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(54) GASIFICATION AGENT MIXING AND PRE-COMBUSTION TECHNIQUE AND DEVICE

(57) A method and a device for mixing and pre-burning a gasification agent are provided in the present invention. The device for mixing and pre-burning the gasification agent includes a gasifier body comprising a furnace chamber provided at an upper portion thereof, a gas distribution plate provided in a middle portion thereof and a gasification agent mixing chamber provided at a lower portion thereof; a pulverized coal transport pipe being in communication with a middle portion of the gasification agent mixing chamber and configured to feed a pulverized coal to the middle portion of the gasification agent mixing chamber; a carbon-containing fly ash transport pipe being in communication with the middle portion of the gasification agent mixing chamber and configured to feed a carbon-containing fly ash to the middle portion of the gasification agent mixing chamber; and a gasification agent transport pipe being in communication with a bottom of the gasification agent mixing chamber and configured to feed a gasification agent to the bottom of the gasification agent mixing chamber. In comparison with the prior art, the present invention can ensure burning, pyrolysis and gasification of the coal within the circulating fluidized bed gasifier completely by adding the high temperature carbon-containing fly ash and the pulverized coal during mixing of the gasification agent, pre-burning the gasification agent, introducing mixture of the high temperature coal gas, the carbon-containing fly ash and the gasification agent to the furnace chamber of the circulating fluidized bed gasifier via a gas distribution plate.

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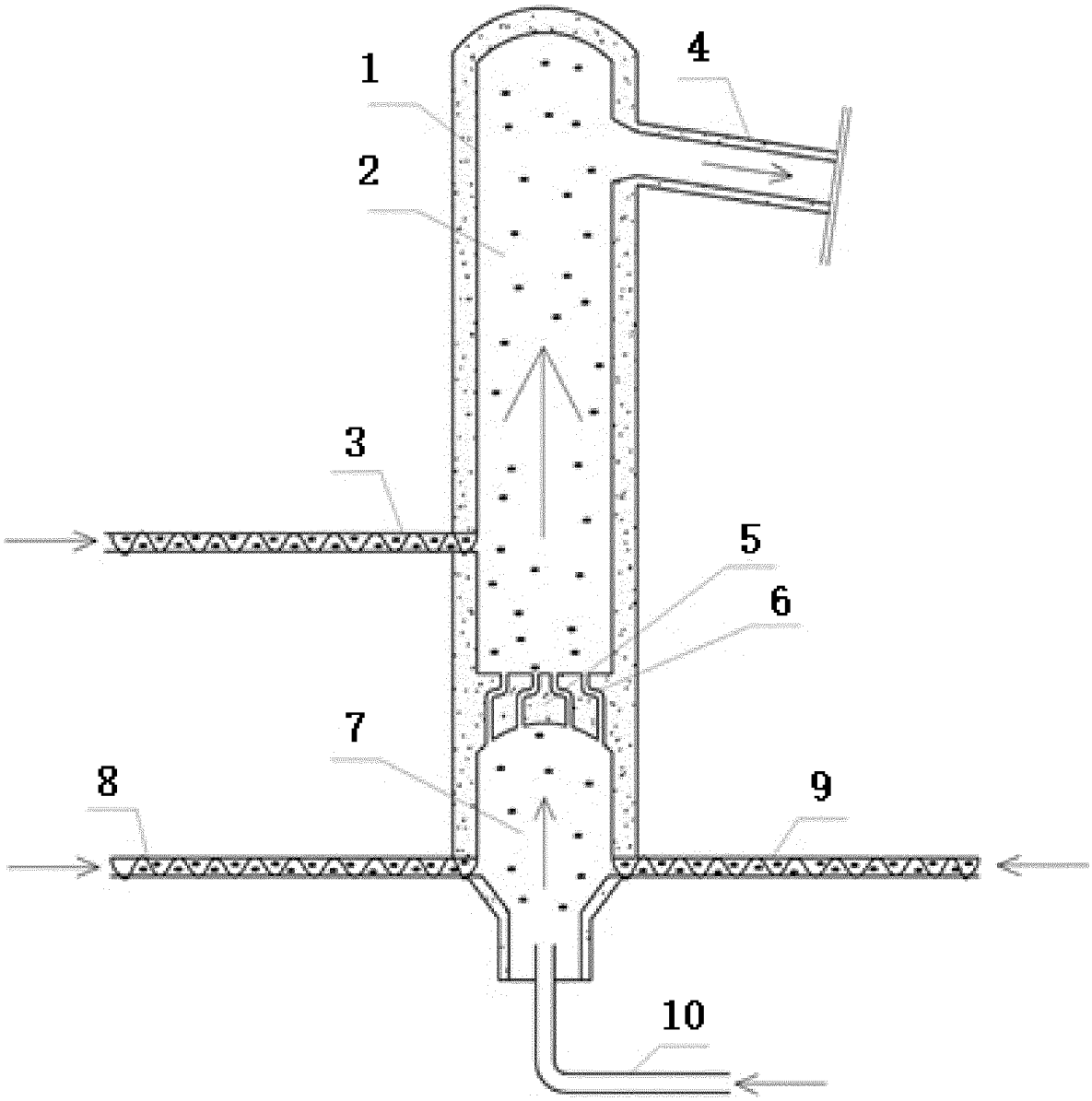

FIG. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of coal gasification technologies, and particularly relates to a method and a device for mixing and pre-burning a gasification agent, which can increase a temperature of the gasification agent entering into a circulating fluidized bed gasifier.

BACKGROUND

[0002] In order to obtain clean high temperature gas, various gasification apparatuses for converting coal to coal gas have been designed. The emergence of each type of apparatus has enhanced development of coal-to-gas technologies to a different extent. However, the apparatuses also have their own insurmountable disadvantages. For example, a fixed bed coal gas generator produces tar and other contaminants although it can fully burn coal. A circulating fluidized bed coal gasification system does not produce contaminants such as tar, but it cannot fully burn coal and cannot be miniaturized. In addition, semicoke and carbon-containing fly ash that cannot be fully burnt by the circulating fluidized bed coal gasification system require an additional auxiliary burning device, resulting in a low rate of single-pass coal to gasification. A low pressure entrained flow bed coal gasification system not only requires highly fine pulverized coal and pure oxygen, but also has a high cost of operation. To solve the disadvantages of the apparatuses mentioned above, skilled persons focusing on coal gasification apparatus researches have designed a coal gasification apparatus that adopts a combined gasification process with a circulating fluidized bed and a pyrolysis bed. However, it is crucial to ensure a temperature during burning, pyrolysis and gasification in the circulating fluidized bed to realize design purposes of the apparatus. A gasification agent entering into the circulating fluidized bed is preheated in various ways in order to ensure the temperature in the circulating fluidized bed, but the effect can not meet the expected requirements. To this end a method and a device that not only can pre-burn and heat the gasification agent, but also can bring heat and high temperature fly ash generated from the pre-burning to the circulating fluidized bed and burn the carbon-containing fly ash completely, are desired to be designed to ensure a temperature during the combined gasification process in the circulating fluidized bed and the pyrolysis bed.

[0003] Therefore, there is a need for a new technical solution to solve the above problems.

SUMMARY

[0004] The present invention provides a method and a device for mixing and pre-burning a gasification agent which can ensure burning, pyrolysis and gasification of the coal within the circulating fluidized bed gasifier completely by adding high temperature carbon-containing fly ash and pulverized coal during mixing of the gasification agent, pre-burning the gasification agent, introducing mixture of the high temperature coal gas, the carbon-containing fly ash and the gasification agent to the furnace chamber of the circulating fluidized bed gasifier via a gas distribution plate.

[0005] According to one aspect of the present invention, a method for mixing and pre-burning a gasification agent is provided in the present invention. The method comprises: feeding a gasification agent to a bottom of a gasification agent mixing chamber, and fully mixing the gasification agent at a lower portion of the gasification agent mixing chamber; feeding a pulverized coal and a coal-containing fly ash to a middle portion of the gasification agent mixing chamber; pre-burning, pyrolyzing and gasifying the pulverized coal, the coal-containing fly ash and the gasification agent in the gasification agent mixing chamber to generate a high temperature coal gas and a high temperature fly ash; introducing the high temperature coal gas, the high temperature fly ash and the gasification agent to a furnace chamber of a circulating fluidized bed gasifier via a gas distribution plate; and burning, pyrolyzing and gasifying fully the high temperature coal gas, the high temperature fly ash, the gasification agent and a raw coal in the furnace chamber.

[0006] Further, the gasification agent fed to the bottom of the gasification agent mixing chamber comprises a high temperature air and a vapour.

[0007] Further, the gasification agent fed to the bottom of the gasification agent mixing chamber further comprises an oxygen.

[0008] According to one aspect of the present invention, a device for mixing and pre-burning a gasification agent is provided in the present invention. The device comprises: a gasifier body, comprising a furnace chamber provided at an upper portion thereof, a gas distribution plate provided in a middle portion thereof and a gasification agent mixing chamber provided at a lower portion thereof; a pulverized coal transport pipe being in communication with a middle portion of the gasification agent mixing chamber and configured to feed a pulverized coal to the middle portion of the gasification agent mixing chamber; a carbon-containing fly ash transport pipe being in communication with the middle portion of the gasification agent mixing chamber and configured to feed a carbon-containing fly ash to the middle portion of the gasification agent mixing chamber; and a gasification agent transport pipe being in communication with a bottom of the gasification agent mixing chamber and configured to feed a gasification agent to the bottom of the gasification agent mixing chamber.

[0009] Further, the gasification agent fed to the bottom of the gasification agent mixing chamber comprises a high temperature air and a vapour.

[0010] Further, the gasification agent transport pipe

comprises a high temperature air transport pipe and a vapour transport pipe.

[0011] Further, the gasification agent fed to the bottom of the gasification agent mixing chamber further comprises an oxygen.

[0012] Further, the gasification agent transport pipe comprises a high temperature air transport pipe, an oxygen transport pipe and a vapour transport pipe.

[0013] Further, the device further comprises: a coal transport pipe being in communication with the furnace chamber in the middle of the gasifier body and configured to feed a raw coal to the furnace chamber; and a gas-material mixture transport pipe being in communication with the furnace chamber at an upper portion of the gasifier body.

[0014] In comparison with the prior art, the gasification agent is pre-burnt and heated during feeding the gasification agent to the circulating fluidized bed gasifier in the present invention, thereby increasing a temperature of the gasification agent on one hand, and introducing the high temperature coal gas and the carbon-containing fly ash generated from the pre-burning into the circulating fluidized bed gasifier via the gas distribution plate by the gasification agent flowing at a high speed on the other hand, to ensure a sufficient temperature within the circulating fluidized bed gasifier for burning, pyrolysis and gasification. The present invention has the gasification agent with a high temperature, can be widely used, and can solve the problem of temperature rising of gasification agents for the circulating fluidized beds with different gas yields and the problem of full burning of the carbon-containing fly ash.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] To illustrate the technical solutions of embodiments of the present invention more clearly, a brief introduction to the accompanying drawings required to describe the embodiments is given below. Obviously, the accompanying drawings in the description below are merely some embodiments of the present invention, based on which other drawings may also be obtained by a person of ordinary skill in the art without any inventive efforts. In the drawings,

[0016] Figure 1 is a schematic structural diagram of a device for mixing and pre-burning a gasification agent according to one embodiment of the present invention.

[0017] In the Figure: 1 denotes a gasifier body; 2 denotes a furnace chamber; 3 denotes a coal transport pipe; 4 denotes a gas-material mixture transport pipe; 5 denotes a gas distribution plate; 6 denotes a gas pipe cap; 7 denotes a gasification agent mixing chamber; 8 denotes a pulverized coal transport pipe; 9 denotes a carbon-containing fly ash transport pipe; 10 denotes a gasification agent transport pipe.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0018] To make the above object, features and advantages of the present invention clearer and easier to understand, the present invention will be further illustrated in detail below in connection with the accompanying drawings and particular implementations.

[0019] "One embodiment" or "embodiment" herein means a specific feature, structure or characteristic that may be included in at least one implementation of the present invention. "In one embodiment" throughout the specification refers to neither the same embodiment, nor a separate or optional embodiment contradictory to other embodiments. Unless especially stated, terms indicating a connection such as connected, linked and joined all refer to a direct or indirect connection.

[0020] As shown in Figure 1, a device for mixing and pre-burning a gasification agent according to the present invention includes a gasifier body 1, a pulverized coal transport pipe 8, a carbon-containing fly ash transport pipe 9, a gasification agent transport pipe 10, a coal transport pipe 3 and a gas-material mixture transport pipe 4.

[0021] The gasifier body 1 includes a furnace chamber 2 provided at an upper portion thereof, a gas distribution plate 5 provided in a middle portion thereof and a gasification agent mixing chamber 7 provided at a lower portion thereof. Both the pulverized coal transport pipe 8 and the carbon-containing fly ash transport pipe 9 are in communication with a middle portion of the gasification agent mixing chamber 7. The gasification agent transport pipe 10 is in communication with a bottom of the gasification agent mixing chamber 7. The pulverized coal transport pipe 8 feeds a pulverized coal to the middle portion of the gasification agent mixing chamber 10. The carbon-containing fly ash transport pipe 9 feeds a carbon-containing fly ash to the middle portion of the gasification agent mixing chamber 7. The gasification agent transport pipe 10 feeds a gasification agent to the bottom of the gasification agent mixing chamber 7. The coal transport pipe 3 is in communication with the furnace chamber 2 in the middle of the gasifier body 1. The coal transport pipe 3 feeds a raw coal to the furnace chamber 2. The gas-material mixture transport pipe 4 is in communication with the furnace chamber 2 at an upper portion of the gasifier body 1. The gas-material mixture transport pipe 4 outputs a gas-material mixture within the furnace chamber 2.

[0022] In one embodiment, the gasification agent fed to the bottom of the gasification agent mixing chamber 7 via the gasification agent transport pipe 10 includes a high temperature air and a vapour, or the gasification agent fed to the bottom of the gasification agent mixing chamber 7 is a gas mixture of the high temperature air and the vapour. Accordingly, the gasification agent transport pipe 10 includes a high temperature air transport pipe and a vapour transport pipe to respectively feed the high temperature air and the vapour to the gasification agent mixing chamber 10. The high temperature air and

the vapour are fully mixed at the lower portion of the gasification agent mixing chamber 10.

[0023] In another embodiment, the gasification agent fed to the bottom of the gasification agent mixing chamber 7 via the gasification agent transport pipe 10 includes a high temperature air, a vapour and an oxygen, or the gasification agent fed to the bottom of the gasification agent mixing chamber 7 is a gas mixture of the high temperature air, the vapour and the oxygen. Accordingly, the gasification agent transport pipe 10 includes a high temperature air transport pipe, a vapour transport pipe and an oxygen transport pipe to respectively transport the high temperature air, the vapour and the oxygen to the gasification agent mixing chamber 10. The high temperature air, the vapour and the oxygen are fully mixed at the lower portion of the gasification agent mixing chamber 10.

[0024] A method for mixing and pre-burning the gasification agent according to the present invention is described below with reference to the device for mixing and pre-burning the gasification agent as shown in Figure 1.

[0025] The method for mixing and pre-burning the gasification agent according to the present invention includes: feeding a gasification agent to the bottom of the gasification agent mixing chamber 7, and fully mixing the gasification agent at the lower portion of the gasification agent mixing chamber; feeding a pulverized coal and a coal-containing fly ash to the middle portion of the gasification agent mixing chamber 7; pre-burning, pyrolyzing and gasifying the pulverized coal, the coal-containing fly ash and the gasification agent at an upper portion of the gasification agent mixing chamber 7 to generate a high temperature coal gas and a high temperature fly ash; introducing the high temperature coal gas, the high temperature fly ash and the gasification agent to the furnace chamber 2 of a circulating fluidized bed gasifier via the gas distribution plate 5; and, burning, pyrolyzing and gasifying fully the high temperature coal gas, the high temperature fly ash and the raw coal in the furnace chamber 2. In one embodiment, the gasification agent fed to the bottom of the gasification agent mixing chamber 2 is a gas mixture of the high temperature air and the vapour. In another embodiment, the gasification agent introduced to the bottom of the gasification agent mixing chamber 2is a gas mixture of the high temperature air, the oxygen and the vapour.

[0026] In summary, in comparison with the prior art, the gasification agent is pre-burnt and heated during feeding the gasification agent to the circulating fluidized bed gasifier in the present invention, thereby increasing a temperature of the gasification agent on one hand, and introducing the high temperature coal gas and the carbon-containing fly ash generated from the pre-burning into the circulating fluidized bed gasifier via the gas distribution plate by the gasification agent flowing at a high speed on the other hand, to ensure a sufficient temperature within the circulating fluidized bed gasifier for burning, pyrolysis and gasification. The present invention has the gasification agent with a high temperature, can be widely used, and can solve the problem of temperature rising of gasification agents for the circulating fluidized beds with different gas yields and the problem of full burning of the carbon-containing fly ash.

[0027] In the present invention, unless especially stated, terms indicating a connection such as "connected", "joined", "linked", and "coupled" indicate a direct or indirect connection.

[0028] It should be noted that any modification made by a person skilled in the art to a specific implementation of the present invention does not deportion from the scope of the claims of the present invention. Accordingly, the scope of the claims of the present invention is not merely limited to the specific implementations mentioned above.

Claims

1. A method for mixing and pre-burning a gasification agent, comprising:

   feeding a gasification agent to a bottom of a gasification agent mixing chamber, and fully mixing the gasification agent at a lower portion of the gasification agent mixing chamber;
   feeding a pulverized coal and a coal-containing fly ash to a middle portion of the gasification agent mixing chamber;
   pre-burning, pyrolyzing and gasifying the pulverized coal, the coal-containing fly ash and the gasification agent in the gasification agent mixing chamber to generate a high temperature coal gas and a high temperature fly ash;
   introducing the high temperature coal gas, the high temperature fly ash and the gasification agent to a furnace chamber of a circulating fluidized bed gasifier via a gas distribution plate; and
   burning, pyrolyzing and gasifying fully the high temperature coal gas, the high temperature fly ash, the gasification agent and a raw coal in the furnace chamber.

2. The method for mixing and pre-burning gasification agent according to claim 1, **characterized in that** the gasification agent fed to the bottom of the gasification agent mixing chamber comprises a high temperature air and a vapour.

3. The method for mixing and pre-burning gasification agent according to claim 2, **characterized in that** the gasification agent fed to the bottom of the gasification agent mixing chamber further comprises an oxygen.

4. A device for mixing and pre-burning a gasification

agent, comprising:

a gasifier body, comprising a furnace chamber provided at an upper portion thereof, a gas distribution plate provided in a middle portion thereof and a gasification agent mixing chamber provided at a lower portion thereof;
a pulverized coal transport pipe being in communication with a middle portion of the gasification agent mixing chamber and configured to feed a pulverized coal to the middle portion of the gasification agent mixing chamber;
a carbon-containing fly ash transport pipe being in communication with the middle portion of the gasification agent mixing chamber and configured to feed a carbon-containing fly ash to the middle portion of the gasification agent mixing chamber; and
a gasification agent transport pipe being in communication with a bottom of the gasification agent mixing chamber and configured to feed a gasification agent to the bottom of the gasification agent mixing chamber.

5. The device for mixing and pre-burning gasification agent according to claim 4, **characterized in that** the gasification agent fed to the bottom of the gasification agent mixing chamber comprises a high temperature air and a vapour.

6. The device for mixing and pre-burning gasification agent according to claim 5, **characterized in that** the gasification agent transport pipe comprises a high temperature air transport pipe and a vapour transport pipe.

7. The method for mixing and pre-burning gasification agent according to claim 5, **characterized in that** the gasification agent fed to the bottom of the gasification agent mixing chamber further comprises an oxygen.

8. The method for mixing and pre-burning gasification agent according to claim 7, **characterized in that** the gasification agent transport pipe comprises a high temperature air transport pipe, an oxygen transport pipe and a vapour transport pipe.

9. The device for mixing and pre-burning gasification agent according to claim 5, further comprising:

a coal transport pipe being in communication with the furnace chamber in the middle of the gasifier body and configured to feed a raw coal to the furnace chamber; and
a gas-material mixture transport pipe being in communication with the furnace chamber at an upper portion of the gasifier body.

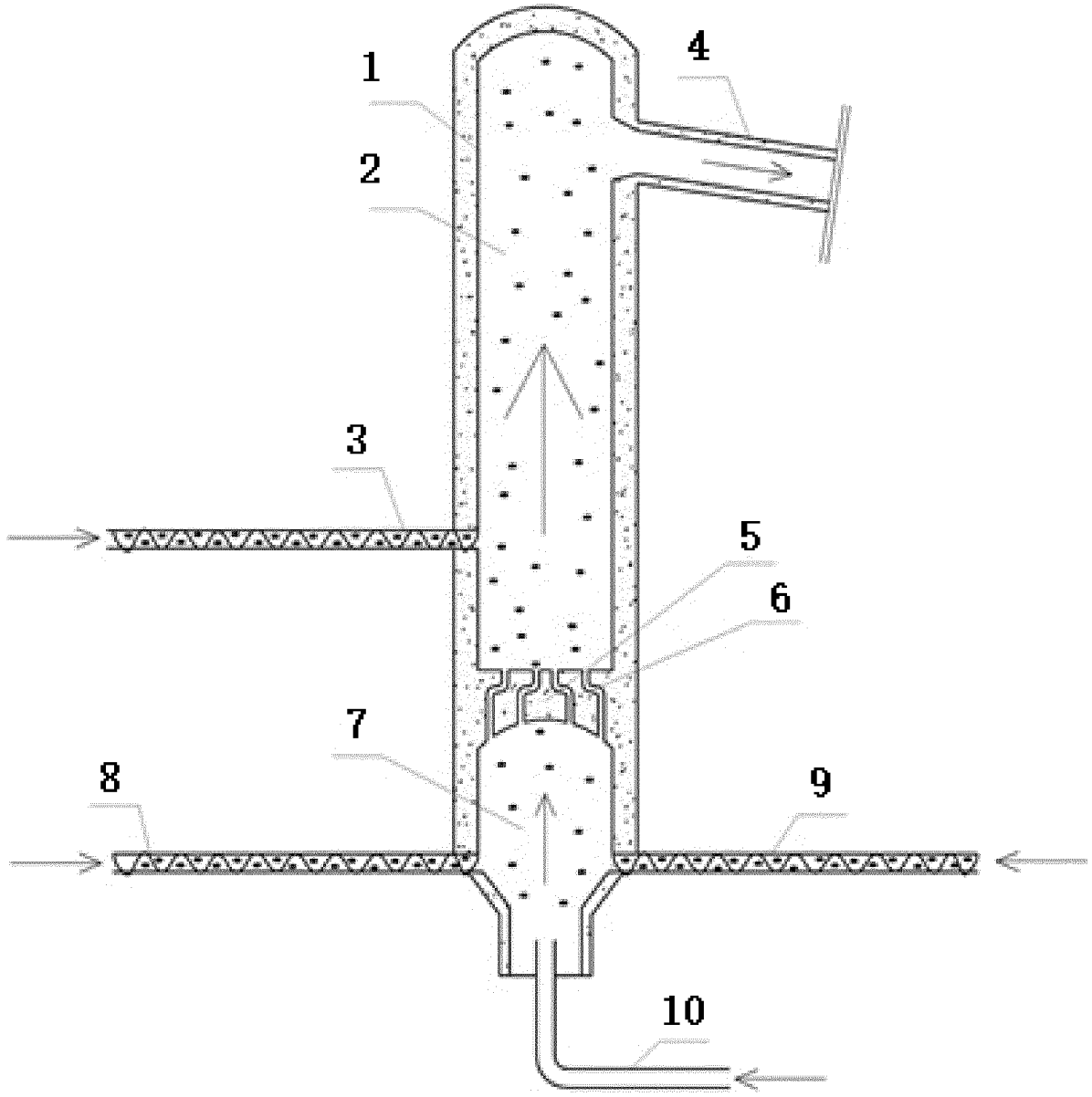

FIG. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/088046

A. CLASSIFICATION OF SUBJECT MATTER

C10J 3/80 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C10J 3/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, CNTXT, VEN, CNKI, WANFANG, BAIDU: 中聚信海洋工程装备有限公司, 张连华, 陈柏金, 王季, 气化, 预燃烧, 预热, 煤, 飞灰, 空气, 水蒸汽, 氧, gas+, combust+, pulveriz+, coal, fly ash, fluidized bed, preheat+, precombust+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 106753588 A (ZHONGJUXIN OCEAN ENGINEERING EQUIPMENT CO., LTD.), 31 May 2017 (31.05.2017), claims 1-6	1-9
X	CN 2937135 Y (AIPEIKESI SCI. & TECH. (SHENYANG) CO., LTD.), 22 August 2007 (22.08.2007), particular embodiments, and figure 1	1-3
X	CN 1850949 A (AIPEIKESI SCI. & TECH. (SHENYANG) CO., LTD.), 25 October 2006 (25.10.2006), particular embodiments, and figure 1	1-3
A	FR 2397451 A1 (FOSTER WHEELER ENERGY CORP.), 16 March 1979 (16.03.1979), the abstract	1-9
A	CN 204342744 U (SUN YAT-SEN UNIVERSITY et al.), 20 May 2015 (20.05.2015), particular embodiments, and figure 1	1-9

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 November 2017	20 November 2017

Name and mailing address of the ISA	Authorized officer
State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	YANG, Hui Telephone No. (86-10) 010-62414273

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/088046

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 106753588 A	31 May 2017	None	
CN 2937135 Y	22 August 2007	None	
CN 1850949 A	25 October 2006	None	
FR 2397451 A1	16 March 1979	ES 470592 A1	01 September 1979
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		JP S5417901 A	09 February 1979
		IT 1095180 B	10 August 1985
CN 204342744 U	20 May 2015	None	

Form PCT/ISA/210 (patent family annex) (July 2009)