US 20100147413A1

(19) **United States**

(12) **Patent Application Publication**

Schingnitz et al.

(10) **Pub. No.: US 2010/0147413 A1**

(43) **Pub. Date: Jun. 17, 2010**

(54) **USE OF PURE CARBON DIOXIDE AS AN INERTING AND FLOW MEDIUM IN POWDER INJECTION SYSTEMS FOR USE IN PULVERIZED COAL GASIFICATION UNDER PRESSURE**

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(21) Appl. No.: **12/598,069**

(22) PCT Filed: **Apr. 18, 2008**

(86) PCT No.: **PCT/EP08/54706**

§ 371 (c)(1),
(2), (4) Date: **Oct. 29, 2009**

(30) **Foreign Application Priority Data**

Apr. 30, 2007 (DE) 10 2007 020 333.2

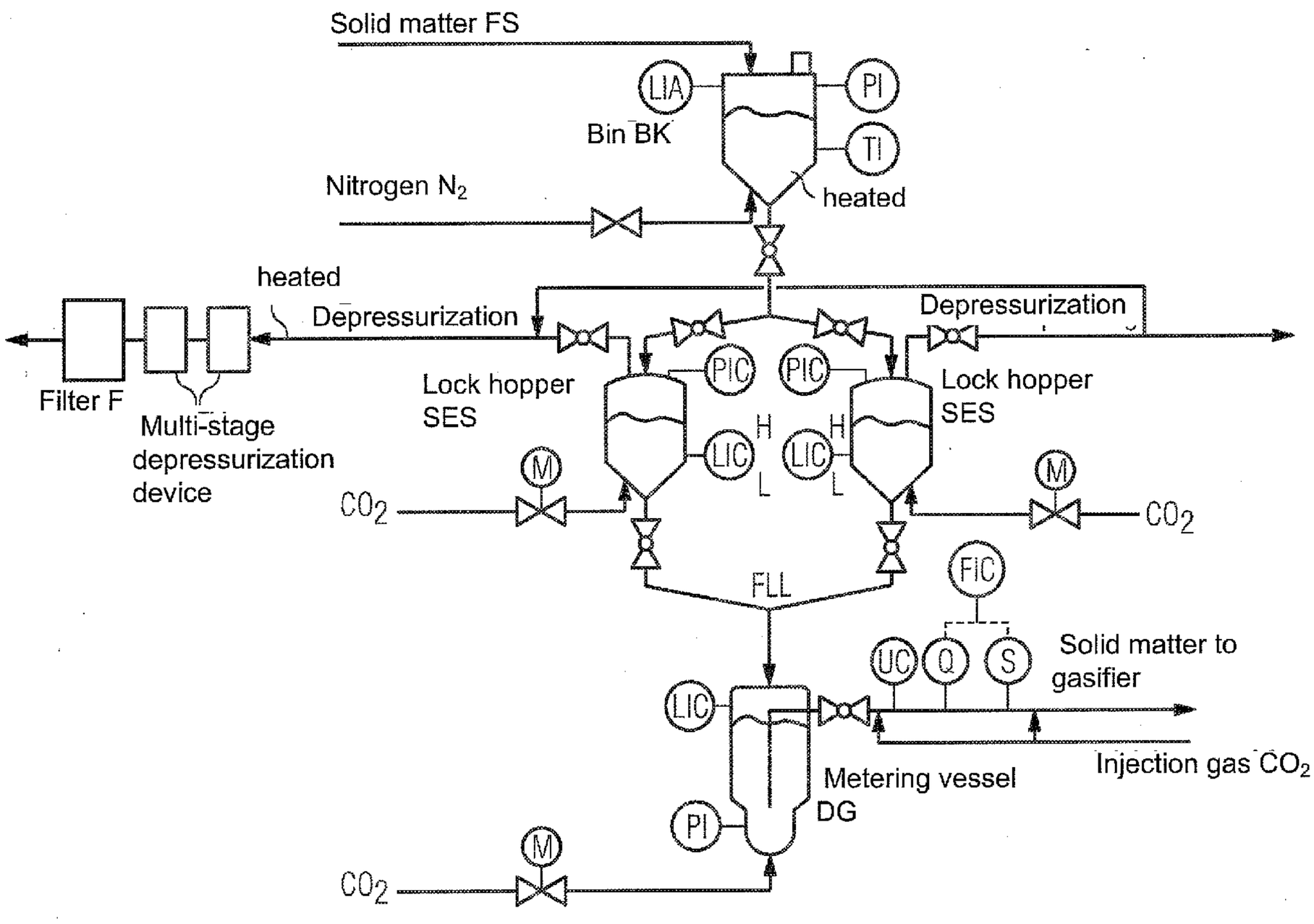
Publication Classification

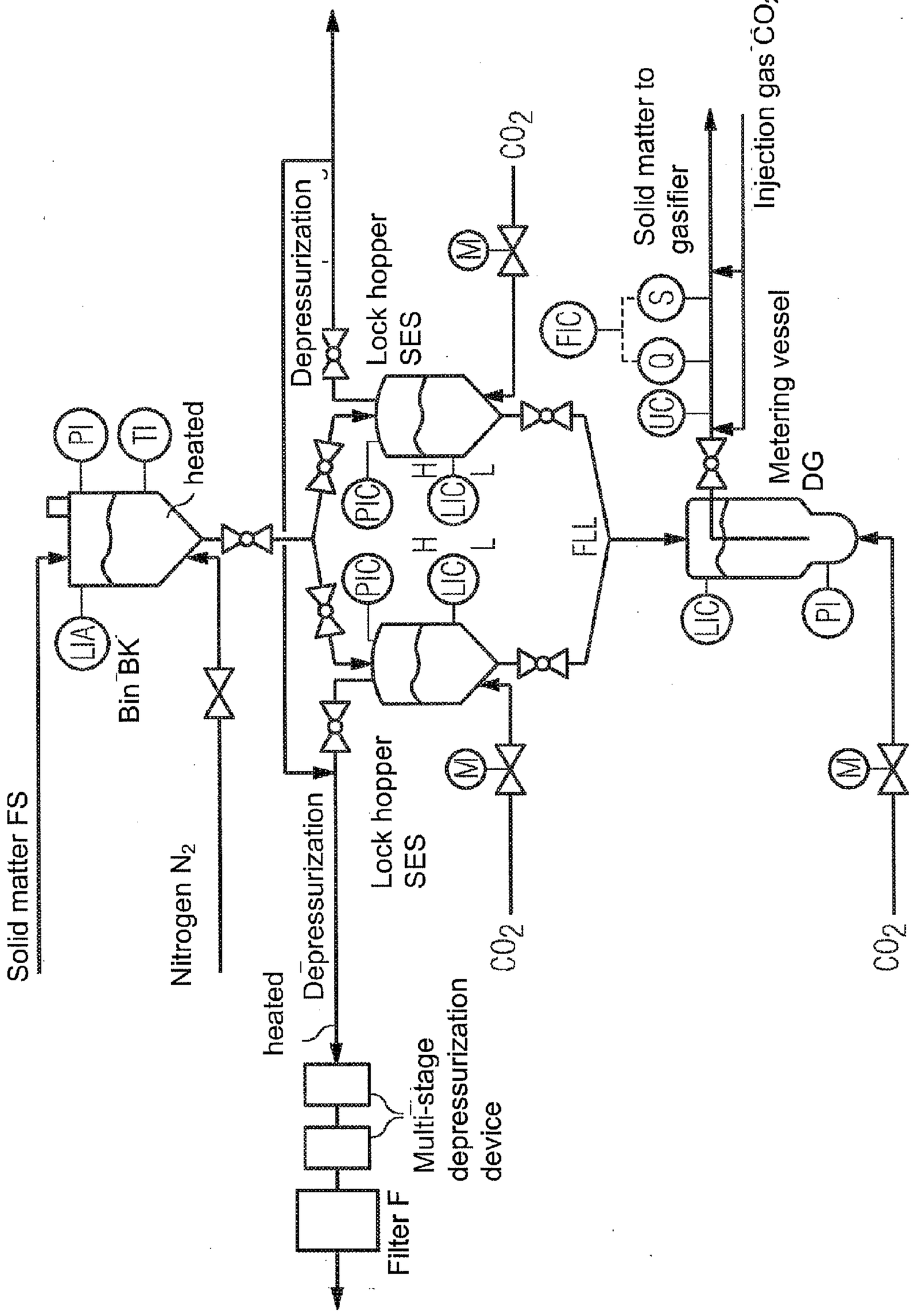
(51) **Int. Cl.**
B65B 31/00 (2006.01)

(52) **U.S. Cl.** **141/4**; 141/37

(57) **ABSTRACT**

A particulate feed arrangement used in pulverized coal gasification under pressure is provided. The arrangement includes a reservoir for stocking the pulverized coal, a plurality of powder injection tubes, and a metering unit. Pure carbon dioxide is fed to the components that are at operating pressure, namely the power injection tube and the metering unit, as the inerting and flow medium or fluidizing medium. The carbon dioxide-carrying components are heated in such a manner that the temperature is above the threshold of the diphase range. A method is also provided. The method allows elimination of any nitrogen in the product gas, which nitrogen is caused by the powder injection system, especially when used in pulverized coal gasification under pressure to produce a synthesis gas for the production of different hydrocarbons.




Solid matter FS
Nitrogen N_2
heated
Bin BK
LIA
TI
PI
heated
Depressurization
Lock hopper SES
PIC
LIC
H
L
M
CO_2
FLL
FIC
UC
Q
S
Solid matter to gasifier
Injection gas CO_2
Metering vessel DG
LIC
PI
CO_2
Multi-stage depressurization device
Filter F

USE OF PURE CARBON DIOXIDE AS AN INERTING AND FLOW MEDIUM IN POWDER INJECTION SYSTEMS FOR USE IN PULVERIZED COAL GASIFICATION UNDER PRESSURE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is the US National Stage of International Application No. PCT/EP2008/054706, filed Apr. 18, 2008 and claims the benefit thereof. The International Application claims the benefits of German application No. 10 2007 020 333.2 DE filed Apr. 30, 2007, both of the applications are incorporated by reference herein in their entirety.

FIELD OF INVENTION

[0002] The subject matter of the application relates to a method and an arrangement for operating a particulate feed system for the pressurized gasification of pulverized coal, having the features set forth in the claims.

BACKGROUND OF INVENTION

[0003] Nitrogen from the air separation unit is normally used as the inerting and conveying medium in pneumatically operated particulate feed systems for high-pressure gasification plants using pulverized coal. This process variant has proved its worth both in particulate feed systems for injecting pulverized coal into blast furnaces and also for high-pressure gasification plants using pulverized coal, and is to a large extent mature technology. Here the lock hopper depressurization gas and the surplus gas accumulating under certain operating conditions in the metering vessel is advantageously de-dusted in special filter units already under elevated operating pressures before being vented to the atmosphere. Although the particulate feed systems based on dense-phase pneumatic conveying operate with very high loading ratios, the nitrogen introduced into the gasification systems in many cases exceeds the permissible limits. This is also caused by increasing process pressure in the majority of applications. Particularly for pressurized gasification of pulverized coal with the objective of obtaining synthesis gas for the production of different hydrocarbons, there arises a requirement to limit the nitrogen content of the product gas.

SUMMARY OF INVENTION

[0004] The object to be achieved by the subject matter of the application is to further develop a method and an arrangement of a particulate feed system for the pressurized gasification of pulverized coal such that the nitrogen introduced into the downstream gasification system and the attendant disadvantages thereof are avoided.

[0005] This object is achieved by the features of the claims.

[0006] According to the invention, carbon dioxide CO_2 is fed to the feed lock hopper as an inerting and conveying medium and to the metering vessel as a fluidizing medium. The sections of the plant that are operated with essentially pure carbon dioxide are heated to the point that a temperature above the threshold of the two-phase region is obtained. The invention advantageously makes use of the fact that not all the components need to be operated with carbon dioxide; instead heated nitrogen is fed to the storage bin as an inerting and disaggregating medium—with reduced cost/complexity compared to carbon dioxide.

[0007] Advantageous developments of the subject matter of the application are set forth in the subclaims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The subject matter of the application will now be explained in greater detail as an exemplary embodiment to the extent necessary for the understanding thereof and with reference to the accompanying drawing in which:

[0009] FIG. **1** shows a block diagram of a particulate feed system according to the invention.

DETAILED DESCRIPTION OF INVENTION

[0010] Heated nitrogen N_2 can be fed as an inerting and disaggregating medium to a bin BK for storing solid matter FS such as pulverized coal, which bin is at ambient pressure and can be heated. The solid matter can be fed via a conveying device to a feed lock hopper SES which is at a high operating pressure of e.g. 40 bar. Carbon dioxide CO_2 can be supplied to the feed lock hopper as an inerting and conveying medium at a temperature above the threshold to the two-phase region at high operating pressure. In the upper region of the feed lock hopper the depressurization gas is drawn off, expanded to ambient pressure via a multi-stage depressurization device mEV and de-dusted in a downstream filter F at ambient pressure. The solid matter is transferred by gravity flow from the feed lock hoppers to the metering vessel DG via an adequately dimensioned downcomer. Two to four lock hoppers are used for each particulate feed system.

[0011] Carbon dioxide is used as a fluidizing gas. A partial fluidized bed is created by the fluidizing gas in the lower part of the metering vessel. In this process the pulverized coal is converted from the particulate feedstock state to the fluidized bed and therefore simultaneously to the conveying state. As the preceding process steps have ensured that the intergranular volume of the particulate feedstock in the metering vessel is filled with carbon dioxide and carbon dioxide is likewise used for fluidization, the gas entrained with the pulverized coal at the conveying line inlet FLE to the reactor consists virtually totally of this gas component.

[0012] Carbon dioxide is likewise used as the injection gas. The injection gas is introduced into the pulverized coal conveying lines. Injection gas feeds may be may be required in order to detect disturbances in the pulverized coal supply to the reactor sufficiently quickly.

[0013] According to the invention, the requirement to limit the nitrogen content in the product gas obtained from pressurized gasification of pulverized coal is taken into account by using carbon dioxide as the inerting and conveying medium in the particulate feed system.

[0014] However, because of the thermodynamic properties of carbon dioxide, a number of special characteristics must be noted here. In particular, it must be taken into account that pure carbon dioxide attains the threshold to the two-phase region at the target process pressures above 40 bar even at ambient temperature. In order to prevent this, sufficiently high operating temperatures must always be ensured in all the process sections that are operated with pure carbon dioxide at or above the required process pressures.

[0015] The carbon dioxide is acquired at a sufficiently high temperature even at the plant periphery. The cooling of the gas during storage, transport and the process-specific use thereof must be counteracted by a suitable heating system.

[0016] It is particularly important to maintain the temperature of the pulverized coal produced in the upstream mill as high as possible until it enters the reactor. For this purpose, the pulverized coal bin, operating at ambient temperature and supplied with nitrogen as an inerting and disaggregating medium, is heated. The supplied nitrogen is also heated in order to prevent the pulverized coal from cooling down e.g. in the event of lengthy plant downtimes. According to the invention, continuous heating is provided in the process sections gas storage, transport and metering system itself.

[0017] In order to eliminate problems caused by reduced service life of filter elements due to production of liquid carbon dioxide as a result of polytropic cooling of the medium during depressurization in the lock hoppers, de-dusting of the depressurization gas at elevated operating pressure is dispensed with.

[0018] The pressure of the slightly dust-bearing depressurization gas is reduced via multi-stage depressurization devices mEV. The depressurization gas is subsequently dedusted in a filter F operating at ambient pressure.

[0019] The section of pipework between lock hopper and depressurization device is heated in order to compensate the polytropic depressurization cooling and maintain the permissible operating conditions of the depressurization filter.

[0020] The depressurization device is designed such that depressurization noise is simultaneously reduced. So-called silencer plates, for example, which are well-known in technical circles, are used as depressurization devices. These bring about a reduction in the depressurization noise, on the one hand, by multi-stage depressurization and, on the other, by spreading the total bore cross-section required over a plurality of smaller bores. A wear-protected control valve with downstream silencer can also be used. If these measures are insufficient, additional sound insulation measures can be employed, e.g. by means of a sound-absorbent cladding.

1.-**5**. (canceled)

6. A method for operating a particulate feed system for a pressurized gasification of pulverized coal, comprising:

providing a bin for storing the pulverized coal which is subject to an ambient pressure;

providing a plurality of feed lock hoppers and a metering vessel both of which are subject to a high operating pressure;

heating the bin;

feeding heated nitrogen to the bin as an inerting and disaggregating medium;

supplying carbon dioxide to a feed lock hopper as an inerting and conveying medium; and

feeding carbon dioxide to the metering vessel as a fluidizing medium.

7. The method as claimed in claim **6**, wherein the supplied carbon dioxide is heated to a temperature above a threshold to a two-phase region at a high process pressure in a high pressure region of the system.

8. The method as claimed in claim **6**, wherein a feed lock hopper depressurization gas is expanded, heated and then filtered at the ambient pressure.

9. The method as claimed in claim **6**, wherein the high operating pressure is 40 bar.

10. The method as claimed in claim **6**, wherein carbon dioxide is used as an injection gas and is introduced into a plurality of pulverized coal conveying lines.

11. A particulate feed arrangement for a pressurized gasification of pulverized coal, comprising:

a bin for storing the pulverized coal which is subjected to an ambient pressure;

a plurality of feed lock hoppers which is subjected to a high operating pressure;

a metering vessel which is subjected to the high operating pressure,

wherein the bin is heated,

wherein heated nitrogen is fed to the bin as an inerting and disaggregating medium,

wherein carbon dioxide is supplied to the feed lock hopper as an inerting and conveying medium, and

wherein carbon dioxide is fed to the metering vessel as a fluidizing medium.

12. The arrangement as claimed in claim **11**, wherein a plurality of components to which carbon dioxide is applied may be heated to a particular temperature that is above a threshold of a two-phase region.

13. The arrangement as claimed in claim **11**, wherein the high operating pressure is 40 bar.

14. The arrangement as claimed in claim **11**, wherein carbon dioxide is used as an injection gas and is introduced into a plurality of pulverized coal conveying lines.

15. The arrangement as claimed in claim **11**, wherein a feed lock hopper depressurization gas is expanded, heated and then filtered at the ambient pressure.

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