said boiler and an improved control of the emission of environmental polluting substances.

The velocity of the air passed through the bed must be sufficiently great for keeping the bed in a fluidized state. As a result a portion of the particulate bed material is entrained by the air which flows through

the bed, which entrained material contains among other things particles of the unburned fuel and of the material for bonding the sulphur which have not yet absorbed sulphur compounds.

- 5 Up till now all entrained particles after having been separated from the flow of combustion gases are returned in the bed by means of some back stoker equipment to improve the efficiency as the entrained particles comprise a considerable quantity of unburned carbon
- 10 particles as appears from the following table.

	fraction d50 μm	% by weight	%C by weight
clothfilter-ash	30	25,6	7,4
	40	18,7	7,7
	60	13,4	5,0
	80	12,9	3,3
	130	29,4	1,5
cyclone ash	250	16,2	1,4
	150	16,5	3,4
	80	14,6	5,1
	45	34,5	13,2
	20	18,2	8,4

Thereby mass-flows are attained which are larger by a factor 3 than the coal supply so that by the continuous returning in the bed of such a large cold flow of matter the combustion in the bed is unfavourably
5 affected.

The object of the invention is to provide a method of the type mentioned herein above which does not have said disadvantages.

This object is obtained in that in the method
10 according to the invention besides the separation of the particles from the air-combustion gases flow also carbon particles and/or particles containing carbon are separated from ash particles and the first mentioned particles are exclusively returned into the bed.

15 The carbon particles and/or particles containing carbon are separated from the ash particles for instance by means of wind-sifting or by high gradient magnetic separation with air as fluid or in a slurry.

However, preferably an electrostatic separation is
20 applied in which the gas flow from the exhaust is passed into a cyclone in which the solid particles are separated and the carbon particles and/or particles containing carbon are electrically charged by friction whereafter said particles are passed through an electrostatic separator so
25 that the carbon particles and/or particles containing carbon drop off the separator at the side of the one electrode and the ash particles at the other side whereafter the first mentioned particles are returned into the bed.

30 In this way a reduced quantity of material to be carried back into the bed is obtained so that advantageously the separated carbon particles may be carried in the original fuel feeding system and therewith into the bed so that substantially no back stoking system
35 is necessary.

However when a separate back stoking system is

used then the system may be much smaller having a reduced number of back stoking points.

In particular in the method according to the invention no so called cold spots are formed in the bed
5 because no large inert masses are carried back into the bed. Moreover in the material carried back the carbon content is constant in conditions of equilibrium so that the operation can be controlled on the basis of the carbon content. Further in the method according to the invention
10 the ash handling is faster and better in equilibrium.

The invention relates also to an apparatus for carrying out the method comprising a housing having at least one support for the bed of particulate material mounted therein, means for feeding a particulate material
15 into the bed and means for passing air through said bed, a room above the bed and at least one discharge which opens in the top portion of said room and which is in communication with a cyclone for separating the solid particles from the gass flow from the discharge, in which
20 according to the invention the solid particles discharge of the cyclone is in communication with a separator for separating carbon particles and/or particles containing carbon from ash particles and the collector means for the first mentioned particles of this device is in connection
25 with the bed.

Preferably the cyclone is a cyclone of which the interior is coated with a material by which the carbon particles and/or particles containing carbon are electrically charged by friction and of which the discharge
30 for the solid particles is in communication with an electrostatic separator.

Advantageously the collector means for the carbon particles and/or particles containing carbon of the separator is in communication with the means for feeding
35 the particulate material into the bed.

The invention is described in more detail by

referring to the drawing in which an apparatus for carrying out the method is schematically shown.

As shown in the drawing the apparatus comprises a fire chamber 1 in which a support 2 pervious to air for the fluidized bed 3 of a particulate material is mounted. Said bed 3 is fluidized in that air is supplied through the combustion air inlet 4 which air flows through the support 2 into the bed 3. Above the bed 3 an open room the so called free board is provided through which the gases from the bed 3 pass which gases are permitted to leave the fire chamber 1 through the outlet 6 said gases flowing through cooling sections 7.

The particulate material in the bed 3 is replenished by means of the metering device 8 which is fed by the coal hopper 9 and the lime stone hopper 10.

The gases flowing from the outlet 6 and containing solid particles entrained from the bed 3 are passed into the cyclone 11 in which the solid particles are separated and fall downwardly whereas the gases leave the cyclone through conduit 12 and are passed to the filter 13 for cleaning said gases the dust particles caught in the filter 13 leaving the filter through discharge 14.

The carbon particles and/or particles containing carbon are also electrically charged by friction in the cyclone 11 so that in the electrostatic separator 15 provided downstream of the cyclone 11 said charged particles are attracted by the electrode at the one side of the separator 15 and arrive in collector room 15' whereas the ash particles fall into the collector room 15'' and compound particles containing relatively little carbon and uncharged particles arrive into collector room 15''' from which said particles are carried to filter 13 through conduit 16 whereas the ash particles are discharged through conduit 17. The carbon particles and/or particles containing carbon are carried back through conduit 18 from the collector room 15' to the metering device 8 and through

said device into the bed 3.

In the bed 3 a heat exchanger 19 is provided.

Further a plurality of cyclones 11 may be provided which cyclones are arranged in parallel or not.

Claims

1. A method for fluidized bed combustion of a fuel in which air is passed through a bed of particulate material consisting at least partially of particles of the fuel, which material is supplied through a supply means,
5 and which air serves as well for fluidizing the bed as for providing combustion air for the fuel, whereafter air together with the combustion gases and said particles entrained in said gases pass through a room above the bed to an exhaust and subsequently the solid particles are
10 separated from the air-combustion gases flow and the solid particles are returned in the bed, characterized in that besides the separation of the particles from the air-combustion gases flow also carbon particles and/or particles containing carbon are separated from ash
15 particles and the first mentioned particles are exclusively returned into the bed.

2. Method according to claim 1, characterized in that the carbon particles and/or particles containing carbon are separated from the ash particles by passing the
20 gas flow from the exhaust into a cyclone in which the solid particles are separated and the carbon particles and/or particles containing carbon are electrically charged by friction whereafter said particles are passed through an electrostatic separator so that the carbon particles and/or
25 particles containing carbon drop off the separator at the side of the one electrode and the ash particles at the other side, whereafter first mentioned particles are returned into the bed.

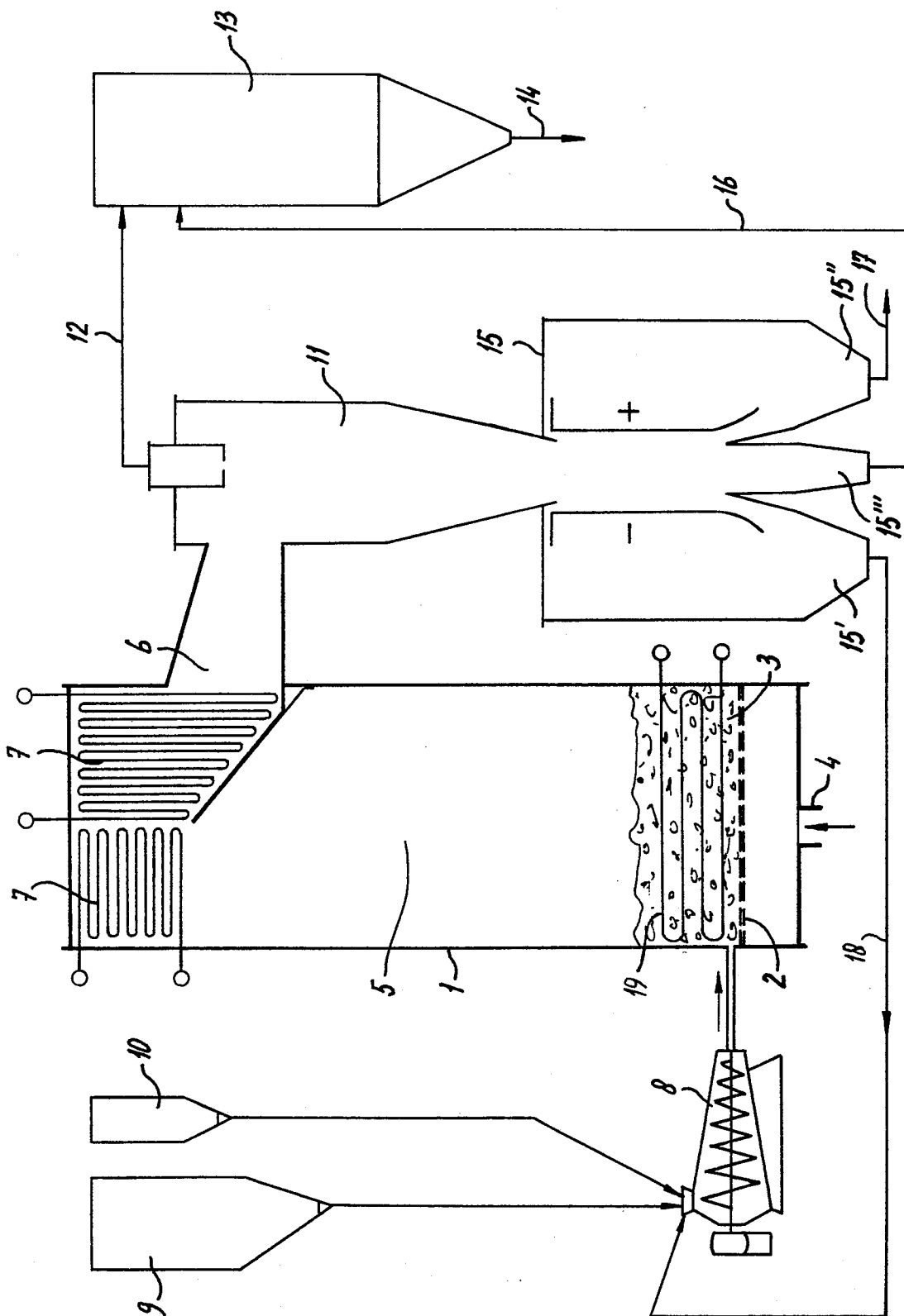
3. Method according to claim 1 or 2 characterized
30 in that the separated carbon particles are carried in the original fuel feeding system.

4. An apparatus for carrying out the method according to claims 1-3 comprising a housing having at

least one support for the bed of particulate material into the bed and means for passing air through said bed, a room above the bed and at least one discharge which opens in the top portion of said room and which is in communication with
5 a cyclone for separating the solid particles from the gas flow from the discharge, characterized in that the solid particles discharge of the cyclone is in communication with a separator for separating carbon particles and/or particles containing carbon from ash particles and the
10 collector means for the first mentioned particles of this device is in connection with the bed.

5. Apparatus according to claim 4 characterized in that the cyclone is a cyclone of which the interior is coated with a material by which the carbon particles and/or
15 particles containing carbon are electrically charged by friction and of which the discharge for the solid particles is in communication with an electrostatic separator.

6. Apparatus according to claim 4 or 5, characterized in that the collector means for the carbon
20 particles and/or particles containing carbon of the separator is in communication with the means for feeding the particulate material into the bed.





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EUROPEAN SEARCH REPORT

0128630

Application number

EP 84 20 0849

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Y	DE-A-3 124 932 (DEUTSCHE BABCOCK AG) * Whole document *	1, 2, 4, 5	F 23 B 5/02 F 23 C 11/02
A		3, 6	
Y	CH-A- 219 595 (KRAUS) * Whole document *	1, 2, 4, 5	
A	DE-A-3 109 685 (BUDERUS AG) * Claim 1 *	1, 4	
A	DE-A-2 539 546 (METALLGESELLSCHAFT AG) * Claim 1 *	1, 4	
A	GB-A-2 022 793 (FOSTER WHEELER ENERGY CORP.) * Claim 1 *	1, 4	
A	DE-C- 736 747 (METALLGESELLSCHAFT AG) * Page 1, line 1 - page 2, line 36 *	2, 5	
A	DE-B-1 215 614 (SLOBODAN) * Column 1, line 1 - column 2, line 49 *	2, 5	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12-09-1984	Examiner SARRE K.J.K.TH.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			