Aug. 17, 1948. W. J. TRAVERS, JR 2,447,217

WELL CEMENTING METHOD

Filed Oct. 14, 1946

2 Sheets-Sheet 1

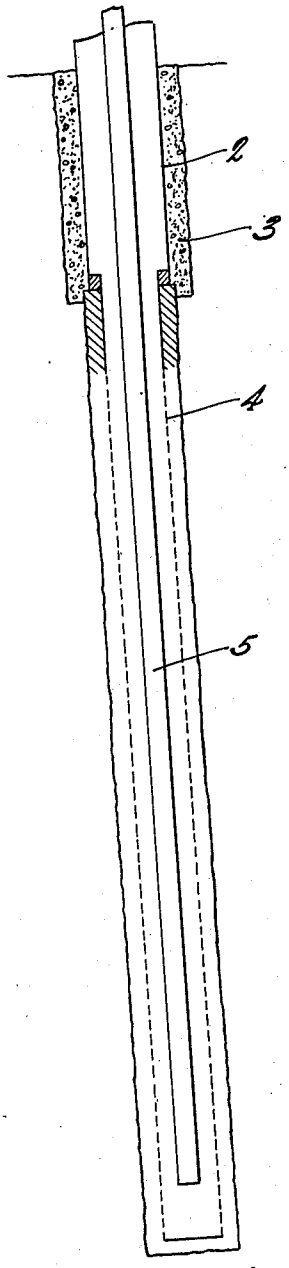


Fig. 1

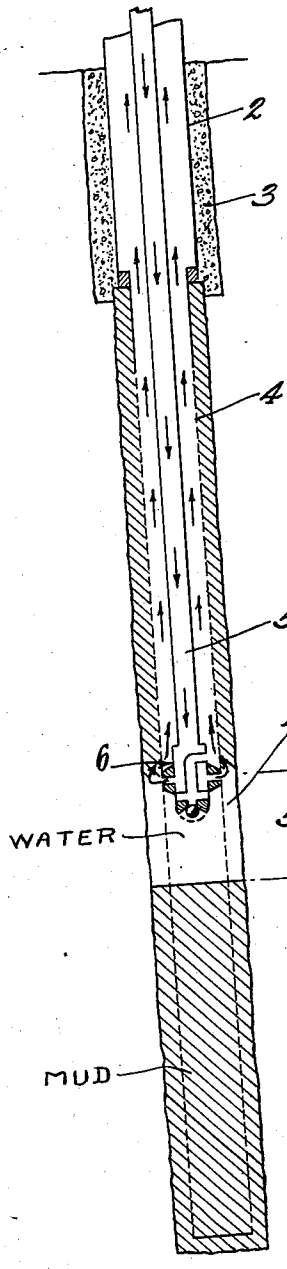


Fig. 2

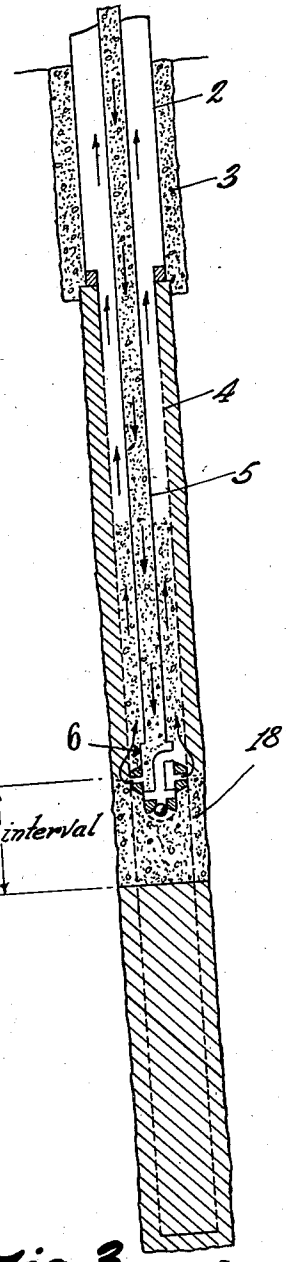


Fig. 3

Inventor
William J. Travers, Jr.

By Lyon & Lyon Attorneys

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2 Sheets-Sheet 2

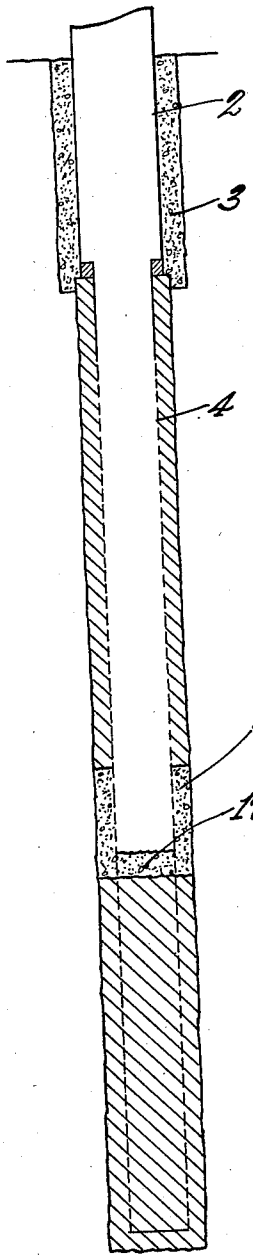


Fig. 4

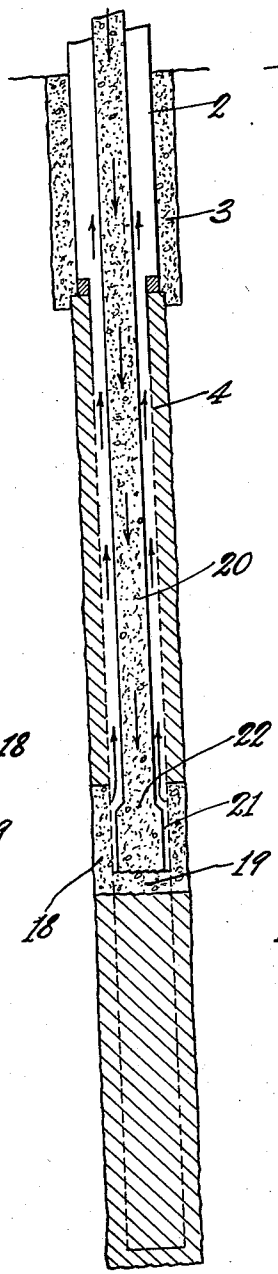


Fig. 5

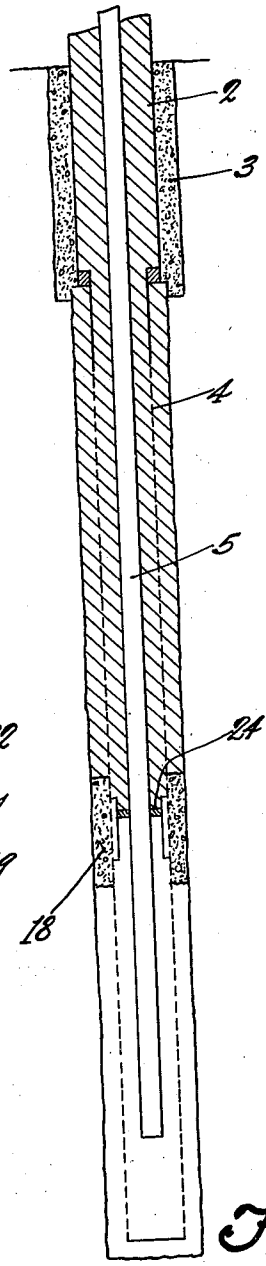


Fig. 6

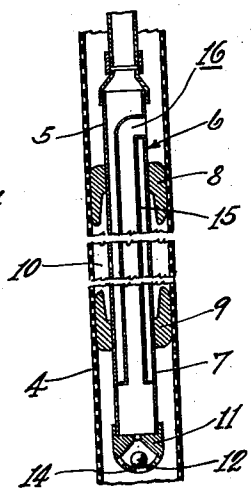


Fig. 7

Inventor
William J. Travers, Jr.

By Lyon & Lyon Attorneys

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UNITED STATES PATENT OFFICE

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WELL CEMENTING METHOD

William J. Travers, Jr., Los Angeles, Calif., assignor to Richfield Oil Corporation, Los Angeles, Calif., a corporation of Delaware

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1 Claim. (Cl. 166—22)

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This invention relates to a method of cementing an oil well for the purpose of effecting a separation of zones in a producing interval.

In producing oil from some fields, it is found that an undesirable high gas-oil ratio is obtained. For the purpose of reducing this high gas-oil ratio it is desirable to perform a cementing operation at a point within the producing horizon for the purpose of shutting-off the gas in the top part of the hole from the producing intervals.

Two practices have heretofore been used to effect such a cementing operation at a point within the producing horizon. In the first of these procedures, where there exists a "blank" (not perforated) section of the casing at a point where the cementing operations are to be performed, shut-off is effected by forcing cement around this blank section until contact between the casing and the walls of the hole is fully obtained. Thereafter the well is recompleted with the tubing to casing packer set in the blank section. Where there is no blank section available at or near the point where the shut-off is desired, it has been formerly necessary to remove the liner from the well and install a new liner properly equipped in order to allow the cementing operation. Such an operation is very expensive. I have developed a method by which the desired cement shut-off may be effected at a point in the producing horizon of a well where there is present a perforated casing, which does not require the removal of such perforated casing.

By the method of the present invention, I have succeeded in successfully effecting a shut-off at the desired point, decreasing the gas-oil ratio of the well at a cost substantially reduced from either of the prior methods.

The method of the present invention, together with various other objects and advantages of the invention, will be fully understood from the following description of a preferred form or example of the method. I have, therefore, described with reference to the accompanying drawings, the preferred form of the present invention.

Referring to the drawings:

Figure 1 diagrammatically illustrates the condition of a well before applying thereto the process of the present invention.

Figure 2 illustrates a washing operation employed in the method of the present invention.

Figure 3 illustrates the cementing operation step of the present invention.

Figure 4 illustrates cleaning out of a portion of the cement preparatory to running the sleeve.

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Figure 5 illustrates cementing of the sleeve in place.

Figure 6 illustrates the re-completion of the well, using the installed sleeve, and a tubing to casing packer.

Figure 7 is a vertical section of a washing and cementing tool employed in the method of the present invention.

Referring first to Fig. 1 of the drawings, I have illustrated therein diagrammatically the condition of a typical well which is to be treated by the method of the present invention. In the drawing, 2 indicates a well casing which is cemented, as indicated at 3. Below the casing there is hung the perforated liner 4, which extends through the producing formation of the well. Within the well there is indicated the usual production tubing 5. When such a well, completed as indicated in Fig. 1 is later found to produce at a high gas-oil ratio and it is desired to effect the shutoff operation of the production strata along some zone where the perforated liner 4 is present, the process is as follows:

The production from the well is first killed by introducing water into the well. There is then preferably introduced a viscous mud, after which the tubing 5 is pulled from the well. A washing and cementing tool 6, illustrated in Fig. 7, is then installed on the lower end of the tubing. The particular tubing illustrated is indicated as including a section of tubing 7 having an upper packer 8 and a lower packer 9, the packers 8 and 9 being spaced apart as indicated to provide an annular zone between the packers, which is in communication with the interior of the tube 5 from the perforation 10.

For the purpose of facilitating the movement of the washing and cementing tools there is preferably provided a valve controlled bypass line around the packers. For this purpose, the lower end of the tubing 5 (Fig. 7) is provided with a valve seat 11 on which is adapted to seat a ball 12 when forced upwardly against the valve seat 11, having a retaining cage 14 which will retain the valve for preventing the valve from dropping off the seat. Within the tubing 5 there is provided the inner tube member 15 spaced from the tube 5 and communicating with the exterior of the tube 15 through an opening 16 above the packer 8.

The washing and cementing tool 6 is thus provided with a bypass passage to permit the ready flow of water, mud, or other fluid from the space above the packer 8 to the space below the packer 9. Movement of fluid, moreover, in the reverse

direction through the bypass 15, may not be allowed to occur.

After the washing and cementing tool 6 has been installed at the lower end of the tubing 5, the tool is then run into the hole to the point along the perforated liner 4, where the cementing operation is to be performed. The perforations in the region of the portion to be cemented and the formation back of the perforations are then thoroughly washed with water, while the space around the tubing above the tool 6 is cleared of mud and water substituted therefor. In conducting these operations the water is forced downwardly through the tubing 5 and passes out through the perforations 10 of the tube and is forced through the perforations of the liner 4 which are between packers 8 and 9. During this operation the tool is gradually elevated in order that a suitable area of the perforated pipe 4 will be washed in this manner. For example about 50 feet is a suitable interval for the liner to be covered in the washing operation.

The washing operations are illustrated in Fig. 2 of the drawings. As the result of this operation there is a zone, such as indicated at 17, in Fig. 2, cleared of mud. At the completion of the washing operation the tool 6 is then lowered to the bottom of the interval which has been washed, and cement is now mixed and pumped down the tubing 5. The amount of cement introduced into the tubing is calculated so that from the calculations of the capacity of the tubing 5 and the amount of cement introduced, the operator knows when the cement starts coming out through the perforations 10 of the tool, and hence through the perforations of the liner 4. After this period is reached, the tool is slowly elevated in order to effect a cementing operation through the entire 50-foot intervals of the perforated liner to be cemented.

In Fig. 3 there is illustrated the end of this operation, the figure showing the tool 6 at the upper end of the interval to be cemented. The interval cemented is indicated at 18. The tubing 5 and the tool are then withdrawn from the liner and the cement allowed to harden.

After the cement has hardened, the interior of the well is then cleaned out of the cement—(drilled out where necessary)—leaving but a short bridge 19 of cement, such, for example, as a 10-foot interval at the bottom of the cemented section 18. There is then attached to the lower end of a drill-pipe, such as indicated at 20, a blank sleeve 21, preferably a low carbon steel sleeve. The sleeve 21 is then lowered on the drill pipe 20 until it rests against the bridge 19, after which cement is introduced, as indicated at 22, for the purpose of cementing the liner to the previous cement bridge 18, as illustrated in Fig. 5. The drill pipe 20 is then disconnected from the blank sleeve 21, which is then cemented in position, and the drill pipe is withdrawn from the well. Thereafter the well and sleeve 21 are cleaned out to the bottom of the well, and as illustrated in Fig. 6, the well is re-completed by the use of the tubing 5, which is now provided with a tubing to casing packer 24 set at the cemented sleeve 21.

As the result of these operations, the gas in the formation above the cemented zone 18 is prevented from entering the well or tubing 5 and accordingly, therefore, the gas-oil ratio of the well is substantially reduced.

While the particular form of the method herein described is well adapted to carry out the objects of the present invention, various modifications and changes may be made without departing from the principles of the present invention, and this invention includes all such modifications and changes as come within the scope of the appended claim.

I claim:

A method of cementing oil wells having a perforated liner therein for excluding gas from the formation of the upper portion of the liner from the lower portion of the liner, which method comprises filling the well with fluid, lowering spaced packers in the well to a point along the perforated liner where the cementing operation is to be performed, forcing water from the space between the packers through the perforations of the liner to clean such perforations, progressively raising the spaced packers while continuing the cleaning operation to cover the zones to be cemented, lowering the spaced packers to the bottom of the zone and forcing cement from the space between the packers through the perforations to deposit cement in the space back of the perforations cleaned by said operation, removing the spaced packers and allowing the cement to harden, cleaning out the interior of the well while leaving a short bridge of cement in the well at the bottom of the zone treated, setting a sleeve on said bridge and cementing the same in place, and cleaning out the well and inserting a production tubing having a packer thereon into the well and setting the packer on said sleeve.

WILLIAM J. TRAVERS, JR.

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