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MEANS AND METHOD FOR LOCATING OIL BEARING SANDS

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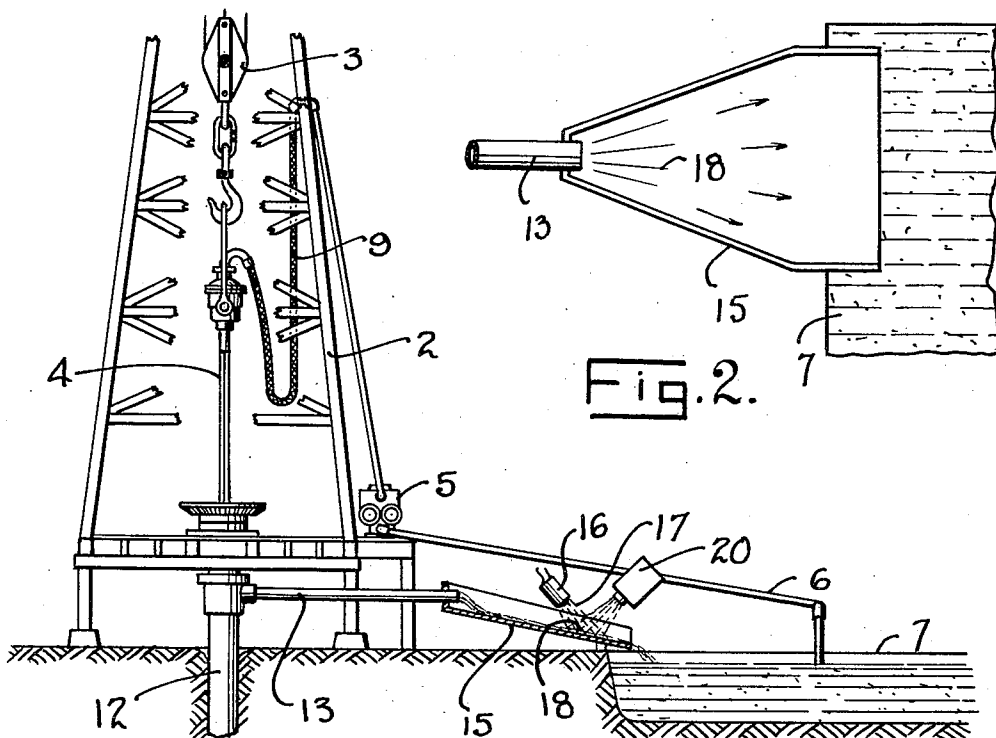


Fig. 1.

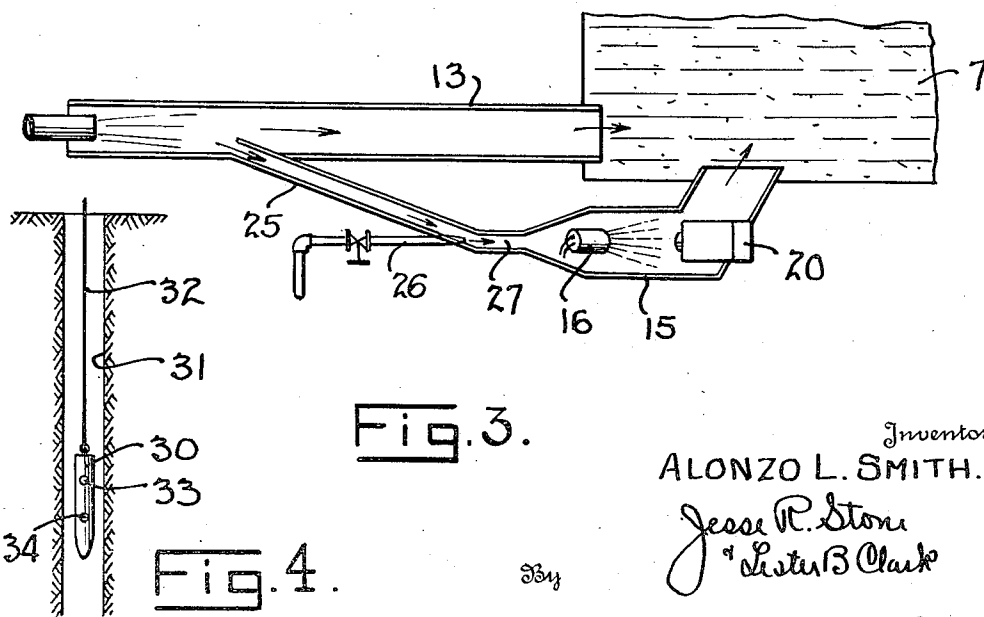


Fig. 3.

Fig. 4.

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MEANS AND METHOD FOR LOCATING OIL
BEARING SANDSAlonzo L. Smith, Houston, Tex., assignor of
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9 Claims. (Cl. 250—83)

The invention relates to a means and method for locating oil bearing formations by detecting the presence of oil in the mud returning from the well bore during the rotary method of drilling wells.

In the rotary method of drilling wells, mud is circulated downwardly into the well bore and discharged from the bit to carry away the cuttings, to cool the bit and to assist in the rate of penetration. The same drilling mud may wall up the sides of the well bore to prevent caving and may be of considerable specific gravity in order to overcome pressures encountered in the formation.

Naturally as the drill bit penetrates the formation, it will remove particles of the strata which is encountered. These particles or cuttings, as they are generally known, are carried away from the drill bit and upwardly through the well bore by the circulation of drilling mud.

It has long been the practice to examine the returns at the mouth of the well by washing them with water or merely sifting the returns to ascertain the nature of the cuttings. In many instances, however, these cuttings are softer formations which are substantially completely disintegrated by the turbulence of the mud as it flows upwardly in the well bore, and heretofore it has been practically impossible to determine from an examination of the return flow of the drilling mud, the fact that an oil bearing strata has been penetrated.

There have been instances, of course, where enormous amounts of oil were present in the formation and could be observed by the naked eye but in the majority of instances, it is impossible by an observation of the drilling mud to determine the fact that an oil bearing strata has been penetrated.

The present invention deals with a means and method for ascertaining from the returns from the well the presence of even minute quantities of oil. The presence of these quantities of oil may be a very definite indication as to the presence and location of an oil bearing strata which has been penetrated by the drilling bit.

It has been found that by applying ultra short wave violet rays to the drilling mud, that the presence of very minute quantities of oil carried by the mud may be detected. Oil has a fluorescent property which makes it readily observable under ultra short wave violet rays and the present invention contemplates utilizing these properties of oil when subjected to such rays of radiation to detect the presence of the oil which is being carried from the well bore by the drilling mud.

The fluorescence of the oil is visible to the human eye when subjected to these ultra short wave violet rays, even though the rays themselves are invisible so that in this manner fluorescent particles or streaks appearing in the mud indicate the presence of oil so that it is only necessary to apply these rays to the mud either as it flows directly from the well bore or to samples which have been taken from the returns.

It is another object of the invention to detect the presence of oil in drilling mud when the mud is subjected to ultra short wave violet rays.

Another object of the invention is to apply ultra short wave violet rays to the drilling mud returns at a well bore in order to detect the presence of oil carried by the mud.

Another object of the invention is to by-pass a portion of the mud returning from a well bore and to treat such mud so that indications of oil carried thereby may be detected.

Still another object of the invention is to examine the well bore for the presence of particles of oil which have accumulated in the well bore due to the penetration of an oil bearing strata.

Still another object of the invention is to determine the presence and location of an oil bearing formation which has been penetrated in the rotary method of drilling wells by analyzing the returns of the drilling mud at the surface for the presence of oil which has entered the mud from such penetrated formation.

Still another object of the invention is to provide an apparatus for indicating and recording the presence of oil in drilling mud.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawing, wherein:

Fig. 1 is a diagrammatical view of a drilling rig illustrating the arrangement of the mud returns in combination with the apparatus for practicing the present invention.

Fig. 2 is a top plan view looking down on the apparatus used in applying the rays to the mud.

Fig. 3 is a broken plan view of another form of apparatus where a portion of the mud is by-passed from the main stream and subjected to observation.

Fig. 4 shows a diagrammatic arrangement for an examination of the bore hole to determine the presence of oil therein.

In Fig. 1 the apparatus shown illustrates generally a derrick 2 and the hoisting equipment 3 by which the drill stem 4 is raised and lowered into the well bore. A pump 5 is used to maintain a

flow of drilling mud in the well bore. This mud is picked up by a suction pipe 6 from the slush pit 7 and is forced through the hose 9 downwardly through the drill stem.

5 A casing 12 may be present in the well bore and the return or flow line 13 extends from the well head.

In the usual method of rotary drilling the mud is passed downwardly through the drill stem 4 and discharges from the drill bit to carry cuttings away from the bit and this return flow moves upwardly in the well bore outside of the drill stem 4. In some instances this procedure may be reversed, however.

15 In practicing the present invention it is desirable to spread the mud over a sufficient area so that the stream will be comparatively thin and in this manner the largest possible area will be exposed for observation. In order to accomplish this a chute 15 has been arranged adjacent the end of the pipe 13 and this chute may take the flared form shown in Fig. 2. The drilling mud discharging from the pipe 13 will thus spread out in a thin stream on the face of the chute and will then be discharged into the pit 7.

25 In Fig. 1 a lamp or other source 16 of ultra short wave violet rays or radiation has been provided. This lamp may be suitably supported so as to direct the rays 17 on to the thin stream of drilling mud as at 18.

The application of these ultra short wave violet rays to the stream of drilling mud accentuates the fluorescent properties of any oil that is being carried along by the drilling mud. If desired the lamp 16 and the chute 15 may be enclosed as a dark room or chamber so that the fluorescence of any oil will be more apparent but no such enclosure has been illustrated in the drawing.

35 The lamp or other source 16 of ultra short wave violet rays or radiation may take any desired form but it has been found that a ground and polished filter of dark colored "Corex" placed in front of a mercury quartz arc burner holds back the visible light emitted thereby and allows only a concentrated beam of invisible ultra short wave violet radiations which are permitted to pass. These radiations vary in range between 2400 Angstrom units and 4250 Angstrom units and the quartz arc is particularly high in output below 3100 units which is of advantage in order to obtain accurate fluorescent observations.

50 It is well known that mineral oil has a very high fluorescent value and it has been found that in this spectrum of 3100 Angstrom units that this fluorescence can be readily observed when an ultra short wave frequency is applied.

55 In actual practice when the beam is applied to the mud the entire surface is of a deep violet color but when particles or bodies of oil which are carried by the mud pass beneath the rays, dots or streaks are visible to the naked eye which are of a polished gold color. Even the most minute quantity of oil carried in the mud can be observed by following this procedure. Quantities of oil which are so small that they will not be detected by chemical or other analysis are readily observable to the naked eye so that it seems obvious that a very accurate method of detecting the presence of oil has been devised.

70 In actual practice the flow of mud passing beneath the beams 17 may be observed and from this information the presence of oil detected. It may be necessary in order to accurately locate the origin of the oil to compute the rate at which the drill bit is advanced and the rate at

which the mud is being circulated in the well bore so as to determine the amount of penetration of the bit after it cut the oil producing formation and the time which was required for the oil to reach the surface as it was carried along by the circulation of mud. These are details of development however which can be readily computed, depending upon the circumstances and conditions in any particular well. It is merely a question of figuring the time lag which occurs between the time the observation is made and the time when the bit penetrated the formation. In some circumstances of course the advancement of the drill may have been discontinued and it may be necessary to maintain the circulation to raise the oil indications to the surface.

In other instances it may be desirable to make a permanent or other record or indication of the presence of the oil in the drilling mud and a recorder or indicator 20 has been positioned so that the fluorescence of the oil in the mud can be detected. This apparatus 20 may be in the form of a recording camera, photo-electric cell or other device which is sensitive to the fluorescence of the oil.

25 In some instances the drilling mud has considerable viscosity and it might be therefore desirable to dilute to some extent this mud with water so as to facilitate the natural separation of the oil, water and mud. To accomplish this an arrangement has been shown in Fig. 3 wherein a by-pass 25 has been provided on the return line 13 so that a portion of the drilling mud will enter this pipe 25. A water pipe 26 may introduce a jet of water into the flow of mud entering the neck 27 so that the mud will be diluted before it spreads out in the chute 15.

30 In this manner the oil will more readily separate from the mud and the light source 16 and the recording device 20 may be positioned over the chute 15 as seen in Fig. 3.

Another application of the invention is shown at Fig. 4 where an instrument 30 is shown as being lowered into the well bore 31 by a wire line or other device 32. The instrument 30 is arranged to contain a device 16 which is a source of ultra short wave violet rays or radiation. This radiation will be directed against a transparent window 33 in the instrument 30 and a recording device 20 will also be focused against the window 33 so that as the instrument is moved into the well bore the passage of any oil particles over the face of the window 33 will be detected. A second window 34 may be provided to duplicate or check the readings of the window 33.

55 The instrument 30 of Fig. 4 may be used in a well bore when it is filled with drilling mud which may contain oil from a producing formation and the amount of oil detected may be an indication of the location of the source of the oil. In other instances the well bore may be baled or otherwise cleared of drilling mud and observations made along the side of the well bore to determine the presence of oil.

60 It has been found in actual practice that the majority and in fact practically all of the materials encountered in an earth formation are non-fluorescent when subjected to the ultra short wave violet rays herein disclosed and even the presence of gas and gasoline does not give a fluorescent indication so that the present invention is of particular value during the drilling operations because it does not give a misleading indication when a gas formation is encountered.

tered which is usually obtained in other methods of examination of the well bore.

It is also contemplated that samples of the drilling mud taken from the return line 13 may be properly tagged and identified as to the particular well and elevation from which the returns were obtained and then these samples may be subjected to the ultra short wave violet rays in the laboratory or other remote location as circumstances may permit. In this manner even after the well bore has been drilled, the examination of these samples will indicate those elevations at which the drilling mud picked up oil indications. In some circumstances even though the casing has been set in the well, it may then be perforated at these oil bearing formation elevations.

It seems obvious that the recordings of the device 20 may be analyzed and examined at will after the bore hole has been drilled or they may be examined periodically during the drilling operations but in every instance the presence of the oil from the formation can be readily detected.

In some instances it may be necessary to eliminate other sources of oil which might contaminate the drilling mud, such as the application of oil to the tool joints or excessive amounts of oil applied to the drilling equipment. If desired non-fluorescent lubricants may be used, but in any instance this is merely a matter of procedure because the indications obtained are so accurate that errors due to lubricating problems can be readily eliminated.

It should also be noted that indications from the practicing of the present invention will distinguish between an oil and a gas sand even though these sands are interconnected in a petroleum formation.

Broadly the invention contemplates a means and method of detecting oil in drilling mud by the application thereto of ultra short wave violet rays or radiations.

What is claimed is:

1. An apparatus for detecting the presence of oil in drilling mud comprising means to apply ultra violet light to the drilling mud so that the rays change the wave length spectrum of any oil that is carried by the mud, and means to record the fluorescence in such spectrum as an indication of the presence of oil in the mud.

2. In combination with a drilling mud return pipe a chute to fan out the flow of mud into a thin stream, and means to direct ultra violet light on the surface of the mud stream so that the fluorescent properties of oil carried by the mud stream will be made detectable.

3. In combination with a drilling mud return pipe, means for diverting a portion of the mud in the return stream, means for diluting the diverted mud, and means for subjecting the diluted mud to ultra violet light under which the oil therein fluoresces.

4. In combination with a drilling mud return pipe a chute to fan out the flow of mud into a

thin stream, and means to direct ultra violet light on the surface of the mud stream so that the fluorescent properties of oil carried by the mud stream will be made detectable, said means including an electric lamp which will produce rays of an ultra short wave frequency approximating 3100 angstrom units.

5. In combination with a drilling mud return pipe a chute to fan out the flow of mud into a thin stream, means to direct ultra violet light on the surface of the mud stream so that the fluorescent properties of oil carried by the mud stream will be made detectable, and additional means to record the fluorescence.

6. A method of locating oil bearing strata penetrated by the bit where drilling mud is circulated in the rotary method of drilling comprising the steps of subjecting mud from the well bore to ultra violet light so as to ascertain the presence and volume of oil carried by the drilling mud, and ascertaining the location of the formation from which the indication of oil entered the mud by determining the rate at which the circulation of the mud occurred.

7. A method of locating oil bearing strata penetrated by the bit where drilling mud is circulated in the rotary method of drilling comprising the steps of subjecting mud from the well bore to ultra violet light so as to ascertain the presence and volume of oil carried by the drilling mud, and determining the location of the formation from which the indication of oil entered the mud by determining the rate of circulation of the mud, and the rate of penetration of the bit so as to account for the time interval required for the mud to reach the surface.

8. A method of locating oil bearing strata penetrated by the bit where drilling mud is circulated in the rotary method of drilling comprising the steps of subjecting mud from the well bore to ultra violet light so as to ascertain the presence and volume of oil carried by the drilling mud, determining the rate of circulation of mud at the time the examination is being made by considering the rate of pumpage, and ascertaining therefrom the depth of the formation from which the mud acquired indications observed.

9. A method of locating oil sands penetrated by the drill bit in the rotary method of drilling wells where drilling mud is circulated into and out of the well bore to carry the cuttings from the drill to the surface, the steps of ascertaining the amount of advancement of the bit if any during the period in which cuttings from a specific elevation are being carried to the surface which includes considering the rate of pumpage of the mud and the rate of advancement of the drill bit when the volumetric capacity of the well bore is considered and subjecting the mud to ultra violet light to effect the fluorescence of any particles in the mud containing petroleum so that the depth of the formation and the fact as to whether that formation was a petroleum bearing formation may be determined.

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