

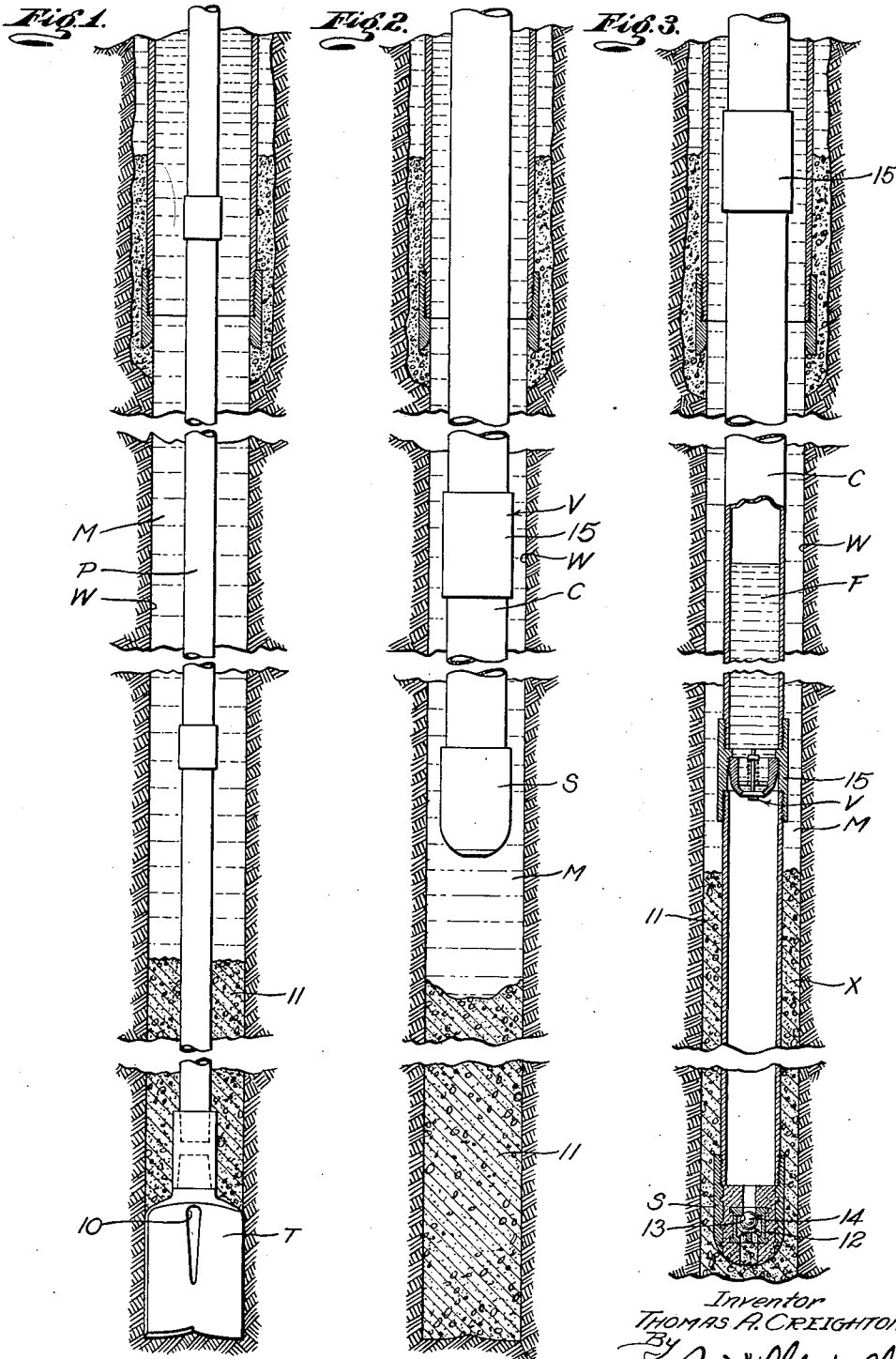
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METHOD FOR CEMENTING WELL CASINGS

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METHOD FOR CEMENTING WELL CASINGS

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This invention relates to a method useful in well drilling operations and relates more particularly to a method for cementing casing in a well. A general object of this invention is to provide a simple, rapid and commercially practical method for cementing casing in a well.

In the drilling of deep wells such as oil wells, gas wells, etc. it is usually necessary to line or case the well with a casing to support the wall of the well and to exclude unwanted fluids from the well. It is the common practice to cement the lower portion of the casing in the well to prevent the contamination of the fluid to be produced and to prevent both the upward and downward passage of fluid around the set casing. In the methods now usually employed to cement a casing in a well the casing is run into the well to its final position and cement is then pumped down through the casing, or through a tube within the casing, to the bottom of the well and is forced up around the lower portion of the casing by the pump pressure. In the rotary method of well drilling the well and the casing are filled with the mud-laden drilling fluid and the cement is contaminated with this drilling fluid when it is pumped through the casing and forced up around the lower end of the casing. As the cement is forced up around the lower end of the casing it mixes with the mud on the casing and on the wall of the well and follows the paths of least resistance leaving channels or spaces occupied by mud and other foreign material. This so-called "channeling" of the cement that encases the lower portion of the casing often results in the leakage of water or other unwanted fluid into the well and necessitates expensive and time consuming operations to stop the leakage around the casing.

Another object of this invention is to provide a method for cementing a casing in a well that assures a full and effective shut-off around the casing.

Another object of this invention is to provide a method for cementing well casing that avoids the "channeling" of the cement.

Another object of this invention is to provide a method for cementing a well casing in which the cement is contaminated by mud, cuttings, etc. to a minimum extent.

Another object of this invention is to provide a method for cementing a well casing in which it is unnecessary to pump the cement up around the casing shoe whereby the cement is free to flow at a slower rate and to completely occupy

the annular space around the casing to form a tight, effective shut-off.

A further object of this invention is to provide a method for cementing well casing that is easy to perform and that does not necessitate the employment of expensive equipment.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred manner of carrying out the method of the invention, throughout which description reference is made to the accompanying drawing, in which:

Fig. 1 is a longitudinal sectional view of the lower portion of a well illustrating the cement being delivered to the well in accordance with the method of the invention. Fig. 2 is a view similar to Fig. 1 showing the casing about to enter the cement and Fig. 3 is a view similar to Fig. 1 with the lower portion of the casing in vertical cross section and showing the casing set in the cement.

In the drawing I have illustrated the open or uncased lower portion of a typical well W. It will be assumed that the well is being drilled by the rotary method and is filled with the rotary mud M usually employed in the rotary method of drilling. As illustrated in Fig. 1 of the drawing a string of drill pipe P is in the well W and carries at its lower end a drilling tool T. The tool T may have drilled the well W to the desired depth. In accordance with the usual practice the well drilling tool T has circulation ports 10 for discharging the drilling fluid or rotary mud M.

The method provided by the present invention includes, generally, the passage or delivery of the proper amount of cement 11 to the lower portion of the well W through the drill pipe P, the removal of the drill pipe P and the tool T from the well, providing a casing C having a closure or a valved shoe S on its lower end and having a suitable float valve V, and then running the casing C into the well W to its final position in the well to displace the cement 11 upwardly around its lower end whereby the lower portion of the casing is embedded in the cement.

In accordance with the present invention the drill pipe P may be employed to deliver or conduct the cement mixture or cement slurry to the bottom of the well W. When the well W has been drilled to the desired depth and while the drill pipe P remains in the well bore the cement 11 may be passed down through the pipe. In practice the cement slurry 11 is pumped through the drill pipe P by suitable pumping equipment. The cement 11 discharges from the ports 10 of the

drilling tool T to flow into the lower portion of the well. Thus the cement 11, in the quantity previously determined, is delivered to the bottom of the well bore W with little or no contamination. The drill pipe P conducting the cement 11 of course prevents the mud M in the well W from contaminating the cement 11 as it is delivered downwardly into the well.

The character of the cement 11 delivered to the lower portion of the well W is of particular importance to the method of the invention. In accordance with the invention Portland cement is employed that is retarded to attain its initial set in from 30 to 40 hours after mixing. When the required quantity of cement 11 has been pumped into the well W through the drill pipe P the drill pipe carrying the tool T is withdrawn from the well. It is to be particularly noted that the cement 11 is delivered to the lower portion of the well W in an uncontaminated state without the necessity of running a special cementing string into the well. As the drill pipe P is already in the well at the start of the cementing operation the employment of the pipe P to conduct the cement effects a marked saving in time.

Immediately following the withdrawal of the drill pipe P and the tool T from the well the casing C is assembled and run into the well. The shoe S on the lower end of the casing C is provided with means for preventing the entrance of fluid into the casing when the same is run into the well, whereby the casing C may be floated into the well. In the particular case illustrated in the drawing the shoe S has a cage 12 provided with a valve seat 13 and a ball valve 14 co-operates with the seat 13 to close the lower end of the casing C. The valve V may be provided in the casing C to assure that the casing may be floated into the well in the event the valved shoe S leaks. The float valve V may be of typical construction and is designed to positively prevent up-flow in the casing C and to trap or support a substantial head of fluid in the casing. The valve V may be mounted or arranged in one of the couplings 15 of the casing and may be provided at any desired point in the lower portion of the casing. The valve elements 12, 13 and 14 of the casing shoe S and the float valve V are formed of frangible or drillable material so that they may be readily drilled out when the well is to be completed or deepened. The valve V may be of any typical construction and any suitable form of valved shoe S or closure may be employed on the lower end of the casing C. Accordingly, the invention is not to be considered as restricted to the use of the particular valve structures illustrated in the drawing.

The casing C equipped with the valved shoe S and the float valve V, as described above, is run into the well W in the usual manner. The valved shoe S and the valve V positively prevent the up-flow of fluid in the casing C and permit the casing to be floated into a deep well without danger of parting through its own weight. In floating the casing C into the well W the valve V and the valved shoe S prevent the entrance of the mud M to the casing so that the hollow or empty casing has sufficient buoyancy to support itself against parting. It may be necessary to pour mud or other fluid F into the empty casing C to give it sufficient weight so that it may be run into the well. The casing C may be run through the well to its final position.

During the latter portion of the downward movement of the casing C into the well W the

shoe S and the lower portion of the casing enters the cement 11. As described above, the cement 11 is retarded so that it remains in a fluid or plastic state until the casing C is embedded in it. The valve 14 in the shoe S prevents the cement 11 from entering the casing C so that the casing displaces the cement 11 upwardly into the annular space X between the casing and the wall of the well W. During the passage of the casing C into or through the cement 11 it is preferred to lower the casing C slowly so that the cement is made to slowly move upwardly around the casing C in the space X as it is displaced by the slow moving casing. It is believed that it will be readily understood how the casing C provided with the valved shoe S displaces the cement 11 to flow upwardly in the space X around the casing.

When the casing C is in its final position in the well the cement 11 is allowed to set and the cementing operation is complete. It is to be understood that the valve V, the valve elements 12, 13 and 14 in the shoe S, and any other internal parts of the shoe S may be removed or broken out to permit the testing of the cement seal and the casing C and to permit completion of deepening of the well.

The method provided by the present invention for cementing well casing prevents "channeling" of the cement due to pumping of the cement upwardly around the lower end of the casing and thus assures an effective fluid tight seal. The method may be readily carried out without employing special packers, etc. The cement 11 is delivered to the lower portion of the well W through the drill pipe P so that it is not contaminated by the mud or fluid M in the well. The lowering of the casing C into the mix or body of plastic cement 11 in the bottom of the well bore W assures the complete embedding of the lower portion of the casing C in the cement so that fluid cannot possibly leak or flow through the annular space X between the casing and the wall of the well.

Having described only a typical preferred manner of carrying out the method of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims:

Having described my invention, I claim:

1. The method of cementing a casing in a well comprising, depositing a body of plastic cement in the well, and then running the casing into the well to enter it in the cement.
2. The method of cementing a casing in a well comprising passing a body of plastic cement to the lower portion of the well, providing the casing with a closure at its lower end, and running the casing into the well to immerse its lower portion in the plastic cement.
3. The herein described method comprising depositing a body of plastic cement in a well by passing the cement down through a tubular drilling string in the well, removing the drilling string from the well, running a casing into the well to introduce its lower end into the cement, and then allowing the cement to set.
4. The well drilling method comprising operating a tubular well drilling string in a well, passing plastic cement through the string to the lower portion of the well to occupy the same, removing the drilling string from the well, lowering a well casing into the well to introduce the casing into the cement and cause the upward dis-

placement of the cement around the casing, and then allowing the cement to set.

5 5. The well drilling method comprising operating a tubular well drilling string in a well, passing plastic cement through the string to the lower
10 portion of the well to occupy the same, removing the drilling string from the well, lowering a casing having a closed lower end into the well to
15 enter its lower portion in the cement and thereby cause the upward displacement of the cement around the casing, and then permitting the cement to set.

20 6. The method of cementing a casing in a well comprising delivering a mass of plastic cement
15 to the lower portion of the well, providing a casing with a valved lower end, running the casing into the well so that its lower portion enters the cement and displaces the cement upwardly around the casing, and then allowing the cement to set.

7. The method of cementing a casing in a well comprising delivering a mass of retarded plastic cement to the lower portion of the well, provid-

ing a casing with a closed lower end, running the casing into the well so that its lower portion enters the cement and displaces the cement upwardly around the casing, and then allowing the cement to set.

8. The method of cementing a casing in a well comprising, delivering a mass of retarded plastic cement to the bottom of the well, floating a casing into the well to enter the cement and displace the cement upward around the casing
10 and then allowing the cement to set.

9. The well drilling method comprising operating a tubular well drilling string in a well, passing retarded plastic cement through the string to the lower part of the well, removing the drilling
15 string from the well, providing a casing with a valved shoe on its lower end, floating the casing into the well so that its lower portion enters the cement and displaces the cement upwardly around the casing, lowering the casing to its
20 final position in the well, and then allowing the cement to harden.

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