

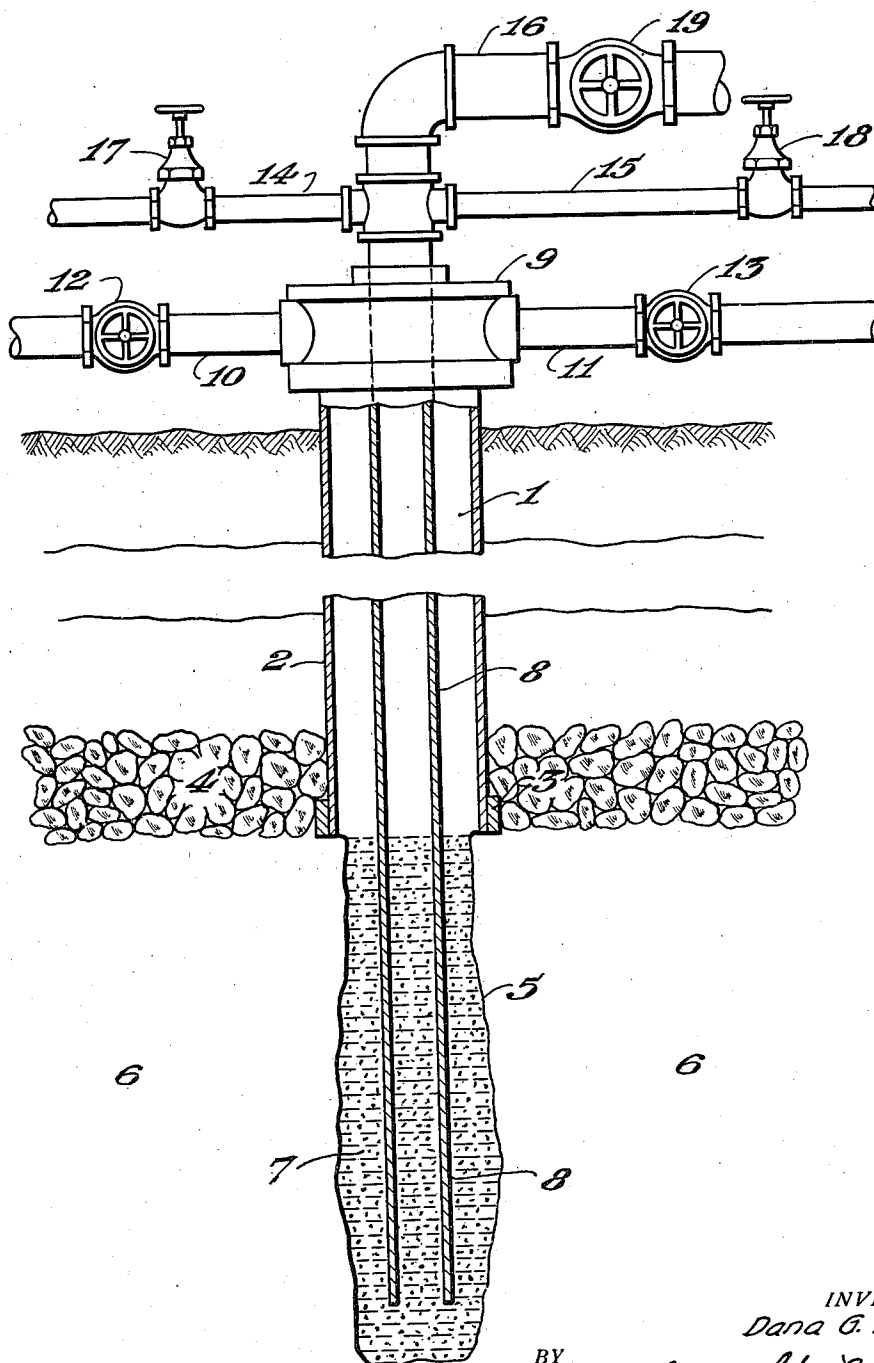
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METHOD OF CLEANING WELLS

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METHOD OF CLEANING WELLS

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The invention relates to a method of cleaning deep wells and more particularly concerns an improved method of removing from the well bore accumulations of detritus consisting of cavings or sloughings such as sand and earthy matter.

Deep wells drilled for the production of mineral fluids are usually cased or lined with metal pipe over a major portion of the bore to prevent the walls of the well bore from caving and filling the hole and to prevent the infiltration of undesirable fluids into the well bore. The lower portion of the well bore penetrating the productive stratum is not cased, however, since the fluid mineral products would be substantially prevented from flowing into the well if the casing extended into this portion of the well bore. As the well is produced, this lower uncased portion of the well tends to become filled with cavings and sloughings consisting of sand and like matter dislodged or displaced from the walls of the uncased well bore by the flow of fluids into the well. This accumulation of sand and earthy matter in the bottom of the well may eventually fill the well to a level above the productive stratum and thus materially reduce the rate of flow of the mineral fluids into the well. It is, therefore, highly desirable to provide a satisfactory method whereby this detritus may be removed from a well in order that the flow of mineral fluids into the well may be restored.

To remove such accumulations of detritus, it has been proposed heretofore to introduce a quantity of water into the well bore and mix the water and the detritus by means of a current of air introduced through the tubing lowered into the detritus. The mixture is then blown up the casing out of the well by a powerful stream of air introduced down the tubing. There are, however, disadvantages attending the use of this method. For instance, the sand and earthy matter comprising the detritus are not easily brought into suspension in the water, but instead quickly tend to settle out before being blown out of the well. Another disadvantage is that the air or gas used to mix the water and the detritus and to carry the mixture out of the well may, under the pressure necessary for these operations, penetrate the surrounding formation so readily as to result in large losses of gas or air as well as rendering it difficult to raise the mixture out of the well.

I have found these difficulties are overcome by introducing into the well and mixing with the detritus therein a colloidal semi-fluid gel in which the detritus readily remains suspended

when subjected to moderate agitation but which does not readily penetrate the surrounding formation, and then blowing the mixture from the well. The invention then consists of the method hereinafter fully described and particularly pointed out in the claims, reference being had to the accompanying drawing illustrating a mode of carrying out the invention.

The accompanying drawing is a diagrammatic view in vertical section of an oil well.

The single figure is a view showing a well equipped for carrying out a treatment according to the invention. As shown the upper portion 1 of the well is cased and passes through non-productive earth and rock, the lower portion of the casing 2 being provided with a casing seat 3 cemented in the rock stratum 4. The lower uncased portion of the well bore 5 is shown drilled into the producing stratum 6. The lower portion of the well bore 5 is also shown partially filled with a colloidal semi-fluid gel having suspended therein sand and earthy matter, this mixture being indicated by numeral 7. Extending into the mixture of detritus and colloidal semi-fluid gel, the tubing 8 is shown in a position suitable for removal of the said mixture. Above the ground level the casing head 9, through which the tubing 8 extends into the well, is shown equipped with pipes 10 and 11 communicating with the casing, said pipes being provided with valves 12 and 13. To the tubing 8 above the casing head 9, pipes 14, 15 and 16 controlled by valves 17, 18 and 19, respectively, are connected, suitably arranged for carrying out the method according to the invention and for producing the well.

The following method is illustrative of the manner of carrying out the invention in a well having an accumulation of sand and earthy matter to be removed. A quantity of a colloidal semi-fluid gel is introduced into the well through the tubing 8. The lower end of the tubing is so located that it preferably just penetrates the surface of the detritus, and then a stream of air or gas is introduced through the tubing 8 while maintaining valve 12 in an open position to allow the excess of air or gas to escape at the well head. The flow of air is so regulated as to bring about mixing of that portion of the detritus penetrated by the tubing 8 and the gel lying above it without blowing the mixture from the well. The injection of air is continued and the tubing 8 is gradually lowered as the mixing is brought about so that the whole of the detritus becomes mixed with the gel when the

tubing reaches the bottom of the bore. After the detritus has been mixed with the gel, the injection of air into the tubing is discontinued and its upper end is opened. The mixture 7 is blown out of the well through the tubing 8 by introducing a powerful stream of air or gas down the casing through either pipe 10 or 11.

It is to be understood that while it is generally preferable to remove the mixture of detritus and colloidal semi-fluid gel from the well through the tubing according to the above method, the mixture may be removed by blowing it out through the casing by forcing gas under high pressure down the tubing of the well, or by removing the tubing and bailing the well.

Among the colloidal semi-fluid gels that are suitable for use are alkaline starch solutions made by dispersing between about 2 to 5 per cent of a commercial starch such as Argo, Faultless or Elastic in an aqueous solution, the alkalinity of which is between about .2 and 1 normal. Such starch solutions can be readily mixed with sand and earthy matter and the sand and like matter remains in suspension in the gel like mixture for a relatively long period of time. Another colloidal semi-fluid gel may be made from bentonite and water. By dispersing between about 1 and 5 per cent of bentonite in water, a solution having gel like properties is obtained which may be suitably used for the purpose of the invention.

Other well-known colloidal semi-fluid gels may be used providing they have sufficient gel strength to retain sand and earthy matter in suspension for the time necessary to complete a treatment according to the invention.

In general, a suitable amount of the colloidal semi-fluid gel to use is from 1 to 4 barrels depending, however, on the amount of detritus to be removed from the well bore. In some cases where a large amount of detritus is to be removed from the well bore, it may be necessary to make successive additions of the colloidal semi-fluid gel before the loose sand and earthy matter is completely moved from the well bore.

In most cases the flow of mineral fluids returning to the well readily removes any of the colloidal semi-fluid gel that adheres to the wall surfaces of the productive stratum. This semi-fluid gel deposited upon the productive stratum when the detritus is mixed with the gel forms a coating or sheath upon the wall surfaces of the productive stratum which serves to prevent excessive loss of gas or air into the formation when the mixture is blown from the well. However, the possibility of such deposits of the colloidal semi-fluid gels hindering the flow of the mineral fluids into the well may be eliminated by selecting one of the gels which may be decomposed by chemical treatment. For example, colloidal semi-fluid gels comprised of alkaline starch solutions may be readily removed from the walls of the well bore by introducing into the well a solu-

tion of hydrochloric acid or a hypochlorite solution and allowing these solutions to remain in contact with the gel for from 1 to 4 hours or more.

Other modes of applying the principle of my invention may be employed instead of those explained, change being made as regards the method herein disclosed, provided the step or steps stated by any of the following claims or the equivalent of such stated step or steps be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In a method of removing detritus from a well equipped with the usual casing and tubing, the steps which consist in introducing into the well a quantity of an alkaline starch solution, lowering the tubing into said starch solution, forcing gas into the tubing and through the alkaline starch solution, whereby the detritus is mixed with and suspended in said solution, forcing the alkaline starch solution containing the suspended detritus from the well through the tubing by introducing a volume of gas under pressure into the well through the casing, and introducing into the well a relatively small quantity of an aqueous solution of hydrochloric acid, whereby the alkaline starch solution remaining on the wall surfaces of the well bore is decomposed by the acid.

2. In a method of removing detritus from a well equipped with the usual casing and tubing, the steps which consist in introducing into the well a quantity of an alkaline starch solution, lowering the tubing into said starch solution, forcing gas into the tubing and through the alkaline starch solution, whereby the detritus is mixed with and suspended in said solution, forcing the alkaline starch solution containing the suspended detritus from the well through the tubing by introducing a volume of gas under pressure into the well through the casing, and introducing into the well a relatively small quantity of an aqueous solution of a hypochlorite, whereby the alkaline starch solution remaining on the wall surfaces of the well bore is decomposed by the hypochlorite.

3. In a method of removing detritus from a well equipped with the usual casing and tubing, the steps which consist in introducing into the well a quantity of an alkaline starch solution, lowering the tubing into said starch solution, forcing gas into the tubing and through the alkaline starch solution, whereby the detritus is mixed with and suspended in said solution, forcing the alkaline starch solution containing the suspended detritus from the well through the tubing by introducing a volume of gas under pressure into the well through the casing, and thereafter decomposing the alkaline starch solution remaining in the well by chemical treatment.

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