Aug. 23, 1966

H. BRANDT

3,268,001

METHOD OF RUNNING A PREFACED SAND CONTROL LINER

Filed Jan. 20, 1964

FIG. 1

FIG. 2

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BY

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ATORNEYS
METHOD OF RUNNING A PREPACKED SAND CONTROL LINER

Harry Brandt, Whittler, Calif., assignor to Chevron Research Company, a corporation of Delaware
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9 Claims. (Cl. 166—12)

This application is a continuation-in-part of my co-pending application Serial No. 91,576, filed February 27, 1961, now abandoned.

This invention relates to a method of sand control completion of a well with prepacked liners and more particularly this invention relates to a method of running a temporarily coated prepack to a predetermined position in a well in a manner to prevent drilling mud invasion of the prepack.

In many oil wells sand control is necessary to allow economical production of oil from the well. Sand control is often accomplished by lowering a prepacked sand control liner into the well to a position adjacent the producing formation. The prepack is generally a pressurized particle pack consolidated around a slotted liner. An additional slotted liner is sometimes placed around the exterior of the particle pack. The prepacked sand control liner allows well fluids from the producing formation to pass through the permeable matrix into the interior of the slotted liner and then up the production tubing. The prepack prevents sand and other particles from accompanying the produced well fluids by further filtering out particles and by causing bridging of the particles. Since the permeable matrix of the prepack must retain permeability, it is necessary to position the prepack in a borehole without having it clogged by drilling mud or other borehole material.

Heretofore the necessity of preventing drilling mud invasion of gravel-packed liners has been recognized. Gravel packed liners are formed of larger particles than prepacks and therefore are not as sensitive to plugging as prepacked sand control liners. A U.S. Patent 2,336,168, issued December 7, 1943 to J. E. Eckel, methods of protecting gravel-packed liners from mud invasion are described. The patentee discloses that greases, waxes, asbestos, tar, natural gums, and resins are suitable for use as mud excluders in protecting a gravel pack according to his method. The patentee teaches that the gravel-packed liner must either be run into a well in a manner to prevent the occurrence of a pressure differential on the gravel pack while placing it in the well or that other "special operations" must be observed in placing the pack. These "special operations" include such steps as freezing the pack prior to placing it in the well to prevent the mud excluder from prematurely flowing out of the pack, and removing the mud excluder from the pack by washing after the pack is in place.

The patentee teaches that a pressure differential can be avoided if the bottom of the slotted liner is left open to well fluids. The occurrence of a pressure differential is supposedly avoided by thus causing the well fluids to flow both up the interior of the slotted liner of the gravel pack and up the annular space between the exterior of the gravel pack and the well. It is clear that the patentee is referring to a horizontal pressure drop across the gravel pack. That is the difference in pressure from outside to inside of the pack while it is being run into the well. For convenience this will be referred to as the horizontal pressure drop. However, it has been found that there will be a horizontal pressure drop across the liner caused by running it into the well even when both the annulus and the interior of the liner are open to the well fluids due to the different velocity of well fluids flowing in the liner and in the annulus.

It has also been found that a pressure drop will occur in the gravel pack caused by the pack being moved through the well fluids. This pressure drop occurs in a generally vertical plane as the prepack is being run into the well and for convenience it will be referred to as a vertical pressure drop.

It is therefore a particular object of this invention to provide a method of preventing a prepacked sand control liner and of running the protected prepacked liner into a well in a manner to prevent drilling mud invasion of the prepack and to readily allow production from a desired producing formation through the prepack without requiring the avoidance of a pressure differential or the other special operations taught by the prior art.

Briefly, the present invention provides for coating a prepacked sand control liner with a wax having a melting point of from 60° to 40° F. below the temperature of the well adjacent the formation where the prepack is to be positioned, inserting the prepack into the well, lowering it into the well in a manner to establish a temperature gradient across the prepack before reaching the location in the well where the temperature will melt the wax, and continuing to lower the prepack in the well in a manner to transport the prepack through the portion of the well where the melting point of the wax is exceeded while maintaining the competency of at least a portion of the wax in the prepack at least until the prepack reaches the desired location and positioning the prepack adjacent the desired formation.

Further objects and advantages of the present invention will be evident from the following detailed description read in light of the accompanying drawings which are a part of this specification and in which:

FIGURE 1 is a longitudinal view partially in section and illustrates one embodiment of a prepacked sand control liner;

FIGURE 2 is a longitudinal view partially in section and illustrates an alternative embodiment of a prepacked sand control liner;

FIGURE 3 is a sectional view of an earth formation penetrated by a well and illustrates apparatus assembled in accordance with the invention located at a first position in the well;

FIGURE 4 is a sectional view of an earth formation penetrated by a well and illustrates apparatus assembled in accordance with the invention located at a second position in the well;

FIGURE 5 is a sectional view of an earth formation penetrated by a well and illustrates apparatus assembled in accordance with the present invention located at a third position in the well;

FIGURE 6 is a perspective view of a portion of an apparatus used in obtaining the curves shown in FIGURES 7 and 8.

FIGURES 7 and 8 are curves illustrating a thermal gradient set up in a wax-coated prepack.

Referring now to FIGURE 1 a prepacked sand control liner, commonly called a prepack, is shown. The prepack illustrated in FIGURE 1 includes an interior slotted liner 20 which has a means, such as a threaded portion 22, connectable to a string of production tubing. A porous section 24 is formed around the slotted liner 20. The porous section 24 is formed, for example, of sand grains cemented together by an epoxy resin. Other particles and methods for combining them to form porous matrix means useful in accordance with the invention are well known in the art. The permeability of prepacks used in the method of the present invention ranges from about 1 darcy to 100 darcies. A plug 26 having an opening for fluid flow therethrough fits on the bottom of the interior slotted liner 20. The plug allows fluids to flow up into the interior of the slotted liner 20 as the
prepack is run in the well. The plug is provided with means for closing off the fluid flow passage when desired so that all fluids produced through the tubing string will flow through the porous matrix. Suitable plugs are shown, for example, in volume 2 of the Composite Catalogue of Oil Field Equipment, 1960–61, at page 3,216. The series 4000 plugs manufactured by the Layne and Bowler Company are suitable for this purpose. Especially suitable are plugs Nos. 409 and 410.

Referring now to FIGURE 2, another embodiment of the prepack useful in the invention is shown. As there shown the prepack has an inner permeable or slotted liner 30 and means 31 thereto connected for sealing the prepack in place. An exterior slotted liner 34 is located concentrically around the inner slotted liner 30 and forms an annular chamber therewith to contain a porous matrix 38. A plug 36 is connected to the bottom of the prepack. The porous matrix may be consolidated by an epoxy resin or it may be preconsolidated. In accordance with the invention the prepack is coated with wax, said wax having a melting temperature of between 0° to 30° F. and preferably about 20° F. below the temperature in the well adjacent to the formation where the prepack is to be placed. Thus the temperature in the well adjacent to the formation must be determined. Well temperature is determined, for example, by means of downhole measuring instruments. Once the downhole temperature is known a wax is selected for use in temporarily protecting the prepack.

In a preferred embodiment of the invention the protective coating material is petroleum wax. The petroleum waxes are soluble in oil and have relatively sharp melting points. It is desirable that the coating material be able to dissolve as well as melt in the downhole environment so that any melted portion of the coating which might be retained in the pores or other small openings of the porous matrix of the prepack will dissolve in the oil present. The melting temperatures of petroleum waxes range from about 100° to 210° F.

The melting point of the petroleum waxes is adjustable by various methods. Included among these are solvent fractionation to increase the melting point of the wax. The melting point of any particular wax may also be adjusted by mixing it with a wax having a higher or lower melting temperature. A particular petroleum wax desirable as a protective coating material in hotter wells is microcrystalline wax. Microcrystalline wax is a term referring to the crystallinity index (CI) of a wax. The crystallinity index of microcrystalline waxes ranges from 65 to 80. Included in the CI range are many naturally occurring microcrystalline waxes as well as waxes of animal or vegetable origins. It is preferred, however, to use the naturally occurring petrolemal microcrystalline waxes in the present invention because the animal and vegetable waxes are less soluble in crude oil than the oil-derived waxes.

Petroleum waxes useful in lower temperature wells and suitable as a protective coating material in accordance with the invention are the natural paraffin waxes which are available in a number of forms including the bottoms from about 100° F. to 165° F. The molecular weights of paraffin waxes are generally less than 500. Natural paraffin wax is available as an alternative coating material, particularly in formations ranging from about 100° F. to 170° F. Synthetic paraffin waxes and low molecular weight polyethylene are available with melting point increments from about 120° F. to 210° F. and above. These waxes are also adaptable for use as the protective coating material.

To obtain maximum benefit from the protective coating it is preferred to coat the exposed permeable matrix portion of the prepack with the protective wax. The coating is obtained by dipping the prepack into a tank of heated wax and then letting the wax cool. Other methods of applying the wax are available and can be used provided the protective wax fills the voids in the permeable matrix portion of the prepack.

It is necessary that the temporary protective material occupy the voids in the porous matrix section of the sand control liner to prevent particle invasion of the porous particle pack and to assist in establishing a thermal gradient across the prepack. It is preferred that the coating or filling of the prepacked sand control liner with the protective material be accomplished during the initial manufacture of the prepacked sand control liner. However, the protective wax may be applied in the field prior to inserting the sand control liner in the borehole.

In accordance with this invention the prepack is coated with a wax selected to have a melting temperature of from 0° to 40° F. less than the temperature in the well where the prepack is placed. The temperature in a well usually increases with depth or stated differently the temperature will decrease going up the well. Usually the incremental temperature increase is between 1° to 2° F. per 100 feet. Most wells have an incremental temperature increase of about 1.3° to 1.5° F. per 100 feet. It can be seen therefore that a wax selected according to the present invention can be in an environment where the temperature exceeds the melting temperature of the wax before the wax-coated prepack has been lowered completely into the well. If the wax melts prematurely and flows out of the permeable matrix while the prepack is traveling in the drilling mud in the hole, the prepack will become plugged and will not function. It has been found, however, that by maintaining a minimum running-in speed on the prepack as it goes down into the well, a thermal gradient can be established between the prepack to maintain the wax in the interior of the permeable matrix competent for a period of time after the melting temperature of the wax has exceeded to allow the prepack to be positioned in the well before the wax can flow out of the permeable matrix.

It has been found experimentally and confirmed by field evidence that a prepack coated with a selected wax according to this invention which on an average rate of at least 100 ft./minute will arrive at the desired location free of plugging by filter or mud cake. Thus even when the selected wax has a melting point toward the higher end of the herein-taught range, i.e., 0° to 40° below the temperature in the well where the prepack is to be located, the wax will continue to serve its
protective function because of the time lag required to melt all of the wax. This will be more fully explained by referring now to FIGURES 3-5. A preferred method for running a prepack in a manner to maintain an average rate of insertion of at least 100 feet per minute is disclosed in U.S. Patent 3,173,487. Briefly that method provides for wire line setting a connected prepack and production packer. A prepack 40 is connected to a production packer 42 by means of a connecting nipple 44. A setting tool 46 connected to wire line 48 and the production packer 42 is used to set the packer 42 at a desired position such as adjacent formation 56 in well 50. Suitable surface apparatus, such as a winch 52 and derrick 54 arrangement, is used to pull out and take up the wire line 48. After the packer 42 is set, the setting tool is removed from the well 50 and production tubing is inserted into the set packer and the well is ready to produce.

As heretofore described, the wax used as a protective coating is selected with a melting point of from 0°F to 30-40°F less than the temperature Tm in the well adjacent where the prepack is to be placed. The location in the well where the temperature is equal to the melting point of the wax is indicated by Tm. The distance L between Tm and T is the distance that the prepack must be moved after the temperatures in the well exceed the melting temperature of the wax. At least a portion of the wax in the permeable matrix of the prepack must stay competent during this time to prevent the vertical pressure drop from causing the wax to flow out of the matrix. If all the wax melts prematurely the mobile wax will flow out of the permeable matrix and the mud in the well will plug it.

The method of the present invention has been used in field operations. Prepacked coated with wax according to the present invention, were run into wells on wire line. The average running-in speed when running a prepack on wire line was above 100 feet per minute. The following table lists some of the results obtainable by the present invention and also illustrates instances where failures occurred when the wax used did not have a melting point in the range of from 0°F to 40°F less than the temperature in the well where it was to be located. The wells in the table are commercial wells located in the Gulf Coast area.

<table>
<thead>
<tr>
<th>Well No.</th>
<th>Setting Depth, Ft.</th>
<th>Fluid in Well</th>
<th>Temperature at Setting Depth, °F</th>
<th>Melting Point of Wax</th>
<th>Initial Production</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7,900</td>
<td>Mud</td>
<td>164</td>
<td>Not wax coated</td>
<td>400</td>
<td>Well would not initially flow.</td>
</tr>
<tr>
<td>2</td>
<td>4,200</td>
<td>Mud</td>
<td>131</td>
<td>Wax, 130°F</td>
<td>400</td>
<td>Satisfactory.</td>
</tr>
<tr>
<td>3</td>
<td>5,600</td>
<td>Mud</td>
<td>140</td>
<td>40°F</td>
<td>400</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>6,300</td>
<td>Mud</td>
<td>150</td>
<td>60°F</td>
<td>400</td>
<td>—</td>
</tr>
<tr>
<td>5</td>
<td>7,600</td>
<td>Mud</td>
<td>161</td>
<td>80°F</td>
<td>400</td>
<td>—</td>
</tr>
<tr>
<td>6</td>
<td>7,800</td>
<td>Mud</td>
<td>174</td>
<td>80°F</td>
<td>400</td>
<td>—</td>
</tr>
<tr>
<td>7</td>
<td>7,800</td>
<td>Mud</td>
<td>174</td>
<td>80°F</td>
<td>400</td>
<td>—</td>
</tr>
</tbody>
</table>

In interpreting the above data it must be remembered that firsthand observation of the prepack down in the well during running-in or its condition on arrival was not possible. However, the percentage of failures of completion jobs using uncoated prepacks as in Well #1 was very high. The percentage of successful completions using wax selected in according to the present invention has been exceptionally good as is illustrated by Wells #2, #3, #4, #5 and #6. While it is impossible to positively lay the failure of Well #1 to a specific wax having too low a melting point, the probability is high that this was in fact the cause. This is supported by other data which follows.

FIGURE 6 illustrates apparatus used to obtain data presented in the curves of FIGURES 7 and 8. As shown in FIGURE 6, a portion 90 of a prepacked sand control liner has been prepared to receive a temperature measuring means. More specifically the prepack section 90 was formed of an inner liner 91 having a permeable matrix 92 formed therethrough. The permeable matrix 92 was provided with a well 93 in the center of the matrix into which a thermocouple as indicated by wires 94 was placed. The prepack 98 was wax-coated according to the present invention and placed in an oil bath at room temperature. The temperature of the bath was raised and recorded and the temperature in well 93 of the permeable matrix was read and recorded. The results are plotted in the curves of FIGURES 7 and 8.

The temperature of the oil bath was raised at rates of about 1.24°F per minute as illustrated in FIGURE 7 and about 6.1°F per minute as illustrated in FIGURE 8. The corresponding temperatures inside the permeable matrix are shown in the figures. The wax used to coat the prepacks was 130°F melting point wax. As is evident from the curves there is an appreciable time lag between the time the bath temperature reaches the melting point of the wax and the time when the wax in the permeable matrix actually melts. This time is increased by the additional heat required to melt the wax. The curves shown in FIGURES 7 and 8 help to explain the field successes of the present method. While it is recognized that no laboratory experiment can duplicate all field conditions, it is apparent that the data presented in these curves confirms that a prepack coated with a selected wax and run into the formation in a manner in accordance with the present invention will be protected from mud plugging.

With reference to FIGURE 7, say a formation has a temperature of 150°F and it is desired to place a prepack adjacent the formation. The formation might be penetrated by a 5000-ft. well. If the the temperature gradient is, conveniently, 1.24°F per 100 feet it is evident that a 130°F melting temperature wax can be successfully used to protect the prepack if the prepack is run at about 1000 feet per minute. More fully, at 1.24°F per 100 feet there would be a distance of about 1610 feet that the prepack would have to travel after the melting temperature of the wax was exceeded. At above 1000 feet per minute it would take less than 16.10 minutes to travel this distance. The curves in FIGURE 7 show that when the prepack reaches formation depth where the temperature is 150°F, the temperature of the wax just reached the wax melting point of 130°F. After the prepack has been located downhole for a period of time the temperature of the prepack and wax increases to a temperature greater than the wax melting point. It is not suggested that the particular curves presented in FIGURES 7 and 8 can be used to predict running-in speeds or other quantitative results. The curves are dependent on the particular prepacked liners used in the experiments. For example, prepacks with the same inner diameter, but having different outside diameters would exhibit a greater difference between bath temperature and liner temperature at any particular time corresponding to times of FIGURES 7 and 8. Thus in actual oil field use of the prepacks in commercial wells as described above it has been found that a thermal lag of about 40°F can be established by running a wax-coated prepack into a well.
according to this invention. The curves in FIGURES 7 and 8 therefore help to explain the way that applicant’s method works and that taken in total with the other data presented herein they confirm the validity and criticality of the limits of the present method.

Other laboratory experiments simulating actual prep-pack runs were conducted according to the invention on core samples obtained from an epoxy consolidated sand prep-pack. The sample cores were cut from the prep-pack by a standard core cutting apparatus. The cores had a permeability of about 17.3 darcies. Three different melting point waxes were used to coat the cores for the runs. The cores were coated with wax by melting the wax and dipping the cores into the hot wax bath. The wax was allowed to cool and harden to cover the exposed surfaces and fill the voids of the permeable matrix of the prep-pack.

A wax-coated core was placed into a pressure cell in an oil bath. The wax-coated core was so arranged in the cell so that all flow through the cell had to go through the core. An overburden pressure was placed on the cell to insure that all flow had to go through the permeable core. Oil was flowed in the cell to the core face and pressure applied to the oil to test the competency of the wax. Pressure was maintained on the oil at the core face and the temperature of the oil bath was increased until flow through the core was observed. The examples set out below show the results of the tests conducted on three different melting point waxes.

Example I

125° F. melting wax.—Two 3/4” cores coated with 125° F. melting point wax were placed end to end in a cell. Overburden pressure on cell was raised to 45 p.s.i. The cell was placed in an oil bath and oil was introduced to core face at 1 p.s.i. No flow was observed. The temperature of the oil bath was increased. The temperature at which wax melts and oil flows through the core was observed.

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<tr>
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<tbody>
<tr>
<td>05...........</td>
<td>72</td>
<td>1</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>19...........</td>
<td>116</td>
<td>1</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>24...........</td>
<td>130</td>
<td>1</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>45...........</td>
<td>130</td>
<td>1</td>
<td>25.4</td>
<td>28</td>
<td>1.85</td>
</tr>
</tbody>
</table>

1 No flow.
2 Used drop.

Example II

143° F. melting wax.—Two 3/4” cores coated with 143° F. wax were placed end to end in the pressure cell. Overburden pressure on the core was set at 50 p.s.i. The temperature at the core was raised to 130° F. Pressure on oil at core face wax raised 30 p.s.i. to check competency of wax coating. No flow was observed through core. Pressure on oil at core face was reduced to 1 p.s.i. while the overburden pressure remained at 50 p.s.i. and the temperature of bath was increased.

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<tbody>
<tr>
<td>00...........</td>
<td>120</td>
<td>1</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>20...........</td>
<td>130</td>
<td>1</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>50...........</td>
<td>160</td>
<td>1</td>
<td>12.5</td>
<td>28</td>
<td>1.85</td>
</tr>
</tbody>
</table>

1 First drop.
2 Beginning to flow.

Example III

160° F. melting wax.—Two 3/4” wax-coated cores were placed end to end in cell. Overburden pressure on cell was set at 50 p.s.i. Oil was flowed to the core face at 150° F. Pressure on oil at core face was set at 20 p.s.i. to check competency of coating. No flow was observed. Oil pressure at core face was set at 1 p.s.i. The oil bath temperature was increased to raise temperature of oil at core face.

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>00...........</td>
<td>150</td>
<td>1</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>16...........</td>
<td>170</td>
<td>1</td>
<td>( )</td>
<td>( )</td>
</tr>
</tbody>
</table>

The above experiments illustrate the thermal gradient that exists across the cores when the temperature on the exterior is raised. As is evident the wax coating does not flow out of the prep-pack when the temperature of its environment is equal to the melting point of the wax. There is an appreciable time lag even when the temperature of the environment increases substantially above the melting temperature of the wax. Thus approximately 15 minutes elapsed after the wax melting point was reached in the above examples before the wax flowed out of the prep-packs and left them unprotected. It is also important to note that the wax after becoming mobile was caused to flow out of the prep-pack with only a 1 p.s.i. pressure drop across the pack. The vertical pressure drop which occurs when running a prep-pack is greater than this.

Although only a few specific embodiments of the present invention have been illustrated and described herein, the inventive concept is not limited to those embodiments but rather only by the scope of the appended claims.

I claim:

1. A method of positioning a prep-packed sand control liner in a well comprising the steps of determining the temperature in a well at a position where a prep-packed sand control liner is to be positioned, selecting a wax having a melting temperature of from substantially equal to but less than the said determined temperature up to 40° F. less than the determined temperature, coating the exposed surfaces and filling the voids of the permeable matrix of said prep pack with said wax, inserting said prep pack in said well, lowering said prep pack through the portion of said well where the well temperature is less than the melting temperature of said wax at a rate to provide a thermal gradient through said prep pack sufficient to maintain at least a portion of the wax in said prep pack unmelted for a time interval after the melting temperature of the wax is exceeded in the well, continuing to lower said prep pack to said position during said time interval through the portion of said well where the well temperature exceeds the melting point of said wax at a rate to maintain at least a portion of said wax un melted in said prep pack until said prep pack reaches said position to prevent drilling mud invasion of said prep pack, and positioning said prep pack at said position.

2. The method of claim 1 where the melting temperature of the wax is about 20° F. less than the determined temperature.

3. A method of protecting a prep-packed sand control liner being run into a well comprising determining the temperature at a location in a well where a prep pack is to be placed, selecting a wax having a melting point of from substantially equal to but less than the said determined temperature up to 40° F. less than the determined temperature, coating the exposed surfaces and filling the voids of the permeable matrix of said prep pack, inserting said prep pack into said well, lowering said prep pack into said well at a rate to maintain at least an annular portion of the wax in said prep pack unmelted until said prep pack arrives at said location.

4. The method of claim 3 where the melting temperature of the wax is about 20° F. less than the determined temperature.
5. The method of preventing particle invasion of a pre-pack comprising coating the exposed surfaces of a pre-pack including the permeable matrix thereof with wax, said wax having a melting temperature of from substantially equal to but less than the temperature at the position in a well where the pre-pack is to be positioned up to 40°F. below the temperature at the position in the well where the pre-pack is to be located, and running said pre-pack into said well to said position at a rate of at least 100 feet per minute.

6. The method of claim 5 where the melting temperature of the wax is about 20°F. less than the temperature in the well at the position where the pre-pack is to be placed.

7. The method of protecting downhole apparatus from particle invasion while said apparatus is being positioned at a predetermined depth in a borehole comprising determining the temperature in said borehole at said predetermined depth, selecting an oil-soluble protective wax with a melting point from substantially equal to but less than the said determined temperature up to 40°F. less than said determined temperature, covering the exposed surfaces of said apparatus with said wax, running said apparatus into said well to said predetermined depth at a rate of at least 100 feet per minute and positioning said apparatus at said predetermined depth in said borehole.

8. The method of claim 7 where the petroleum wax is a microcrystalline wax.

9. The method of claim 7 where the melting point of said petroleum wax is 20°F. less than said determined formation temperature.

References Cited by the Examiner

UNITED STATES PATENTS
2,336,168 12/1943 Eckel 166—34

FOREIGN PATENTS
548,436 11/1957 Canada.

OTHER REFERENCES

JACOB L. NACKENOFF, Primary Examiner.
CHARLES E. O'CONNELL, Examiner.
I. A. CALVERT, T. A. ZALENSKI, Assistant Examiners.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,268,001

Harry Brandt

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 11, for "ot" read -- to --; column 3, line 53, for "foodstocks" read -- feedstocks --; column 6, line 39, for "about" read -- above --; line 46, after "wax" insert -- has --.

Signed and sealed this 1st day of August 1967.

(SEAL)

Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents