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(54) PROCESS FOR GASIFYING SOLID FUEL

(71) We, METALLGESELLSCHAFT AKTIENGESELLSCHAFT, a body corporate organised under the laws of the German Federal Republic, of Reuterweg 14, 6 Frankfurt on Main, German Federal Republic, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a process for gasifying solid fuel, particularly coal, by treatment with oxygen and steam under a pressure of at least 5 bars in a reactor.

Solid fuels can be gasified in a reactor under a pressure in the range of 5 to 150 bars, preferably 10 to 80 bars, by treatment with oxygen-containing gas and steam and details of various processes and reactors and the units associated therewith have been disclosed in the Patent literature. The solid fuels to be gasified include mainly hard coal, brown coal, and peat. During the pressure gasification the fuel in granular form is held in a packed bed and the gasifying agents flow opposite to the direction of movement of the solids. The gas produced by the gasification is fed in conventional manner to a scrubber-cooler, in which the gas is cooled and subjected to preliminary purification.

Previously proposed pressure gasification reactors have a water-cooled jacket, in which a so-called jacket steam is produced, which is used as a gasifying agent. The cooling jacket communicates with the reaction chamber of the pressure reactor through a jacket steam transfer conduit, which provides for equalization of the pressure between the interior of the reactor and of the jacket. This equalization of pressure affords a desired protection for the inner shell of the reactor so that the inner shell may be designed to withstand only a relatively low pressure load. It has now been found that this pressure-equalizing communication between the cooling jacket of the reactor and the reaction chamber may result in difficulties when the gasification operation is temporarily shut down and the feeding of the oxygen-containing gasifying agents to the fuel bed is discontinued. In this case the heat contained in the gasification system results in the continued generation of steam in the cooling jacket of the pressure reactor. When the transfer of this steam through the jacket steam transfer conduit into the fuel bed is continued, the still hot carbonaceous material will react with the steam and will thus be cooled.

The shut-down also results in a pressure drop in the reaction chamber so that evaporation in the cooling water jacket is promoted. Moist steam may also promote corrosion in the cooled reactor. When the gasification is to be resumed after a temporary shut-down, the cooled fuel bed must be reheated first so that an inferior product gas is initially produced and this product gas must be burnt as waste in most cases.

According to the present invention there is provided a process for gasifying a solid fuel by treatment with oxygen and steam under a pressure of at least 5 bars in the reaction chamber of a reactor which comprises a water-cooled jacket, a steam transfer conduit leading from the inner chamber of the jacket to the reaction chamber, and a product gas discharge conduit leading from the reaction chamber to a scrubber-cooler, wherein, under normal conditions of operation, steam generated in the reactor jacket and oxygen are fed into the reaction chamber in order to gasify said solid fuel but all of said steam is fed directly into the scrubber-cooler under conditions other than those of normal operation when the supply of oxygen to the reaction chamber is interrupted.

In contradistinction from normal operation, the jacket steam is no longer trans-

ferred into the reaction chamber and can no longer result in a cooling in said area. Because the jacket steam is directly fed into the scrubber-cooler and the scrubber-cooler communicates with the reaction chamber through the product gas discharge conduit, the equalization of pressure between the reaction chamber and the interior of the reactor jacket is maintained during a shut-down. As a result, the cooling of the coal bed during a temporary shutdown of the gasification operation and troubles arising during a temporary shutdown are minimized and the energy loss is reduced, thus improving the economy of the pressure gasification process of solid fuels.

In order to enable the invention to be more readily understood, reference will now be made to the accompanying drawing, which illustrates diagrammatically and by way of example an embodiment of a gasification reactor and scrubber-cooler.

Referring now to the drawing, there is shown a conventional pressure gasification reactor 1, details of the construction of said reactor not being shown in the drawing. Fuel in the form of a packed bed is gasified in a reaction chamber 2 in the interior of the reactor under superatmospheric pressure, the fuel being fed from above and residual ash being discharged from the lower end of the reactor by means which are not shown. The reaction chamber 2 is surrounded by an inner shell 3 and outer shell 4. Cooling water 5 boils under pressure between the two shells 3 and 4 to produce so-called jacket steam, which is discharged through a conduit 6. During normal gasification operation a valve 7 is closed and a valve 8 is open so that the jacket steam is transferred through conduits 9 and 10 into the reaction chamber. When the valve 12 is open, a mixture of oxygen-containing gas and extraneous steam from a conduit 11 is added to the jacket steam and the resulting mixture is then disturbed into the fuel bed by a rotary grate 13.

The crude product gas which has been produced in the reaction chamber 2 is fed through a discharge conduit 14 to a scrubber-cooler 15 and is sprayed therein with water and condensate supplied from a conduit 16, the condensate having been derived from the crude gas. Scrubbed gas leaves the scubber-cooler 15 through a conduit 17, and liquid is withdrawn through a conduit 18.

When the pressure gasification operation must be temporarily shut down and is to be subsequently resumed, the valve 12 is closed to discontinue the supply of oxygen-containing gas to the reaction chamber 2. At the same time, the valve 7 is opened so that the jacket steam which is still being produced is fed through a conduit 20 to the scrubber-cooler 15. The valve 8 is closed so that steam can no longer enter the still hot coal bed above the rotary grate 13.

When it is desired to compensate entirely or in part also the heat loss from the cooling water jacket, a valve 22 is opened and hot extraneous steam is fed through a conduit 21 into the water jacket.

In the case of a shut-down, the feeding of the jacket steam into the scrubber-cooler and the required shut-off of the jacket steam transfer conduit leading to the reaction chamber 2 may easily be controlled by automatically operated means if a control signal is produced by the valve 12 when the same is closed to interrupt the oxygen supply. This control signal may be used to control actuators, not shown, for the valves 7 and 8 in such a manner that valve 7 is opened and valve 8 is closed. When the normal gasification operation is to be resumed, the valves 8 and 12 are opened and valve 7 is closed. This may also be effected by automatically operated control means.

WHAT WE CLAIM IS: —

1. A process for gasifying a solid fuel by treatment with oxygen and steam under a pressure of at least 5 bars in the reaction chamber of a reactor which comprises a water-cooled jacket, a steam transfer conduit leading from the inner chamber of the jacket to the reaction chamber, and a product gas discharge conduit leading from the reaction chamber to a scrubber-cooler, wherein, under normal conditions of operation, steam generated in the reactor jacket and oxygen are fed into the reaction chamber in order to gasify said solid fuel but all of said steam is fed directly into the scrubber-cooler under conditions other than those of normal operation when the supply of oxygen to the reaction chamber is interrupted.

2. A process as claimed in claim 1, wherein steam is fed into the jacket when the normal gasification operation is not maintained in order to delay the temperature drop in the fuel bed in the reactor chamber.

3. A process as claimed in claim 1 or 2, wherein the feeding of steam to the scrubber-cooler is controlled by automatically operated means and is not initiated until a conduit feeding oxygen into the reactor has been closed, and wherein shut-off

valves valves in the steam transfer conduits are oppositely actuated and interlocked to prevent a closing of both valves at any time.

4. A process for gasifying a solid fuel substantially as herein before described with reference to the accompanying drawing.

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