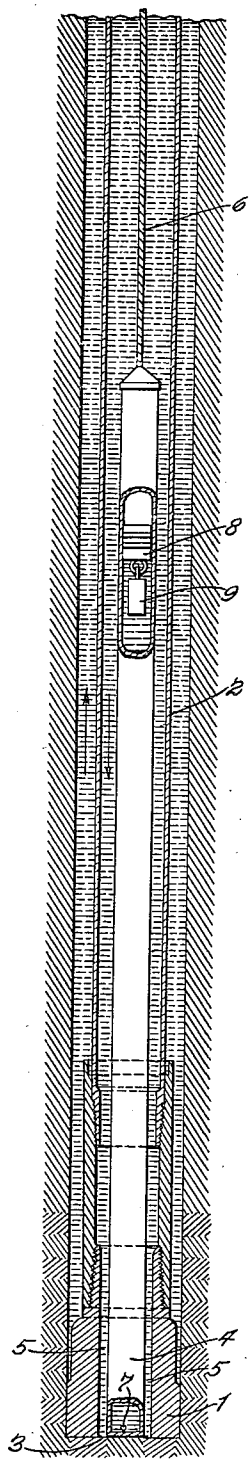
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WELL DRILLING MUD CONDITIONER AND METHOD

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WELL DRILLING MUD CONDITIONER AND METHOD

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This invention relates generally to the drilling of oil and gas wells and particularly to a process of drilling such wells whereby the difficulties encountered in drilling certain formations are minimized.

In the drilling of oil and gas wells through formations containing strata of colloidal or gel forming matter in which the conventional rotary method of drilling is employed, the colloidal or gel forming matter from the formation being drilled is taken up by the clay laden fluid and, in the course of being carried out by the well, hydrates to an extent such as to produce increases in viscosity and other disadvantageous characteristics. This action of the cuttings is experienced particularly in the so-called heaving shale formations which contain varying percentages of bentonitic matter.

While it has been customary to condition the mud or clay laden fluid employed in rotary drilling by adding thereto suitable chemicals, of which there are great variety, which act as mud-conditioning agents either to reduce the viscosity of the mud or improve other characteristics to a large extent, these mud-conditioning agents are such as to become "spent" after they have been exposed to the water in the mud for a comparatively brief period of time and consequently in many cases these mud-conditioning agents, although effective to accomplish the intended purpose in the mud at the time of treatment, are not effective to overcome the properties of the colloidal matter taken up from the formation being drilled.

It is an object of the present invention, generally stated, to provide a process of drilling in which the mud-conditioning agent will be rendered effective upon the colloidal matter and other cuttings taken up by the mud from the formation being drilled.

A further object of the invention is to provide a process in drilling oil or gas wells in which the characteristics of the outcoming mud stream are maintained substantially equivalent to the characteristics of the ingoing mud stream.

Another object of the invention is to provide an apparatus suitable for feeding chemicals adjacent the bit of a drilling apparatus, such as employed in the drilling of oil and gas wells.

Other objects will become apparent to those skilled in the art when the following description is read in connection with the accompanying drawing, in which the single figure is a sectional view showing a typical earth formation with a bore hole therein and the drilling apparatus in position in the hole.

In accordance with the present invention, generally stated, chemicals, such for instance as mud-conditioning agents, are discharged in the bore hole adjacent the point of the bit. When a chemical, such as a mud-conditioning agent, is discharged adjacent the point of the bit it is effective to treat the cuttings, such for instance as those containing bentonitic or other colloidal components and immediately overcome or minimize the disadvantageous properties of those components which would otherwise be experienced in the outgoing mud stream.

For example, in the so-called heaving shale formations found in the Gulf Coast of Texas and Louisiana oil fields, the shale contains a substantial percentage of bentonitic matter which, upon hydration, substantially increases the viscosity of the mud in the outgoing mud stream and thus necessitates greater pumping effort in order to maintain circulation in the well. Moreover, such increases in viscosity render the mud stream more susceptible to gas cutting, and, consequently while the mud may be properly conditioned for excellent functioning while it is on the outside of the hole and before it reaches the bit, the outgoing mud stream is not properly conditioned and difficulties may arise due to the change of characteristics in the mud on account of the entrained colloidal matter which has been taken up from the formation at the bit.

In accordance with the present invention, therefore, a supply of one of the well known mud-conditioning compounds may be provided at the bottom of the well and held in position so as to feed the compound adjacent the cutting edges of the bit whereat it is available for immediate reaction or treatment of the components taken up from the formation and which would otherwise change the characteristics of the mud.

The present invention is not limited in its application to the treatment of bentonitic or other colloidal matter encountered in the hole for the reduction of viscosity, but is usable in other relations as, for instance, to overcome the familiar "balling-up" of a bit which frequently occurs in drilling the so-called "Gumbo" formations. Likewise in drilling through producing sand formations it frequently happens that a cake of drilling mud components is built up upon the wall of the bore hole to such an extent as to prevent the oil from flowing in. When this condition is encountered it is often desirable to remove the cake of mud components from the wall of the

bore hole at the producing sand region. In order to accomplish this in accordance with the present invention a chemical is introduced adjacent the operating edges of the bit, a chemical being employed which is capable of destroying the cake built up upon the formation, and, consequently the local destruction of the cake is made possible without injuring the cake in other regions in the hole and without severely affecting the mud.

Any suitable apparatus may be employed for carrying out the process of the present invention so long as provision is made for discharging an active chemical adjacent the bit. A particularly convenient apparatus, however, comprises a suitable reservoir for containing the chemical to be applied together with a means for regulating the discharge of the chemical from the reservoir as the drilling proceeds. The apparatus may form a part of the drill or may be independently removable with reference to the drill.

As an illustrative embodiment of the present invention the independently removable type of apparatus will be described. Referring to the drawing, a typical soft formation bit 1 is provided at the lower end of a string of drill pipe 2. The drill 1 is provided with a central opening 3 arranged to receive a barrel 4. The barrel 4 may function as the reservoir for the chemical treating compound and it will be understood, of course, that between the outer surface of barrel 4 and the inner surface of bit 1, passageways 5 are provided to permit the circulation of drilling fluid therethrough.

In accordance with this embodiment of the present invention, the barrel 4 may be provided at its upper end with a suitable cable 6 for elevating the same out of the hole when it is desired, for instance, to replenish the supply of chemical in barrel 4. The arrangement is comparable to the conventional wire line core barrel insofar as barrel 4 may be removed from the position shown, independently of bit 1.

At the lower end of barrel 4 one or more orifices 7 may be provided. In a convenient form of apparatus the size of the orifices 7 may be adjusted in any desired manner in order to control the feed of the chemical out of barrel 4.

In order to insure discharge of the chemical from the barrel 4, suitable means for forcing the same therefrom may be provided. In the embodiment shown a gravity-operated plunger 8 longitudinally movable on the interior of the barrel 4 may be provided. Such a plunger may be provided with a weighting element 9 and provision may be made for varying the weight of element 9. In the latter event the weight of the element 9 may be coordinated with the size of orifice 7 in order to accomplish discharge of the chemical into the well at a rate predetermined in accordance with the characteristics of the formation being drilled and the characteristics of the chemical being applied.

From the foregoing description it will be apparent that the present invention accomplishes its objects and that a process of drilling oil and gas wells is provided whereby various difficulties encountered in drilling operations particularly in drilling through shale formations may be obviated by the introduction of appropriate chemical treating compounds at the bottom of the hole. The characteristics of the formation being penetrated are generally known ahead of time and from past experience the drilling difficulties may be forecast. Accordingly by the selection of appropriate chemical compounds whose known action is such as to overcome or minimize the forecast difficulties and by introducing them at the bottom of the hole adjacent the point where they are taken up by the mud stream the effect of such compounds upon the characteristics of the mud is obviated or minimized.

While the invention is particularly applicable and has been described with particular reference to the treatment of the mud stream, it will be understood that the chemical may be one which acts upon the formation to facilitate drilling, as for example an acid capable of reacting with and softening the rock of the formation such as limestone, chalk or calcite.

While in the foregoing description reference has been made to several specific applications of the process of the present invention for overcoming illustrative drilling problems, it is not to be understood that the process of the present invention is limited to those applications which have been specifically mentioned herein, but, on the contrary, that it is applicable at the large to conditions encountered in drilling where the characteristics of the formation being penetrated has either a deleterious action upon the mud or reduces the efficiency of drilling operation. It is to be distinctly understood, therefore, that such applications of the process of the present invention, or the carrying out of the same by apparatus other than that disclosed herein, or such other modifications or the use of such individual features or the subcombinations of such features of the present invention which do not depart from the spirit thereof are, although not specifically described herein, contemplated by and within the scope of the appended claims.

Having thus described the invention, what is claimed is:

1. In the art of rotary drilling oil and gas wells, the process comprising, circulating a drilling fluid in the bore hole and about a bit, maintaining a supply of drilling fluid conditioning agent in proximity to the bit, and gradually feeding the drilling fluid conditioning agent from said supply into said drilling fluid as the drilling progresses.

2. In the art of drilling oil and gas wells, the process comprising, penetrating a formation with a drill, circulating a drilling mud about the drill, maintaining a segregated supply of mud conditioning chemical adjacent the point of drilling, and gradually releasing the chemical from the segregated supply into the mud stream adjacent the point of drilling.

3. The combination with a bit for drilling earth formations, of an enclosed barrel, means for discharging the contents of the barrel gradually adjacent the point of the bit, and means for withdrawing the barrel independently of the bit while the bit remains in a hole in the earth.

4. The combination with a bit for drilling earth formations, of an enclosed barrel, means for discharging the contents of the barrel gradually adjacent the point of the bit, means for forcing the contents from the barrel, and means for withdrawing the barrel independently of the bit while the bit remains in a hole in the earth.

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