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(54) Method and system for degrading a foam fluid

(57) A foam drilling fluid returning from a borehole that is being drilled using a foam drilling system is degraded by injecting air or another gas into the foam at or near the wellhead.

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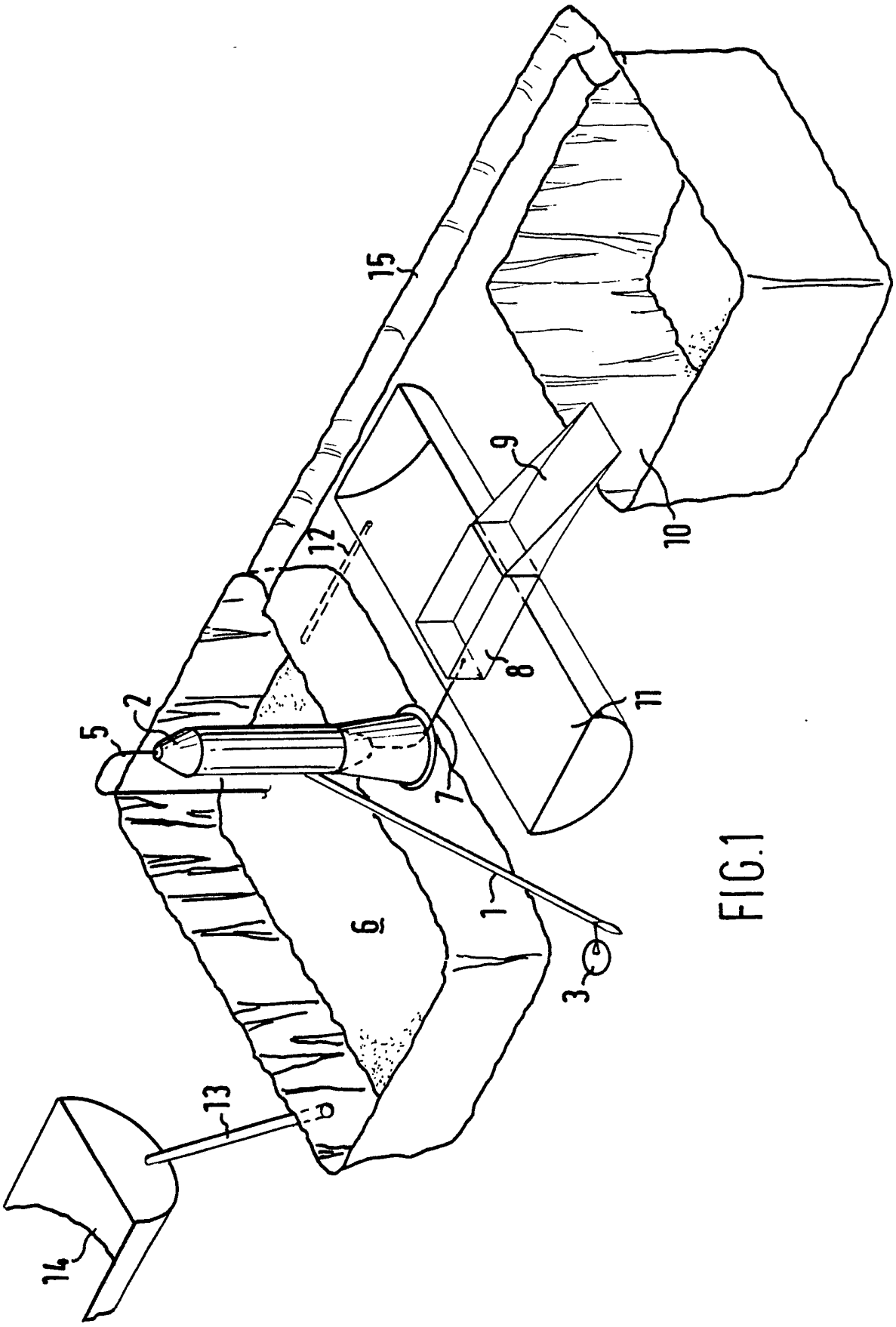

FIG.1

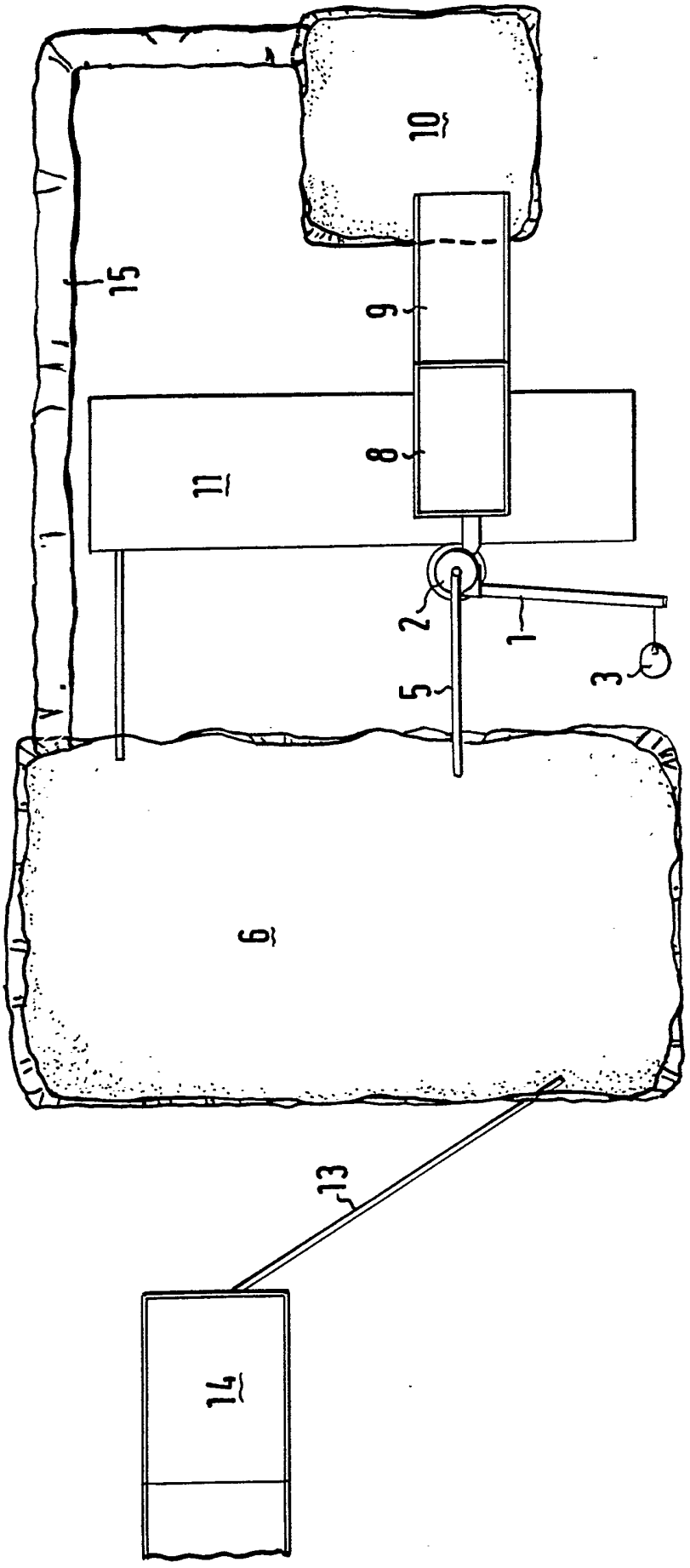

FIG.2

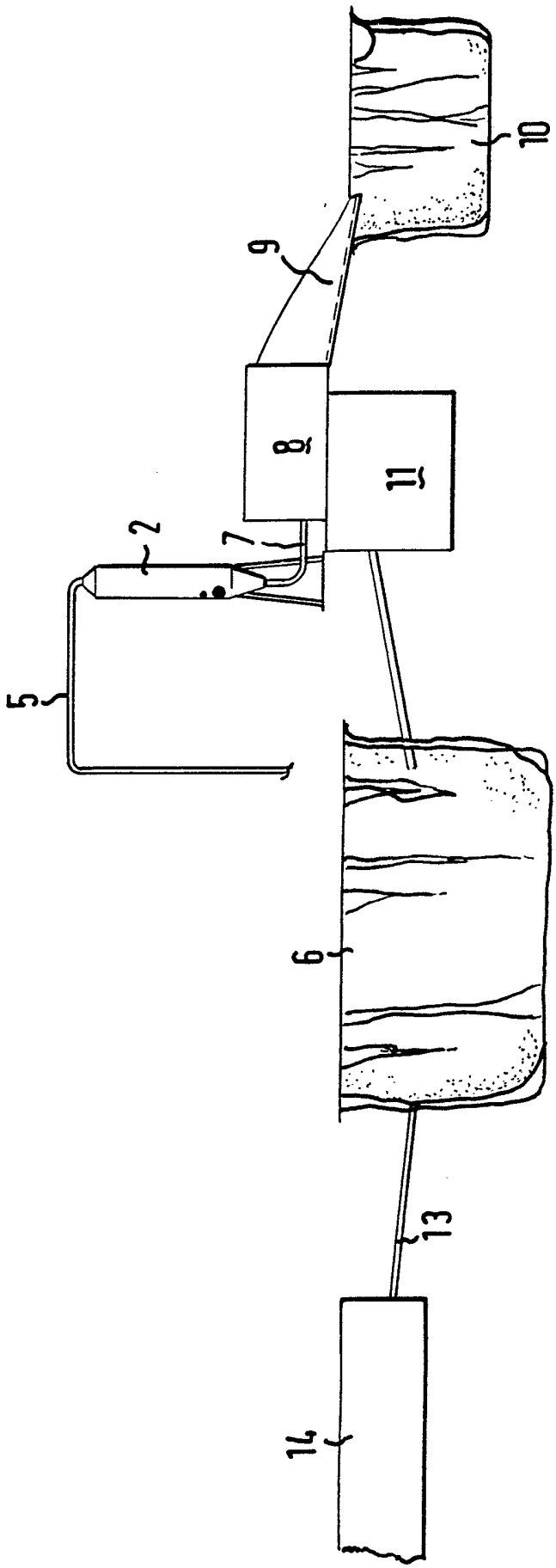

FIG.3

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METHOD AND SYSTEM FOR DEGRADING A FOAM FLUID

The invention relates to a method and a system for degrading a foam fluid returning from a borehole that is being drilled using a foam drilling system.

Stable foam is a drilling fluid made typically from a surfactant-water solution in which air or another gas is completely dispersed. The liquid forms the continuous phase of this mixture and the air forms the discontinuous phase. When the proper balance of liquid and air is achieved, the liquid forms a molecularly thin film around the air bubbles. Drilling with a foam, instead of mud, has many advantages. For instance, penetration rates are higher than mud, and foam can be cheaper in large diameter holes than air drilling because of the large air volumes required, moreover foam has a high carry capacity and therefore good hole cleaning is achieved at low annular velocity.

Foam can also handle large volumes of produced fluids and if gas is produced, the incapsulation of the gas by the liquid renders the mixture non-flammable until the gas is released in the sump.

Furthermore, foam has a low heat capacity and poor heat conductance compared to mud. These qualities make foam an excellent fluid to drill permafrost.

However, major disadvantages of existing foam drilling system systems are that after returning to the surface the foam must be de-aerated for its proper handling by the pumps and that an extremely large pit is required to contain the foam to allow sufficient room for cuttings and for the foam to dissipate.

The invention as claimed is intended to remedy these drawbacks of the known foam drilling systems.

Accordingly it is an object of the present invention to provide a method and a system for degrading a foam fluid returning

from a borehole so as to reduce the size of sumps required for disposal.

The method according to the invention comprises the step of injecting a gas into the foam fluid as it flows from the wellhead of the borehole being drilled to fluid treatment facilities.

The system according to the invention comprises means for injecting a gas into the foam fluid at a location between the wellhead of the borehole being drilled and fluid treatment facilities.

Preferably the injected gas is air which is injected into the blooie line via which the fluid mixture is injected into a gas buster vessel. The gas buster vessel may comprise at the top thereof a gas outlet and at the bottom thereof an outlet for draining liquid and drill cuttings into a shale shaker.

In the method according to the invention the injected gas suppresses and breaks the foam to such an extent that a gas buster can separate the gas from the foam. The exact mechanism for this is unknown, but field experience has shown that the method provides very successfull degradation of the foam.

Field experience has further shown that the liquid extracted from the degraded foam is very attractive for being reused for creating a foam drilling system because of the presence of natural gels which provide a foam with a high viscosity and good lifting capacity. A further advantage of the quick degradation of the foam is that it reduces the surfactant usage thereby saving both chemical and disposel costs.

These and other objects and advantages of the method and system according to the invention will be evident from the following detailed description read in conjunction with the accompanying drawings, in which:

Figure 1 is a perspective view of a system according to the invention,

Figure 2 is a top view of the system shown in Fig. 1, and

Figure 3 is a side view of the system shown in Fig. 1.

Referring now to Figures 1, 2 and 3, there is shown a system for treating and purifying a foamy drilling fluid returning from a borehole. The system comprises a blooie line 1 extending between a wellhead (not shown) and a gas buster vessel 2. Air is injected into the blooie line 1 by an air compressor unit 3.

The injected air suppresses and degrades the foam to such an extent that in the gas buster vessel 2 the free air can be separated from the liquid and solid components of the returning drilling fluid mixture.

The blooie line 1 has in downstream direction a downwardly directed slant orientation and is connected substantially tangentially to the cylindrical gas buster vessel 2. The gas buster vessel 2 is equipped at its top with a gas exhaust conduit 5 which has a downstream end located above a flare pit 6 in which any surge of remaining foam or liquids from the vessel 2 can be collected.

At the lower end of the gas buster vessel a liquid drainage pipe 7 is arranged via which the sludge of liquids and drill cuttings is passed into a shale shaker 8. Drill cuttings are discharged from the shaker 8 via a shaker slide 9 into a shale pit 10 whereas liquids and a remaining small amount of foam drain through the bottom of the shaker into a shaker tank 11. By proper placement of the overflow conduit 12 the tank 11 only discharges a water-surfactant mixture into the flare pit 6 while said remaining foam breaks down in the shaker tank 11.

If desired a second settling tank (not shown) may be arranged between the shaker tank 11 and flare pit 6 for accomplishing increased removal of fines. Any remaining fines settle down in the flare pit 6 so that only water, colloidal clay particles (gels) and surfactants are fed via the overflow 13 to the liquid storage tank 14 from which the liquid is recycled to the injection pumps and compressors used for foam (re-)generation.

The reused fluid contains natural gels and experience has shown that this "dirty" foam fluid produces a foam with higher viscosity with improved lifting capacity. Reusing the fluid reduces

the surfactant usage saving on both chemical and disposal costs. Use of the industry standard half life foam measurement for reused foam was found inadequate. Half life, the time required for half of the liquid to settle out of a sample foam, is reduced by the natural solids in the system but increased viscosity offsets this reduction. A viscosity measurement obtained from a dropping ball test was successful as a measurement of the reused foams ability to clean the hole.

As illustrated the flare pit 6 and shale pit 10 are interconnected by an overflow trough 15 in order to avoid any seepage of chemicals into the environment in case one of the pits tends to overflow. If necessary the bottom and walls of the pits 6, 10 and overflow 15 may be covered by plastic sheaths in order to avoid any contamination of ground water.

If desired, the pits 6 and 10 may be replaced by open or closed tanks so that a closed circuit is created and any chance of airborne or other contamination of the environment is eliminated.

The key to the system according to the invention is the injection of air, or another suitable gas, into the foam at or near the wellhead. The injected air degrades the foam so that the gasbuster vessel 2 can effectively separate a majority of the air from the foam, while the remaining, if any, small amount of foam can be passed over a shale shaker 8 into the shaker tank 11 where the foam dissipates.

C L A I M S

1. A method for degrading a foam fluid emanating from a borehole that is being drilled by means of a foam drilling system, the method comprising the step of injecting a gas into the foam fluid as it flows from a wellhead of the borehole being drilled to fluid treatment facilities.

2. The method of claim 1, wherein the gas is air.

3. The method of claim 1 or 2, wherein the gas is injected into the foam as it flows through a flowline extending between the wellhead and a gasbuster comprising of a vessel from which top gas is removed and from which bottom liquid and drill cuttings are discharged into a shale shaker.

4. The method of claim 3 wherein the drill cuttings are removed from the shale shaker via a shale slide into a shale pit whilst the liquid is discharged from the shale shaker via a shaker tank into a flare pit.

5. A system for degrading a foam fluid emanating from a borehole that is being drilled means of foam drilling comprising means for injecting a gas into the foam fluid at a location between the wellhead of the borehole being drilled and fluid treatment facilities.

6. The system of claim 5 wherein the gas injection means comprise a gas compressor unit and a gas flow regulating device.

7. The system of claim 5 or 6 wherein the gas injection means are connected to a flowline extending between the wellhead and a gas buster vessel comprising at its top a gas outlet and at its bottom an outlet for draining liquid and drill cuttings into a shale shaker.

8. The system of claim 7 wherein said flowline has a slant downwardly directed orientation.

9. The system of claim 8 wherein the flowline is the blooie line.

10. The system of claim 7 wherein the vessel has a vertically oriented tubular shape and said flowline has an outlet which passes in a substantially tangential direction through the wall of the vessel.

11. The system of claim 7 wherein the shale shaker comprises a shale slide for discharging drill cuttings into a shale pit and a liquid discharge which is located above a shaker tank.

12. The system of claim 11 wherein the shaker tank comprises a liquid outlet for discharging liquid into a flare pit.

13. The system of claim 12 wherein the gas outlet of the gas separation vessel comprises an exhaust pipe having a discharge outlet which is located above the flare pit.

14. The system of claim 12 wherein the shale pit and the flare pit are interconnected by an overflow trough.

15. A method for degrading a foam fluid according to claim 1, substantially as described with reference to the accompanying drawings.

16. A system for degrading a foam fluid according to claim 5, substantially as described with reference to the accompanying drawings.

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