

UNITED STATES PATENT OFFICE

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MUD WALL DISINTEGRATOR

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My invention relates to means for disintegrating mud and particularly to a means and method for removing the mud sheath formed during rotary well drilling operations.

5 There are three systems of well drilling in general use, the most widely adopted being the "rotary" method.

In rotary drilling, a centrally apertured bit is attached to a hollow pipe which is rotated by a suitable power source about its longitudinal axis. The bit is provided with teeth of various shapes designed to bite the rock away in small pieces, and is lubricated by a continuous stream of mud pumped down through the hollow pipe and bit.

15 The stream returns to a surface sump, carrying the rock particles or "cuttings" with it, by passing upwardly in the bore on the outside of the pipe. The mud is used to carry abrasive material in suspension and to cool the bit. The mud column also controls the oil and gas pressures encountered, and has other important functions.

As the drill is driven deeper into the earth, a wall of partially dried mud is gradually built up around the outside of the bore. The heat encountered, especially in deep wells, may cause a filtering or "baking" action, and it is frequently found that the mud wall becomes so hard and impervious that it must be removed before the oil can flow into the bore. This removal is hence very important in determining the size and output of the well.

One of the common methods of removal involves treating the wall with an acid which will cause it wholly or partially to decompose, permitting the mud to slough off and be carried away in suspension by the fluid in the hole. Four of the factors governing the type of acid which is suitable for such use are: the rate of disintegration of the wall; safety in handling; chemical inertness toward steel casing; and cost. Hydrochloric (muriatic) acid has been widely used. It is relatively inexpensive, and reacts rapidly with the mud, but is difficult to handle in the concentration necessary for treatment and tends to attack the casing and drill pipe in the hole unless inhibited.

Inhibiting the acid consists in adding thereto a substance which will reduce as far as possible the reaction of the acid with the casing, while at the same time not interfering with the break-down of the mud. Such a substance could be a salt of any metal lying below hydrogen in the electro-motive series. One of the best and cheapest inhibitors is cuprous chloride. Others are described in United States Patent 1,877,504 to Grébe and

Sanford, which claims the use as inhibiting agents of arsenic acid, arsenic tri-oxide, and other soluble arsenates and arsenites, as well as a variety of other substances. Such inhibitors, however, are at best a compromise. Even with their use, it is necessary to introduce the inhibited acid to the bore in undesirable concentrations. As the reaction progresses, the acid becomes continually weaker; while a comparatively rapid reaction may occur at first, it tapers off rapidly. The time required for a treatment is usually from five to eighteen hours, but is dependent on a number of factors, including the wall thickness, the depth of hole, and others.

My invention overcomes the difficulty experienced with even the most successful of the previously known methods by the use of a weak acid, together with a substance which will combine therewith in the bore in such a way as to produce continually a fresh supply of a strong acid. The concentrations thus secured will break down the mud wall rapidly without deleterious effects on the casing. In pursuance of this method, I preferably introduce in solution, acetic acid and magnesium chloride, which will react in the bore to form an inert salt and hydrochloric acid.

The fundamental reaction in the chemical breakdown of a mud sheath is that between the acid and calcium carbonate, which is an important constituent of nearly all native clays. The calcium carbonate is dispersed throughout the mud; it combines with acid to form an unstable compound, carbonic acid, which again breaks down into water and carbon dioxide gas. The mud becomes honeycombed by the decomposition of the calcium carbonate, so that the remainder of the wall is easily penetrated by and sloughs off with the fluid circulating or standing in the hole.

It will be seen from the above description that the primary object of my invention is to provide more effective means for removing the mud sheath from well bores. Other objects are: to provide a continuously replenished supply of acid in a well bore; to maintain the concentration of acid always at its most effective value; to provide means for breaking down a mud wall at a constant rate; to introduce chemicals reacting with the mud wall of a well bore in a form non-reactive with the drilling tools; to provide means for increasing the reactive power of acetic acid relative to the mud wall; to provide for more complete penetration of the mud wall by the disintegrating agent; to provide a rapidly reacting agent in a non-corrosive form; to provide a mud