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J. E. BOWDEN ETAL
VORTEX TYPE RECONDITIONER AND RECONDITIONING
METHOD FOR USED DRILLING MUD

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2 Sheets-Sheet 1

Fig. 6

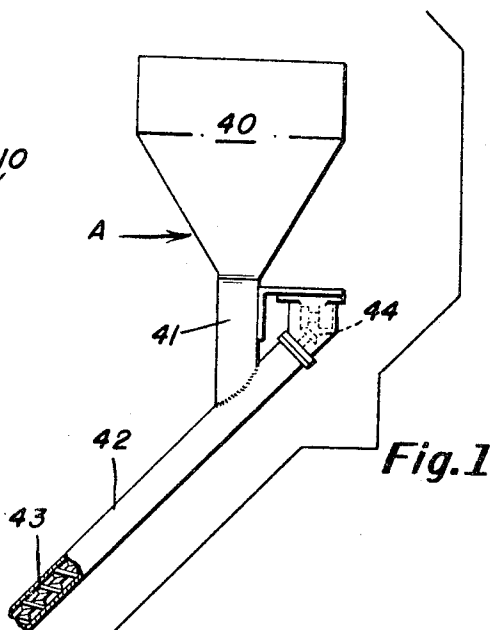
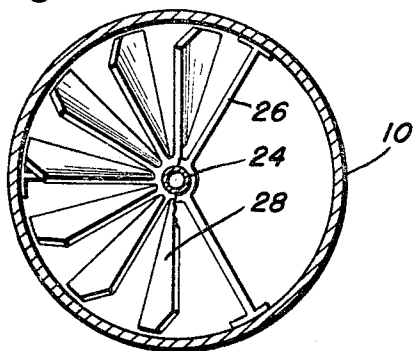


Fig. 1

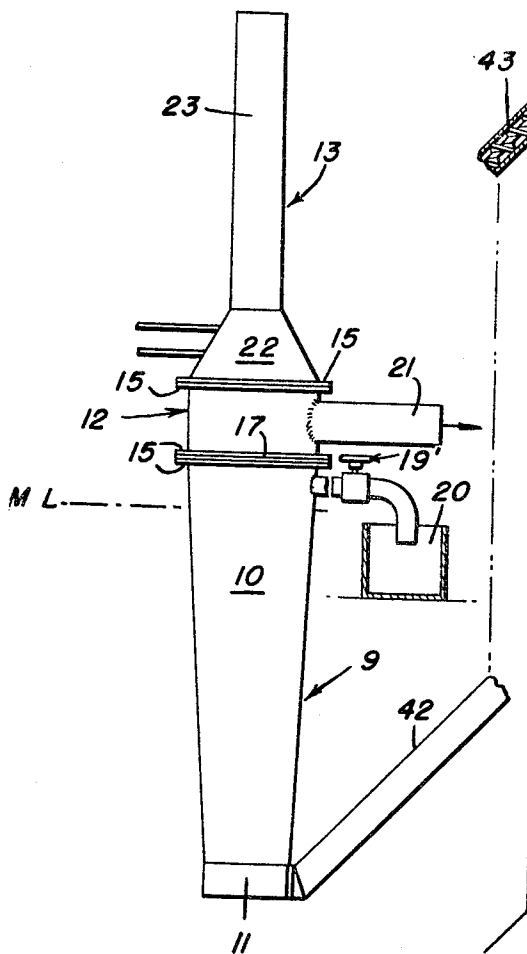
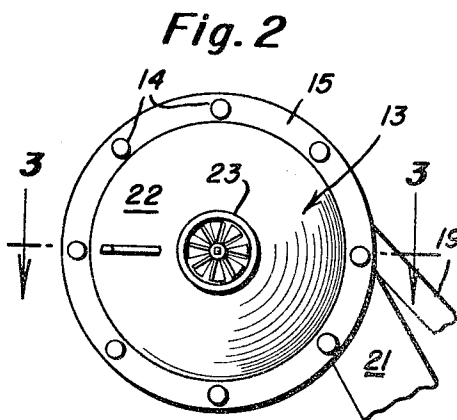


Fig. 2



J. E. Bowden
Cornelius G. Lynch
INVENTORS

BY
John A. Mawhinney

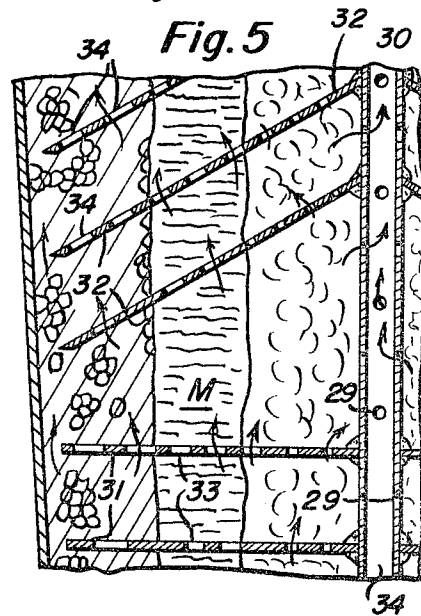
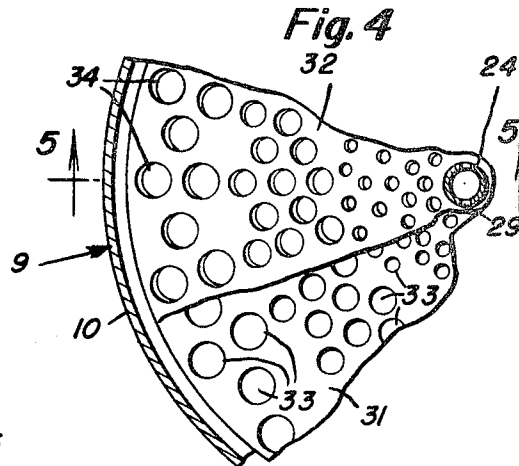
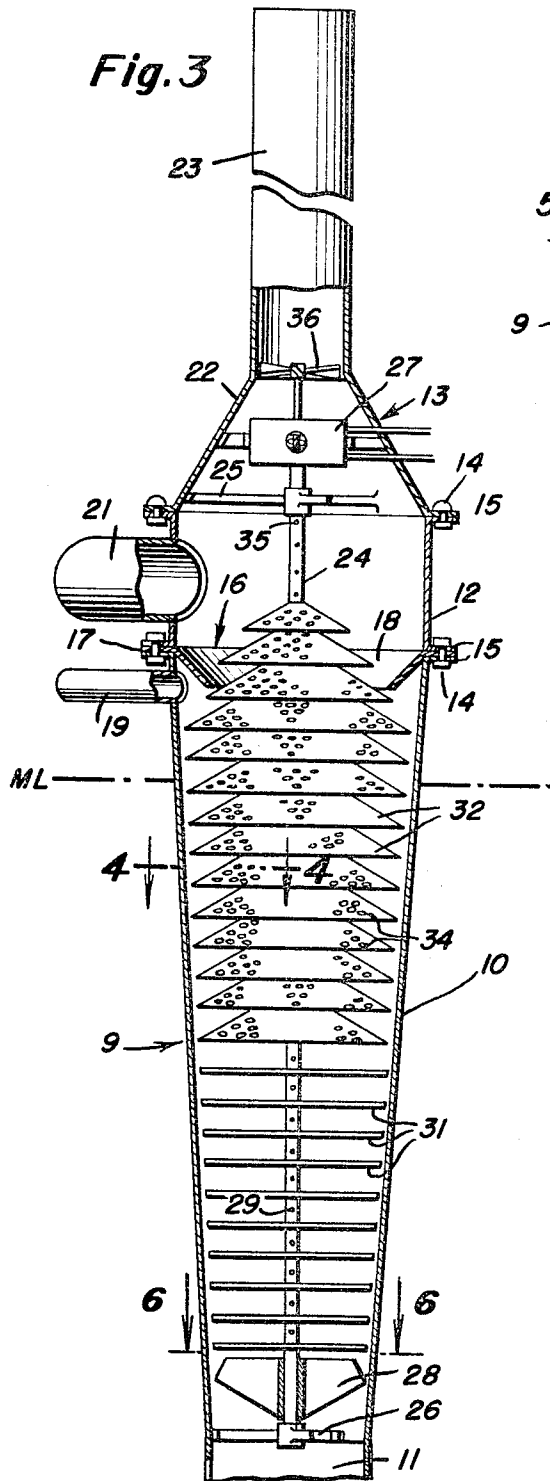
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J. E. Bowden
Cornelius G. Lynch
INVENTOR.S

BY
John A. Mawhinney

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VORTEX TYPE RECONDITIONER AND RECONDITIONING METHOD FOR USED DRILLING MUD

J. E. Bowden and Cornelius G. Lynch, Hobbs, N. Mex.,
assignors to Vortex Tool & Manufacturing Co., Odessa,
Tex., a corporation of Texas

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9 Claims. (Cl. 55—52)

This invention relates to a vortex type reconditioner for and method of reconditioning used drilling mud, that is, an apparatus and method which will desand and degas the drilling mud so that it may be satisfactorily reused with considerable saving in operation.

One desideratum of the invention is to provide a device of such character that will especially coact with a unit or accessory apparatus which supplies one or more desired additives to the drilling mud so as to be admixed therewith during reconditioning, thus simultaneously reconditioning the used mud and incorporating the additive matter in the mud.

One object is to provide means which attains the ends sought by the invention through velocity, vorticity or travel of the mud of the used objectionable mud.

A second object is to effect operation and method basically through centrifugal force.

A third object is to provide novel rotatable disk and receptacle means for imparting the vorticity to the used mud so as to effectively remove bubbles, gas, heavy and undesirable sand, resilient and abrasive substances and particles and the like, that is desand and degas the used drilling mud in the terms used in the art, it being understood that this meaning is to be given such terms desand and degas wherever used in this specification.

A fourth object of the invention is to provide novel means for the admixture, in carrying out the process, of the used mud in such a way that the undesired components are removed and additives when desired are incorporated intimately and mixed uniformly throughout the reconditioned mud.

A fifth object is to provide means and method to desand and degas the used mud in such manner as will increase the efficiency and extend the life of, both the conditioner proper and associated parts employed.

Various additional objects and advantages will become apparent from a consideration of the description following taken in connection with the accompanying drawings illustrating by way of example one operative form of the apparatus.

In said drawings:

FIGURE 1 is a view in elevation of the improved used drilling mud reconditioner, in association with accessory apparatus for mixing and/or supplying additives to the base of the reconditioner, the latter being shown broken away and partly in section;

FIGURE 2 is a plan view of the mud reconditioner;

FIGURE 3 is a view taken at 90 degrees with respect to FIGURE 1, showing the reconditioner, with the parts partly in vertical section so as to disclose interior details;

FIGURE 4 is an enlarged cross-sectional view taken approximately on the line 4—4 of FIGURE 3;

FIGURE 5 is a vertical sectional view taken on the line 5—5 of FIGURE 4; and

FIGURE 6 is a horizontal sectional view taken on the line 6—6 of FIGURE 3.

Referring specifically to the drawings, wherein like reference characters designate like or similar parts, 9 designates an upwardly flaring frusto-conical receptacle, hopper or vessel which is disposed upright in a pit of used drilling mud extending well below the level of such

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mud as indicated at ML and into which pit such used drilling mud is discharged and usually discarded after functioning in an oil well or the like. Such drilling mud according to the present invention will enter the receptacle 9 through the open lower end of a main section 10 as at 11.

Said receptacle 9 also has an intermediate section 12 and a top or hood section 13, said sections 10, 12 and 13 are suitably connected together as by means of rivets or bolts 14 extending through outwardly extending flanges 15 on such sections. It will be noted that an arrestor or deflector 16 for undesired sands or other solids is secured in place by a flange 17 through which the lowermost rivets or bolts 14 also pass.

Said arrestor or deflector 16, it will be noticed, is generally of ring shape and has an inwardly and downwardly extending wall 18. Extending away from section 9 close to said deflector 16 is an outlet or discharge pipe 19 for the undesired sands or solids which travel upward on the inner surface of the main section 10. Pipe 19 has a control valve 19' therein and leads to a suitable trough or the equivalent 20.

It will be noted that the main wall of the section 12 is a true cylinder and that a discharge pipe 21 for reconditioned drilling mud leads therefrom to any desired location or apparatus for reuse.

Section 13 has a frusto-conical hood portion 22 from which chimney 23 rises to liberate gases into the atmosphere.

Axially disposed within the receptacle 10 is a vertical shaft 24 which is rotatably mounted in a spider bearing 25 of section 13 and another spider bearing 26 of the section 10 adjacent the base of the latter. Such shaft is rotatably driven by any desired means, for instance by a motor 27 of the electric, hydraulic or other suitable type. Shaft 24 is closed at both ends but otherwise has a hollow bore or channel 30.

On shaft 24 within receptacle 10 adjacent its base and above spider bearing 26 a suitable impeller 28 is fixed (FIGURES 3 and 6). Such impeller is operated at high velocity and pumps or moves the entering used drilling mud from the pit at the inlet 11 in an upward direction thoroughly admixing the constituents of the spent drilling mud so as to thoroughly agitate the same and move it upwardly and centrifugally outwardly first as flat layers and then in simulation of a vortex with liberation of bubbles, gases and the like which, through openings or perforations 29, enter the said bore or interior channel 30 of the shaft 24. The admixing and agitation of the spent drilling mud is enhanced by a series of preferably flat discs 31 carried by the hollow shaft 24 within the lower part of section 10. Above the discs 31 are a series of conical discs 32. All discs 31 and 32 are perforated as shown respectively at 33 and 34, so that the centrifugal and vortex action of the mud causes constant squeezing of portions of the mud there-through; the perforations of each disc 31 and 32 being largest at the periphery of the disc and preferably gradually diminishing in size toward their centers or axis of rotation of shaft 24 as well shown in FIGURES 4 and 5.

It will be noted that a number of the three uppermost conical discs 32 may diminish progressively in size and extend into the intermediate section 12 of the receptacle but without closing the central opening of deflector 16. The bubbles and gas from the used mud M will be liberated above the uppermost discs 32 from the hollow 30 of shaft 24 through ports or openings 35, such gas rising into the top section 13 and being liberated at chimney 23 into the atmosphere accelerated by an eduction fan 36 suitably driven by the motor 27.

Presuming operation of the parts and method described, the lower portion of the drilling mud reconditioner is

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submerged in a pit of used drilling mud to be reconditioned as to the level suggested by the dot-dash lines ML in FIGURES 1 and 3. The motor 27 under appropriate control rotates the hollow shaft 24 at high velocity and the spent drilling mud which enters the receptacle 9 through its lower end 11 is moved or pumped upwardly through the action of the impeller 28. A mixing action and agitation of such used drilling mud is effected as it moves upwardly, first through the action of the discs 31 and then through the action of the discs 32. The centrifugal force to which the drilling mud M being reconditioned is thus subjected throws the heavier and undesirable material or sand against the inner surface of section 10 and its upward movement will be arrested and deflected by deflector 16 into discharge pipe 19, under appropriate control by the valve 19¹, for discard into the trough 20 or other suitable dump. Such agitation and mixing action applied to the used drilling mud M during its said upward travel will also liberate the bubbles and gases into the atmosphere by reason of the openings or ports 29, bore 30, openings 35, and sections 12 and 13 accelerated by the chimney 23 and educing action of fan 36.

Particular attention is called to the fact that because of the inward size graduation of the ports, holes or openings 33 and 34, fracture of the larger sands is minimized and their upward travel through or past the discs 31 and 32 is facilitated and enhanced without interfering with the centrifugal treatment of the used mud in their flat layers by discs 31, and centrifugal and vortex force of discs 32 whose conicity facilitates fall of sand by gravity therefrom.

Reference is now again made to FIGURE 1 and particularly to the accessory apparatus generally designated A as it coacts with the reconditioner since the latter is of a construction which greatly facilitates admixture of one or more additive materials with the used drilling mud while being reconditioned, that is, while the sands and gases are in the process of removal. Of course, any desired additives may be supplied through the open lower end of the receptacle 10, and being for instance bentonites and other clays, various chemicals, starches, water-loss conditioners, thinning agents, detergents and the like. More in detail, the auxiliary apparatus A may have a hopper 40 at its top to receive the additive and in which additives may be admixed and from which additive material travels downwardly through piping 41 and 42 to or adjacent said open end 11. The feed of the additive is preferably enhanced by a rotatable auger or screw 43 which extends the full length of the piping 42 and is preferably driven by any suitable conventional power unit as suggested at 44.

It will thus be seen when the auxiliary apparatus A is used, the additive is incorporated into the used drilling mud while actually in the process of the latter being reconditioned, and that at the end of the reconditioning cycle, the objectionable heavy solids and gases will not only have been removed but that the drilling mud reconditioned and containing any additive or additives desired, the reconditioned mud will rise through the central opening of the arrestor or deflector 18 and discharge through the pipe or conduit 21 to storage or to the place of reuse.

Various changes may be made within the spirit and scope of the invention as defined by the appended claims.

We claim:

1. The method of reconditioning used drilling mud in a conical shaped vessel in atmospheric communication adjacent its top comprising the steps of introducing the mud in fluid state into said conical shaped vessel through the smaller bottom end thereof while the vessel has at least half of its vertical height immersed in a tank of the used drilling mud and pumping the used fluid drilling mud in said vessel with a rotating, swirling and upward motion, accelerating the rotating swirling motion of the fluid mud

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by rapidly rotating perforated conical discs positioned with their concave sides facing downwardly to subject the mud to centrifugal action so that the heavier particles are flattened against the outwardly tapered wall of the conical vessel and separated from the mud, said heavier particles moving outwardly and upwardly while held against the conical wall of the vessel by centrifugal force, directing the separated heavier particles against a catch ring projecting across the path of the ascending particles adjacent the upper end of the conical vessel to arrest the upward movement of said particles, expelling these arrested particles from the vessel through outlet means positioned adjacent to and below said catch ring, said rapidly rotating discs creating a vortex with a void at substantially the transverse center of the vessel and causing the liberation of the gas from the mud so that the liberated gas moves into the void and upwardly through the perforations in the discs, discharging the liberated gas from the vessel into the atmosphere adjacent the top of the vessel, and recovering the reconditioned mud for reuse.

2. The method of degassing and desanding used drilling mud as claimed in claim 1 comprising the further step of impelling an additive with the used mud upwardly with said vortex action.

3. The method according to claim 1 wherein gases in the mud are liberated during the upward movement of the mud.

4. Reconditioning apparatus for used drilling mud comprising a receptacle communicating adjacent its top with the atmosphere and open adjacent its lower end, a high speed rotary shaft within said receptacle, impeller means on said shaft for introducing the used mud into the receptacle through the open lower end of the receptacle, disc means rotatable with said shaft and above said impeller means to subject the mud to centrifugal force to cause the mud to be moved outwardly and upwardly towards the wall of the receptacle so that the sand entrained with the mud is thrown against the wall of the receptacle and upwardly along the wall, means for arresting said sand, outlet means below said arresting means for discharging said arrested sand, said rotation of the disc means producing a void at the center of the receptacle and permitting the gas in the mud to escape and flow into and upwardly in the void to the atmosphere, and means for recovery from the receptacle the reconditioned drilling mud above said arresting means.

5. A reconditioner according to claim 4 in which said receptacle has a lower portion which tapers outwardly in an upward direction and said lower arresting means is adjacent the top of said portion.

6. Reconditioning apparatus for used drilling mud comprising a receptacle open at both ends and having a main upwardly extending section, an intermediate section and a hood section, means securing said sections in alignment, a shaft generally axially with respect to said sections and located primarily in the main and intermediate sections mounted to rotate at high velocity, an impeller on said shaft at the base of the main section to introduce the used mud into the receptacle, means rotatable by said shaft comprising a series of discs above said impeller to subject the impelled used drilling mud to centrifugal force so that the sands entrained in the mud will be thrown outwardly and upwardly to separate the sands from the mud and to form a void at the center of the receptacle and permitting the gas in the mud to escape and flow into and upwardly in the void, a deflector adjacent the junction of the main and intermediate sections for arresting the separated sands, outlet means for the sands from the main section adjacent said deflector, said deflector being centrally open for rising therethrough of the reconditioned mud from which the sands and gas have been removed, means for the outlet of the reconditioned mud from said intermediate section, and said hood section being open for

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liberation of gases from said void into the atmosphere.

7. Apparatus according to claim 6 wherein the main section tapers upwardly and outwardly so that the upper end of the main section has a diameter substantially twice that of the lower end of said main section.

8. Apparatus according to claim 6 wherein said discs consist of a lower series and an upper series, the discs of the lower series being flat and the discs of the upper series being conical, the discs of both series being perforated, said shaft having a hollow portion with gas receiving openings and also with gas outlet openings above the first-mentioned openings communicating with the interior of the intermediate section.

9. Apparatus according to claim 6, wherein said discs have multitudinous perforations, said perforations being largest in size adjacent the periphery of the discs and decreasing in size in the direction of the axis of rotation for the disc.

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REUBEN FRIEDMAN, *Primary Examiner.*

C. N. HART, B. NOZICK, *Assistant Examiners.*