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(19)

(54) PROCESS FOR TREATING DRILLING CUTTINGS AND MUD

(71) We, WEST'S PYRO LIMITED, a British Company of Dale House, Tiviot Dale, Stockport, Cheshire, SK1 1SA, 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:–

The present invention relates to a process for treating both drilling cuttings and waste must products from oil based mud drilling operations and allows for the disposal of solids which are pollution free.

In drilling operations, e.g. for gas or oil, it is conventional practice to supply the drill bit with a mud lubricant which both cools and lubricates the bit and carries to the surface the drilling cuttings. The mud is separated from the cuttings and the mud is recycled. The cuttings are disposed to waste.

The present invention, however, is particularly concerned with the situation where the lubricating properties of the mud are improved by adding hydrocarbon oil, normally diesel, and in such cases it is found necessary to treat the cuttings to remove the hydrocarbon contamination and also to dispose of spent oil based mud.

Treatment processes available to remove oil from cuttings are solvent washing and distillation. The equipment required for the distillation process is heavy and bulky and is consequently particularly disadvantageous on off-shore drilling rigs.

Solvent extraction requires large quantities of solvents and again the supply and disposal of the solvents is disadvantageous in an off-shore situation. Both processes have the disadvantage that they do not completely remove porosity contamination.

It is therefore the object of the present invention to obviate or mitigate the above mentioned drawbacks.

According to the present invention, there is provided a process for de-contaminating drilling cuttings contaminated with hydrocarbon oil and/or oil-based liquid mud employed in drilling operations and contaminated with hydrocarbon oil, comprising the steps of providing a fluidised bed of inert particles, heating the fluidised bed to a predetermined operational temperature to start up the process, delivering hydrocarbon oil-contaminated drilling cuttings down onto the surface of the heated fluidised bed or liquid mud into the heated fluidised bed whereby the hydrocarbon oil burns and contributes to the heat requirements of the process, controlling the operational temperature of the process by the addition of fuel to the fluidised bed and a temperature dissipant to both the interior of and the combustion space above the fluidised bed, and discharging hydrocarbon-free drilling cuttings or mud solids from the bottom of the fluidised bed.

Also according to the present invention there is provided apparatus for de-contaminating drilling cuttings contaminated with hydrocarbon oil or oil-based liquid mud employed in drilling operations and contaminated with hydrocarbon oil, comprising fluidised bed combustor, a fluidised bed of inert particles arranged within said combustor, a start-up burner for heating the fluidised bed to a predetermined operational temperature, a first feed inlet through which contaminated drilling cuttings can be delivered down onto the surface of the fluidised bed, a second feed inlet through which contaminated mud can be pumped into the bed, a temperature dissipating injection system including separate means for supplying water or the like to both the interior of and the combustion space above the fluidised bed for lowering the operational temperature, an auxiliary fuel injection system for supplying additional fuel to raise the operational temperature, and a common bottom discharge for hydrocarbon-free drilling cuttings and mud solids.

The invention may be applied to all drilling operations where mud based lubricants are used whether land-based or off-shore.

An example of apparatus suitable for carrying out the process of the present invention is illustrated diagrammatically in the accompanying drawing.

The apparatus for carrying out the process of the present invention comprises a fluidised bed combustor 10 whereof the fluidised bed is indicated at 11. The combustor 10 is substantially

conventional in construction and has the usual start-up burner 12 to which is connected a fuel supply (not shown) by a feed line 13. A main air supply fan 14 is connected to burner 12 by a supply line 15 and provides air for combustion at start-up.

This fan 15 also provides fluidising air to the bed 11 and primary air for combustion of the hydrocarbon in the drilling cuttings or oil based mud.

An alternative start-up burner position is indicated at A. This burner would be a single burner and would fire down onto the bed at an angle of 45°.

If the hydrocarbon content in the drilling cuttings increases, secondary air, provided by a fan 23, is introduced into the combustor to provide the additional air necessary for complete combustion. The secondary fan 23 also provides the additional air required for burning the oil based mud.

If the temperature in the combustor rises above normal operating temperature, the excess heat is dissipated by injecting water directly into the bed and into the combustion space above the bed. The water injection system comprises feed lines 18 and 20 connected between a water supply (not shown) and ringmains 19 and 21 respectively from which extend injectors (not shown) directed towards the bed 11 and in the case of ringmain 21 into the upper portion of the combustor 10. An emergency water head tank 22 is provided in case of failure of the water supply.

If the temperature in the combustor falls below normal operating temperature, additional fuel is supplied by an auxiliary fuel injection system. The auxiliary fuel injection line for the combustor 10 is indicated at 16 for feeding fuel into the latter *via* a ringmain 17 and injectors (not shown).

An inlet 26 is provided for introduction of the inert particles which make-up the bed 11. Once the bed 11 has been made up this inlet 26 is closed until further making-up is necessary.

A downwardly-inclined feed inlet for contaminated drilling cuttings is indicated at 27, the drilling cuttings being delivered thereto from an open-bottomed hopper by multiple screws and a final single water-cooled screw.

A further feed inlet 28 is provided and through which the oil based mud can be pumped into the combustor.

The discharge from the combustor 10 is indicated at 29 and through this discharged decontaminated drilling cuttings or solids from the oil based mud, i.e. both free of hydrocarbon contamination.

The exhaust products of the combustor 10 which include fine materials and mud solids fines are delivered to a Venturi scrubber 30 into the top of which is fed cooling water. Separation and cooling occurs in the Venturi scrubber 30, the exhaust gases are discharged by exhaust fan 31 *via* an exhaust stack 32 to atmosphere. The solids pass into a seal pot 33 which has a drain valve 34 and overflow 35 both of which are connected to the combustor discharge 29.

The combustor 10 is usually fed with only contaminated drilling cuttings or spent oil based mud at any one instance although it is envisaged that both could be supplied at the same time.

A high pressure air line 36 is connected to water injection systems 18, 19 and service to purge the ringmain 19 and keep same clean. Similar provision is made for the auxiliary fuel supply system 16, 17 and the oil based mud inlet 28 and feed line.

In use, the contaminated drilling cuttings and/or the oil based mud is, heated in the fluidised bed 11 of the combustor 10 to burn off the diesel oil, the heated bed being composed, as aforesaid, of inert particles which are stable at the operating temperature.

To start the process of the invention the fluidised bed is heated to a suitable temperature, usually between 700 and 1000°C and the contaminated drilling cuttings and/or oil based mud then supplied into the bed.

The hydrocarbon content of the cuttings and/or mud contributes to the heat requirements of the process. The process will be either endothermic or exothermic depending on the hydrocarbon content of the feed. When the hydrocarbon content falls below the level required to maintain the operating temperature in the bed provision is made, as aforesaid, to supply additional heat, if necessary, *via* 16 and 17. Where the heat content of the hydrocarbon contaminant is in excess of process requirement combustor temperature is controlled as aforesaid, by water injection into the combustor.

The treated drilling cuttings and/or oil based mud, both freed from contaminant are discharged *via* 29, either directly or where carried by the exhaust gases after passage through the wet scrubber 30 or alternatively a dry cyclone.

If required, heat may be recovered from the exhaust gases by conventional means.

Where the treated cuttings discharge *via* the customary fluidised bed overflow they will carry with them inert material forming the original bed. Provision is made for adding fresh material but in general the treated cuttings are suitable as inert bed material and the bed is normally self sustaining.

The invention has the advantages that porosity contamination of the drilling cuttings is removed, allowing subsequent pollution free disposal and the heating value of the hydrocarbon contaminant is utilised to obtain optimum process thermal efficiency.

WHAT WE CLAIM IS:–

1. A process for de-contaminating drilling cuttings contaminated with hydrocarbon oil and/or oil-based liquid mud employed in drilling operations and contaminated with hydrocarbon oil, comprising the steps of providing a fluidised bed of inert particles, heating the fluidised bed to a predetermined operational temperature to

start up the process, delivering hydrocarbon oil-contaminated drilling cuttings down onto the surface of the heated fluidised bed or liquid mud into the heated fluidised bed whereby the hydrocarbon oil burns and contributes to the heat requirements of the process, controlling the operational temperature of the process by the addition of fuel to the fluidised bed and a temperature dissipant to both the interior of and the combustion space above the fluidised bed, and discharging hydrocarbon-free drilling cuttings or mud solids from the bottom of the fluidised bed.

2. A process according to Claim 1 comprising the step of recovering cutting fines and/or oil-based mud solids fines from exhaust gases of the process before they egress to atmosphere.

3. Apparatus for de-contaminating drilling cuttings contaminated with hydrocarbon oil or oil-based liquid mud employed in drilling operations and contaminated with hydrocarbon oil, comprising fluidised bed combustor, a fluidised bed of inert particles arranged within said combustor, a start-up burner for heating the fluidised bed to a predetermined operational temperature, a first feed inlet through which contaminated drilling cuttings can be delivered down onto the surface of the fluidised bed, a second feed inlet through which contaminated mud can be pumped into the bed, a temperature dissipating injection system including separate means for supplying water or the like to both the interior of and the combustion space above the fluidised bed for lowering the operational temperature, an auxiliary fuel injection system for supplying additional fuel to raise the operational temperature, and a common bottom discharge for hydrocarbon-free drilling cuttings and mud solids.

4. A process for decontaminating drilling cuttings contaminated with hydrocarbon oil and/or oil based mud employed in drilling operations and contaminated with hydrocarbon oil, substantially as hereinbefore described with reference to the accompanying drawing.

5. Apparatus for decontaminating drilling cuttings contaminated with hydrocarbon oil and/or oil-based mud employed in drilling operations and contaminated with hydrocarbon oil, substantially as hereinbefore described with reference to the accompanying drawings.

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1590379 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*