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WELL DRILLING MUD AND THE METHOD OF MAKING THE SAME

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The present invention relates to the oil and gas well drilling art and more specifically to mud-laden fluids used in the drilling of oil and gas wells.

Heretofore, mud-laden fluids have been utilized in gas and oil well drilling operations for the purpose of performing a number of desired functions and obtaining certain desired and advantageous results. Principally these functions obtained by the use of mud-laden fluids are as follows:

(*a*) To lubricate and cool drill stems and drill bits in the bore holes;

(*b*) To pick up cuttings produced by the drill bit and conduct them to the surface through the bore hole;

(*c*) To plaster or form a thin filter cake or coating on the walls of the bore hole to reduce water loss and softening of the bore hole walls; and

(*d*) To furnish a hydrostatic head pressure in the bore hole preventing flow into the hole of formation fluid from the various strata as penetrated by the drill bit.

The advantages of the present invention as they relate to the above enumerated functions of gas and oil well mud will become more readily apparent hereinafter as they are specifically set forth in the following disclosures.

It is a principal object of the present invention to provide a new and improved mud composition for use in oil and gas wells which is obtained through the practice of a new and unique method of manufacture of the mud from a plurality of mineral ingredients.

Another object of this invention is the provision of a new and improved mud composition for use in oil and gas wells which consists of a homogeneous mixture of quantities of magnetite and micaceous material which mixture is dispersible or suspensible in a fluid vehicle to form a mud-laden fluid.

A further object of this invention is the provision of a new and improved mud for oil and gas wells which has the specific advantages of: non-abrasive characteristic; increased shear strength; increased filtering qualities; and greater stability against separation of ingredients.

Still another object of this invention is the provision of a new and improved mud of the type described which, by reason of its increased shear strength, serves more efficiently to pick up and conduct cuttings vertically through the bore hole and to maintain such cuttings in elevated positions within the hole when rotation of the drill is stopped during periods of temporary shutdown.

Another and further advantage of this invention is the provision of a mud composition of the type hereinbefore described which has an inherently improved filtering characteristic which results in the thin formation of a wall coat or plaster within the bore hole which increases the reduction of water loss and serves to maintain head pressure within the bore hole more effectively and efficiently than has been heretofore attained.

Still a further object of this invention is the provision of a new and improved drilling mud of the type hereinbefore described which, by reason of its homogeneous non-separating character adapts it to a new and unique

viscosity control attained by subjecting the drilling fluid containing the new mud to direct and alternating electrical fields to increase and decrease respectively the viscosity and flocculation characteristics of the fluid.

Still another and important object of this invention is the provision of a new and improved method for compounding a mud for suspension in an oil and gas well sealing fluid which consists in the simultaneous grinding of raw, bulk magnetic and micaceous material to produce a composition of finely divided particles composed of micaceous material uniformly impregnated with magnetite which is suspensible or dispersible in an aqueous vehicle.

Yet another object of this invention resides in the provision of a new and improved method of manufacture and of the unique compositions hereinbefore set forth which enables the provision of a mud for use in oil and gas wells having the highly improved characteristics and advantages heretofore set forth which may be made available to the industry at costs comparable with costs of muds currently utilized.

Still other objects and advantages of this invention will become more readily apparent to those skilled in the art when the following description and examples are considered.

The composition of the present invention may be briefly described as a homogeneous mixture of finely divided magnetite and micaceous such as vermiculite, wherein the magnetite particles are uniformly impregnated in the micaceous material particles. This homogeneous mixture is capable of being dispersed or suspended in an aqueous vehicle which then forms a mud or solid-laden liquid for use in gas or oil well bore holes.

The method of the present invention may be described briefly as the manufacture or compounding of a mud composition for use in suspension in a fluid for oil and gas well bore holes which consists in the simultaneous grinding in a common mill of prescribed quantities of raw, bulk magnetite and a micaceous material to reduce the bulk mixture to a substantially uniform particle size of —325 mesh or less and to homogeneously admix the particles of the two ingredients to embed the magnetite particles uniformly in the vermiculite particles.

By way of specific examples of the method of the present invention, and to illustrate compositions forming a part of the present invention, the solid component of a mud-laden drilling fluid is attained by grinding at 70% solids (in aqueous solution) for one hour in a ball mill proportionate quantities (as shown in Tables I and II) titaniferous magnetite of approximately —35 mesh and vermiculite of approximately +10 mesh. The resultant component (dry) consists of a homogeneous mixture of magnetite and vermiculite of —325 mesh wherein the magnetite particles are uniformly embedded in the vermiculite.

Table I

Mud Composition	By Weight, Percent	By Volume, Percent
Vermiculite (expanded)	7.1	25
Magnetite	92.9	75

Table II

Mud Composition	By Weight, Percent	By Volume, Percent
Vermiculite (unexpanded)	11.6	40.28
Magnetite	88.4	59.72

It has been discovered that practice of the above method

utilizing quantities of vermiculite, by weight, varying from 5% to 50% will produce a drilling mud composition attaining the numerous advantages hereinbefore set forth. It has been discovered that as the percentage of vermiculite ground with the magnetite increases the viscosity of the resultant drilling fluid in which the composition is suspended increases with an accompanying increase in the gel strength of the fluid. Increase in the fluid gel strength serves to increase the filtration characteristic as well as the shear strength characteristics of the fluid to obtain the advantages hereinbefore attributed to these factors.

As an additional facet of my discovery, I have found that by physically embedding the magnetite, which has heretofore been utilized in drilling fluids as a weighting agent, in the vermiculite, which has heretofore been used as a suspending agent, to produce a non-separating homogeneous mixture of these elements that a ready and positive control of the viscosity of the drilling fluid in which the mud composition is suspended may be attained. For example, by passing the drilling fluid through a tube or pipe having an electrical coil wound thereabout enables the subjecting of the fluid selectively to a direct or an alternating current field. When the drilling fluid is subjected to a direct current field the magnetite particles within the fluid become magnetized producing an adherence among such particles within the fluid forming a "flock." Such magnetically flocculated fluid has a characteristically high viscosity. Alternately, by subjecting the drilling fluid to an alternating current field the magnetite particles are demagnetized thereby destroying magnetic "flocks" and thereby characteristically reducing the viscosity of the fluid.

It has been further discovered that the viscosity of the fluid is controllable over a wide range by varying the relative intensity of the magnetic field of the coil through which the drilling fluid is passed.

An additional advantage, knowledge of which has arisen through use of the new and improved mud hereinbefore described, rests in the ability of this new mud composition to be cleaned at the wellhead location by the utilization of commercial magnetic separators. The magnetic qualities of the present mud enable the cleaning of the mud through magnetic separation down to very fine sizes as opposed to the herebefore normal practice of cleaning prior muds by screening with extreme limitations on the fineness of the cleaning separation. These prior screening operations have been attended by a high loss of mud gravity which has necessitated the building up of the remaining mud after cleaning with expensive materials such as barite to bring the mud gravity back to its minimum limits. Such additives are not required in the present mud since the magnetic separation will not affect the mud gravity due to the high efficiency of cleaning by such method.

The foregoing disclosures make readily evident that a new and highly improved mud composition for aqueous suspension in the formation of a mud-laden drilling fluid has been provided which attains objects and advantages heretofore unobtainable and unknown in the art. Additionally, the utilization of a mud composition of the type herein described and compounded by the new and improved method herein disclosed enables the accomplishment of not only new but substantially unexpected results which serve to increase the efficiency and the adaptability of mud-laden liquid in the gas and oil well drilling art.

Obviously many variations and combinations are possible within the ranges of ingredient proportion to satisfy required mud characteristics dependent upon individual

and localized circumstances without departing from the spirit and scope of my discoveries and invention.

Having thus described and fully disclosed and expalined my present invention and the highly desirable objects and advantages obtained through the practice thereof, what I desire to claim is:

1. A composition for use as a weighting agent in a drilling fluid for oil and gas wells, comprising a non-separating homogeneous mixture of fine particles of vermiculite impregnated with fine particles of magnetite, the proportion of vermiculite to magnetite by weight being between 5 and 50 percent.

2. A composition as defined in claim 1 wherein, the vermiculite is expanded.

3. A composition as defined in claim 1 wherein, the vermiculite is unexpanded.

4. A composition as defined in claim 1 wherein, the vermiculite is expanded and by weight the proportion of vermiculite to magnetite is 7.1 percent.

5. A composition as defined in claim 1 wherein the vermiculite is unexpanded and by weight the proportion of vermiculite to magnetite is 11.6 percent.

6. The method of producing a composition for use as a weighting agent for a drilling fluid for oil and gas wells consisting of simultaneously grinding a mixture of bulk magnetite and bulk vermiculite to a reduced particle size, the proportion of vermiculite to magnetite by weight in said mixture being between 5 and 50 percent.

7. The method of producing a composition for use as a weighting agent for a drilling fluid for oil and gas wells consisting of simultaneously grinding a mixture of bulk magnetite and bulk vermiculite to a particle size of —325 mesh and less, the proportion of vermiculite to magnetite by weight in said mixture being between 5 and 50 percent.

8. The method of producing a composition for use as a weighting agent for a drilling fluid for oil and gas wells comprising, simultaneously grinding to a fine particle size a mixture of bulk magnetite and bulk vermiculite wherein the proportions of vermiculite to magnetite by weight is between 5 and 50 percent to cause the vermiculite to be impregnated with magnetite by having magnetite embedded therein.

9. The method defined in claim 8 wherein, the bulk magnetite and bulk vermiculite are ground to a substantially uniform particle size of —325 mesh or less and the grinding is continued until the magnetite particles are uniformly embedded in the vermiculite particles.

10. A method of controlling the viscosity of a mud-laden fluid for use in drilling oil and gas wells containing finely ground particles of vermiculite impregnated with magnetite, said vermiculite being in proportion to the magnetite in the order of from 5 to 50 percent by weight, including the steps of subjecting the fluid to a direct current magnetic field to produce flocculation of the fluid, and subjecting the fluid to an alternating current magnetic field to deflocculate the fluid.

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