

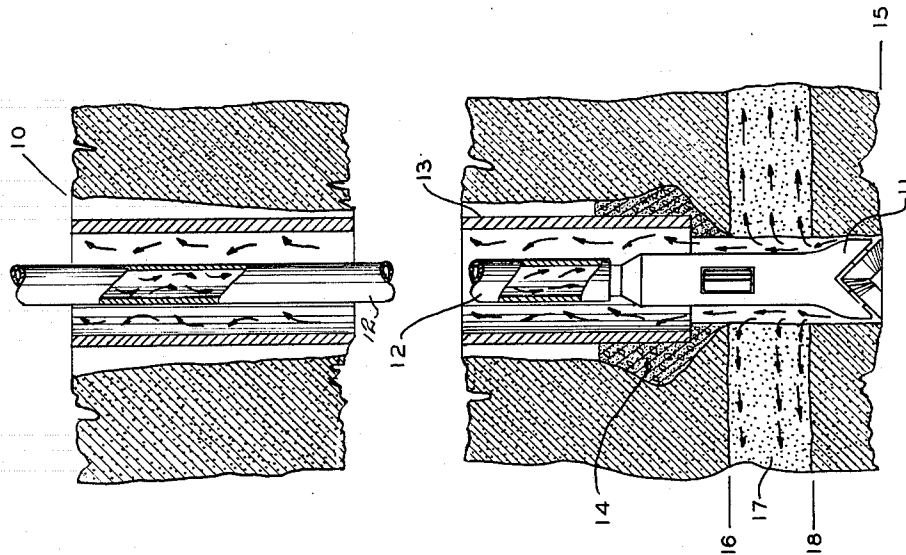
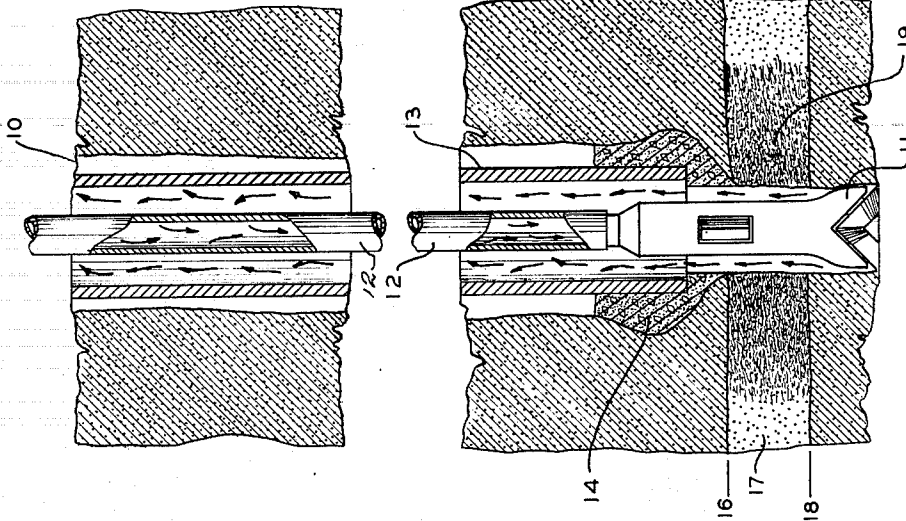
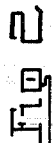
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METHOD OF SEALING OFF POROUS FORMATIONS IN WELLS

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METHOD OF SEALING OFF POROUS FORMATIONS IN WELLS

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4 Claims. (Cl. 255—1)

The present application is a continuation in part of my application Serial No. 743,485, filed in the U. S. Patent Office September 10, 1934, entitled, Method of sealing porous formations in drilling wells to prevent loss of circulation fluid.

This invention relates to a method of sealing wells, and in particular relates to a method of sealing off a porous oil sand encountered in drilling a well hole.

In the drilling of wells porous oil sands are often encountered at relatively shallow depths which contain oil and through and past which it is desired to drill in order to obtain a depth sufficient to reach the major oil bearing stratum. In numerous other instances, and for various reasons, it is often desired to prevent the oil, at various stages of the drilling operation from flowing into the well as the same under certain conditions materially hinders the operation.

When such oil bearing stratum as those above described are encountered it has been the practice to attempt to seal off the same to prevent leakage therefrom into the well hole. To effect such a sealing, various liquids including those containing solid matter in suspension have been used. These in the majority have been unsatisfactory, and where such a sealing medium as mud and water, which is commonly used, are employed, the mud cakes or plasters up the crevices of the oil sand stratum in such a manner that when it is later desired to re-establish the oil flow from the stratum it is almost entirely impossible for the reason that the crevices are completely clogged by the mud thus preventing escape of the oil.

Furthermore when drilling through a stratum of porous oil sand with a rotary tool there is the danger that the circulation fluid of mud and water necessary to such operations will escape through the stratum and be lost.

It is an object of this invention to provide a method of sealing off porous oil sands occurring adjacent the well hole in such a manner as to positively prevent the liquids contained therein from flowing into the hole, yet whereby the flow from such sands can easily be re-established when desired.

Another object is to provide a method of sealing off porous oil sands from a well hole in such a manner as to prevent leakage thereinto and wherein the sealing medium can easily and completely be removed when the flow of oil from the stratum into the well is later desired and which does not hinder the drilling operations.

Still another object of this invention is to pro-

vide a method of sealing off oil sands encountered while drilling wells in such a manner that when desired the seal may be readily broken and the oil allowed to flow into the well.

A still further object of this invention is to provide a method of sealing wells during drilling operations as will positively guard against the escape of such liquids as are desirable to be retained therein to facilitate drilling.

It is desirable, under certain conditions, to effectively seal off from the well hole any deposits or strata containing such substances as water and oil which are encountered during the drilling operations, and the sealing off of such deposits and positively preventing the liquids of the same from leaking into the well hole and the escape thereinto of liquids desired to be retained constitutes a major object of this invention.

Still other objects and advantages and a more complete appreciation of the invention will be had from a consideration of the following specification and attached drawing forming a part thereof, wherein:

Fig. 1 is a cross-sectional view of a well hole illustrating a part of my invention, and which has been drilled by a rotary tool, and wherein an oil sand stratum has been encountered.

Fig. 2 is a cross-sectional view of the same or similar hole as that shown in Fig. 1, but wherein the hole has been sealed off from the oil sand stratum and drilling resumed.

In Fig. 1 there is illustrated a well hole 10 which has been drilled by the rotary tool 11 and drill pipe 12 and which contains a pipe casing 13 held in place by the cement 14. The drill hole has been sunk to a level 15 and at level 16 a stratum of porous oil sand 17 has been encountered which extends downwardly to level 18. Water, oil, or gas from the stratum 17 has a tendency to seep into the well hole and materially hinder the drilling operations. The presence of water in the hole flowing in from the stratum 17 may cause the well to cave, with the possible loss of the entire hole. If oil enters the well from the stratum its presence at certain stages will materially hinder the drilling operations, particularly if it is desired to advance the hole to a greater depth. Again the escape of gas from the stratum into the well hole may set up serious conditions resulting in a blow-out due to the gas pressure. So for various reasons it is highly desirable to seal the well hole against leakage thereinto of the fluids from stratum 17.

To overcome the evils above described, I have found that the crevices of such a porous oil sand

stratum as that shown at 17, and which face upon the well hole walls, may be completely sealed against further leakage. An efficient and positive sealing medium for such sands has been found to be a mixture of oil with paper, paper pulp and various fibres of either vegetable, animal or mineral origin, or any mixture thereof. Finely divided paper mixed with oil in such proportions that the same can be easily pumped into the well have proven very satisfactory. Where the crevices to be sealed are relatively large it has been found well to add fibres, as they have a tendency to mat up and seal large crevices.

When such an oil sand stratum as that described is encountered a sealing medium comprising oil and paper may be introduced into the well at the top thereof through the drill pipe 12 and pressure applied to force it downwardly into the well to the porous stratum shown in the drawing, or the sealing medium may be pumped under pressure directly into the well through the drill pipe.

In practice it has been found convenient to add the sealing medium to a circulation fluid, the direction of flow of which is represented by the arrows 20, and which is commonly composed of mud and water, and introduce the two into the top of the drill pipe 12 and force the circulation fluid together with the sealing medium downwardly into the well by virtue of the pressure inherent upon the circulation fluid. Fig. 1 shows such a mode of introducing the sealing medium, and the arrows indicate the direction of flow. As the circulation fluid now attempts to escape into the stratum 17 it carries with it the sealing medium and after a short time the same will be forced back into the porous oil sand stratum and seal the crevices thereof which abut on the well hole walls, and numeral 19 in Fig. 2 represents the sealing medium in such a position. Due to the pressure by which the circulation fluid is caused to circulate the sealing medium will be positively forced back into and retained in the porous stratum and completely seal the same off from the well hole.

After the seal has been effected the drilling progresses, and Fig. 2 represents the condition of the hole after the sealing medium has ultimately been positioned in the stratum 17 to effect a positive seal at 19 against the migration or leakage in either direction of liquids or fluids in the well hole or the stratum 17.

The circulation fluid is now almost entirely free of the sealing medium as the same has been forced back into the stratum 17.

In either of the several methods above prescribed for applying and positioning the sealing medium, it is not necessary to suspend the drilling operations for any appreciable length of time. It has been found feasible to introduce the sealing medium through the drill pipe into the well without removing the same and the sealing medium is continuously forced into position simultaneously with the drilling operations.

It has been found practical to utilize such a method of sealing at various stages of drilling, and it should be appreciated that such a sealing medium and method as that described can be used at various stages in the development of the well hole for sealing off and preventing oil and water from flowing into the well. The sealing has been found most efficient for use at the bottom of the well hole when porous strata have been encountered through which the circulating fluid has

a tendency to escape. It is highly desirable that oil be employed as the vehicle for the paper, fibrous, or like sealing agent, as this makes it possible to later re-establish flow from such porous strata as have been sealed off from the well. In the event that such re-establishment of flow is desired, it is only necessary to treat the sealed portions with acids or caustic solutions which will disintegrate the paper or such other analogous sealing agents as may be used. In practice the use of oil and paper as a sealing medium has been found to have a great advantage over the ordinary mud and water circulating fluid which is occasionally used in a sealing capacity for the reason that mud will entirely clog up the crevices of any strata being sealed by the same and it is practically impossible thereafter to remove such a mud seal in the event that the re-establishment of flow from the strata is desired.

What I claim and desire to secure by Letters Patent is:

1. In drilling wells through oil sand strata the method of preventing oil or water contained therein from leaking into the well hole which consists in introducing into the well hole a sealing medium comprising an oil vehicle and a pulpy sealing agent, and applying pressure within said hole to force the sealing medium downwardly into said hole and against the side wall thereof and into the crevices of the oil or water bearing sand strata facing on said well hole walls to seal the same against further leaks.

2. In drilling wells through oil sand strata the method of preventing oil or water contained therein from leaking into the well hole which consists in introducing into the well hole a sealing medium of oil and finely divided paper by forcing the same therein under pressure, maintaining said pressure and thereby forcing said sealing medium downwardly into the well hole and against the side walls thereof and into the crevices of the oil or water sand bearing strata to close the same.

3. In the drilling of wells through oil sand strata the method of preventing oil or water contained therein from leaking into the well hole and about the pipe contained therein, which consists in introducing into the top of the pipe a sealing medium of paper, oil, and water, applying pressure within the top of said pipe to force the sealing medium downwardly to the bottom of the hole, continuing the application of pressure to the medium and forcing the sealing medium from the bottom of said hole upwardly therein between the side walls thereof and the pipe and into the crevices of the oil sand strata fronting on the well side walls to completely close said crevices and prevent further leakage of oil or water therefrom.

4. In drilling wells through oil sand strata the method of sealing said strata off from the well and further preventing the liquids contained therein from leaking into the well which consists in lowering a pipe into the well hole, introducing into the top thereof a sealing medium of paper carried by and suspended in oil, applying pressure within the pipe and at the top thereof above said sealing medium to force the same downwardly into the well, continuing the application of pressure on said sealing medium and forcing it into the facets of the oil sand strata fronting on the side walls of the well hole to seal the same against further leaks.

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