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METHOD FOR CEMENTING AND TESTING WELLS

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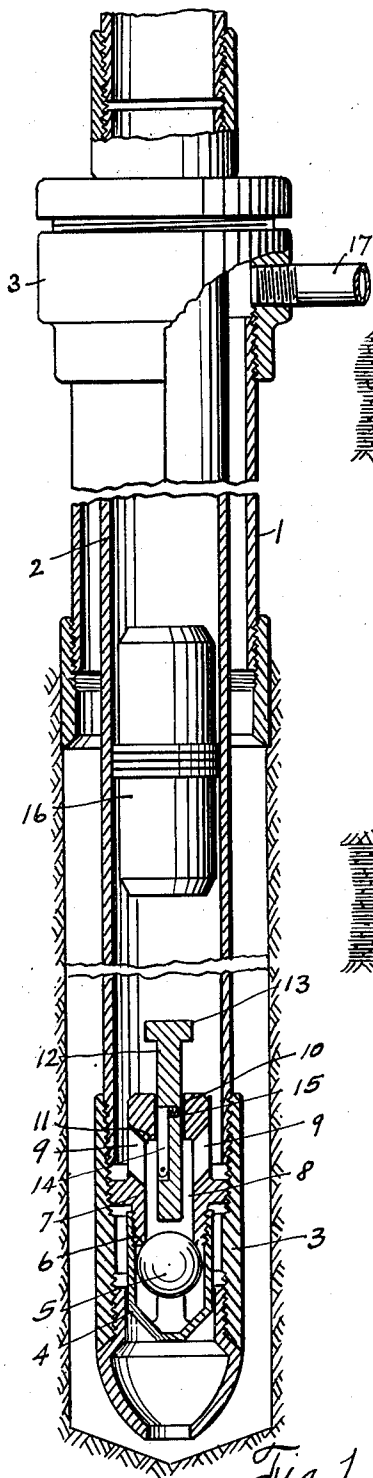


Fig. 1.

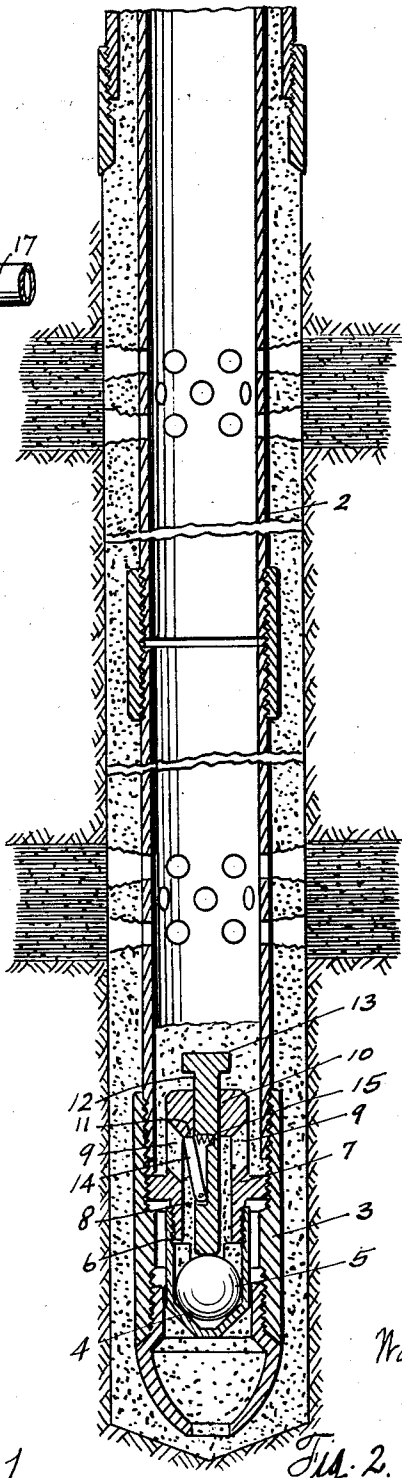


Fig. 2.

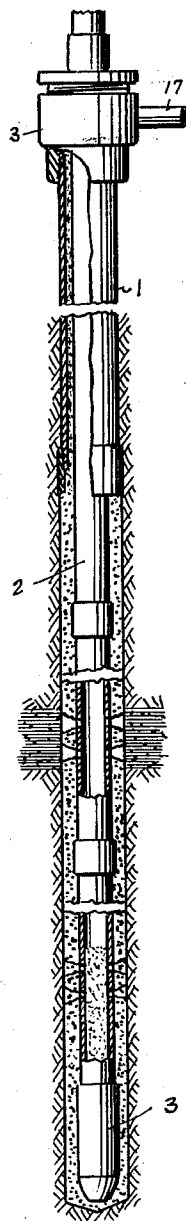


Fig. 3.

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METHOD FOR CEMENTING AND TESTING
WELLS

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4 Claims. (Cl. 166—21)

This invention relates to a method for cementing and testing wells.

It is often desirable to cement around a casing or pipe in a well bore to separate one stratum from another and particularly to form a barrier between the water bearing and oil bearing strata. It is common practice to force plastic cement down through the casing or pipe to be cemented and out through an outlet into the space between the casing or pipe and the walls of the bore. This is commonly done by entrapping the plastic cement between a lower and an upper plug in the casing and then forcing the cement downwardly to the point of discharge by the application of fluid under pressure to the upper plug. When the lower plug passes beneath the outlet, at the point where the cementing is to be done, the upper plug is forced on downwardly to force the load of cement out through said outlet and the cement rises around the casing until the upper plug is stopped by the lower plug and no more cement can then be forced out. When this method is employed, it often happens that the cement arising around the casing does not form a complete barrier but channels are left therein through which the water or gas or oil can pass from one stratum to another. Furthermore, inasmuch as the cross sectional area of the bore between the pipe to be cemented and the walls of the bore is usually greater than the cross sectional area of inside of the pipe a sufficient quantity of cement can not be forced, by the ordinary method, down through the pipe and returned back up on the outside of the pipe or casing to the level desired to cement around the upper portion of said pipe or casing.

It is an object of this invention to provide a method whereby the cement may be forced down around the inner pipe from top to bottom and into the lower end thereof whereby the inner pipe may be cemented from top to bottom of the pipe to be cemented and the cement may rise within the inner pipe the desired distance.

Another object is to provide a method whereby a string of pipe or casing may be floated into the well by the use of a float shoe which is closed against the inlet of liquid while the string is being lowered but which may be opened when the string reaches the bottom so that the liquid in the well may be forced out through the string by fluid pressure as the cementitious material is being forced into the bore around the string of pipe and the space between said string and the walls of the bore from the upper to the lower

end of the string may be filled with cement whereby the entire string may be cemented to prevent gas escaping from lower strata and entering the shallower water sands and charging said last mentioned sands with gas which otherwise would later blow out after the completion of the well, to injure or destroy the well.

Another object of the invention is to provide a novel method for testing wells in unproven fields and by the use of which a well can be drilled to the maximum depth desired and the different strata having producing possibilities accurately located and a string of pipe then set in the bore and cemented on the outside and after the cement has set the string then perforated opposite the lowermost stratum and if oil be not found therein the inside of the casing then cemented up to the next stratum supposed to contain oil or gas and the pipe again perforated and said stratum tested; the different strata thus being tested from the lowermost one upwardly until a producing stratum is found or the well is abandoned. At the present time in drilling wells when a stratum is encountered supposed to contain oil, the casing is set on top of said stratum and the hole is reduced and bored into the stratum and pipe of smaller diameter is then set and if oil in paying quantities is not found the smaller pipe must be moved in order to resume drilling operations and this process must be repeated as the different strata are reached supposed to contain oil, until the well is completed or abandoned. The method of testing herein described and claimed is much simpler and not so expensive as the method now commonly used as above identified.

The method of cementing herein described and claimed may be employed for cementing a string of pipe from the upper to the lower end thereof or from any selected point as at a point above the well screen to the top of the well.

With the above and other objects in view the invention has particular relation to a novel method, an example of which is given in this specification and illustrated in the accompanying drawing, wherein:

Figure 1 shows a fragmentary vertical sectional view partly in section showing the string lowered to the bottom of the bore preparatory to cementing the same.

Figure 2 shows a fragmentary vertical sectional view showing the lower end of the string cemented throughout the length thereof and perforated opposite the strata to be tested, and

Figure 3 shows a side elevation of the string

of pipe located and cemented in the well and perforated opposite the strata and showing the string plugged up above a non-producing stratum.

In the drawing the numeral 1 designates the surface casing and the numeral 2 designates a string of casing or pipe, which extends to the bottom of the well. Attached to the upper end of the surface casing 1 there is a conventional type of braden head 3 through which the string 2 extends, said braden head closing the space between the surface casing 1 and the inner casing 2. A float shoe designated generally by the numeral 3 is attached to the lower end of the casing 2. This float shoe contains a valve cage 4 which confines the ball valve 5 and above said valves within the float shoe there is an annular valve seat 6. As the inner casing or pipe 2 is lowered through the fluid in the well the valve 5 will be held in position to close the seat 6 to prevent the entrance of drilling fluid from the well into the casing 2. The seat 6 forms the lower end of a nipple 7 which is of tubular formation, having the central axial water course 8 therethrough, which divides forming the side passageways 9, 9 into the interior of the string 2. The upper end of the passageway 8 is reduced forming a bearing 10 and an inside annular shoulder 11. A plunger 12 is slidably mounted in the bearing 10 and has a head 13 on its upper end. A latch 14 is seated in a counter-sunk vertical groove in one side of said plunger and is pivoted therein at its lower end. The upper end of said latch is free and is seated against a coil spring 15. While the string 2 is being lowered the plunger 12 is in upper or inactive position but when said string is landed on bottom a plug as 16 may be forced by fluid pressure down through the string 2 and the plug will engage the head 13 and force the plunger 12 downwardly against the valve 5 to unseat the same and when the upper end of the latch clears the shoulder 11 the spring 15 will force said latch outwardly and cause it to engage said shoulder as to latch the plunger 12 in its lower or active position whereby the valve 5 will be secured in its lowermost, or open, position. Water may then be forced into the space between the surface casing 1 and the inner casing 2, through the inlet pipe 17 which is screwed into the braden head 3, and the plug 16 thereby forced back up through the casing 2 to the ground surface. A sufficient amount of clean water may be forced down through the bore on the outside of the pipe 2 and back up through said pipe to wash the well. Cementitious material may then be forced into the well bore around the inner pipe through the pipe 17 by the application of pressure thereto and as said material is forced downwardly the fluid in the bore will be forced downwardly ahead of it, and will pass up through the inner pipe 2. This process is continued until the bore from the top to bottom around the inner pipe is filled with cement and a sufficient amount of the cement is forced into the lower end thereof beneath the lower stratum to be tested. The cement is then allowed to set or harden.

After the cement has sufficiently set a perforating tool may be lowered through the inner pipe and said pipe and the surrounding cement perforated opposite the lower stratum. As previously stated each stratum has been located during the drilling of the bore so that the perforations can readily be made opposite the stratum which it is

desired to test. If the tested stratum proves to be a producing stratum the well can then be completed in the usual way but if it should not prove to be a producing stratum plastic cement can be lowered through the inner pipe and the same can be cemented up above the perforated section and the inner pipe can then be perforated opposite the next succeeding stratum above until a producing stratum is discovered or the well abandoned.

The inner pipe is thus completely and effectively cemented from the top thereof down to the bottom of the bore so as to effectively seal off each stratum from the others.

Cementitious material will ordinarily be employed for the purpose specified but it is to be understood that in carrying out the process other suitable materials may be employed such as barite or any other heavy material which may be reduced to a fluid state so that it may be pumped into the well and which will pack around the inner pipe to a sufficient density to become impervious to the passage of liquid therethrough and the term cement or cementitious material as used herein is intended to be construed to include any plastic material or fluid solution of such a nature as to be readily forced into the well under pressure and to set or pack about the inner pipe so as to form a continuous seal around said inner pipe to prevent the passage of liquid from one stratum to another in the well.

What I claim is:

1. The process of testing strata in a well which consists in locating a pipe in the well, forcing a sealing material into the well around the pipe, allowing the material to set to form a continuous seal from a point beneath to a point above the strata, perforating the pipe and seal opposite the various strata to be tested from the lowermost upwardly, closing the perforations opposite a stratum beneath prior to perforating opposite a stratum above.

2. In completing a well the process which comprises lowering a pipe, having a normally closed inlet, into the well, opening said inlet, forcing a sealing material into the space between the pipe and the walls of the well from above downwardly until said space has been filled entirely around the pipe, to a point beneath the inlet, then allowing the material to set.

3. The process of testing earth strata which have been pierced by a well bore, which process comprises setting a string of pipe in the well, forcing a sealing material from above downwardly into the space between the pipe and the walls of the well to fill said space a selected distance along the pipe and to close the lower end of the pipe, allowing said material to set, perforating the pipe and seal at points opposite the strata to be tested in succession from below upwardly, closing the perforations at one stratum prior to perforating at the next succeeding stratum.

4. The process of testing strata in a well which consists in locating a pipe in the well, delivering a sealing material into the well about the pipe, allowing the material to set to form a continuous seal from a point beneath to a point above the strata, perforating the pipe and seal opposite the various strata to be tested from the lowermost upwardly, closing the perforations opposite a stratum beneath prior to perforating opposite a stratum above.

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