

Jan. 31, 1967

J. P. MARTIN

3,301,329

TOOL FOR CEMENTING AND/OR PLUGGING A WELL OR THE LIKE

Filed May 15, 1964

2 Sheets-Sheet 1

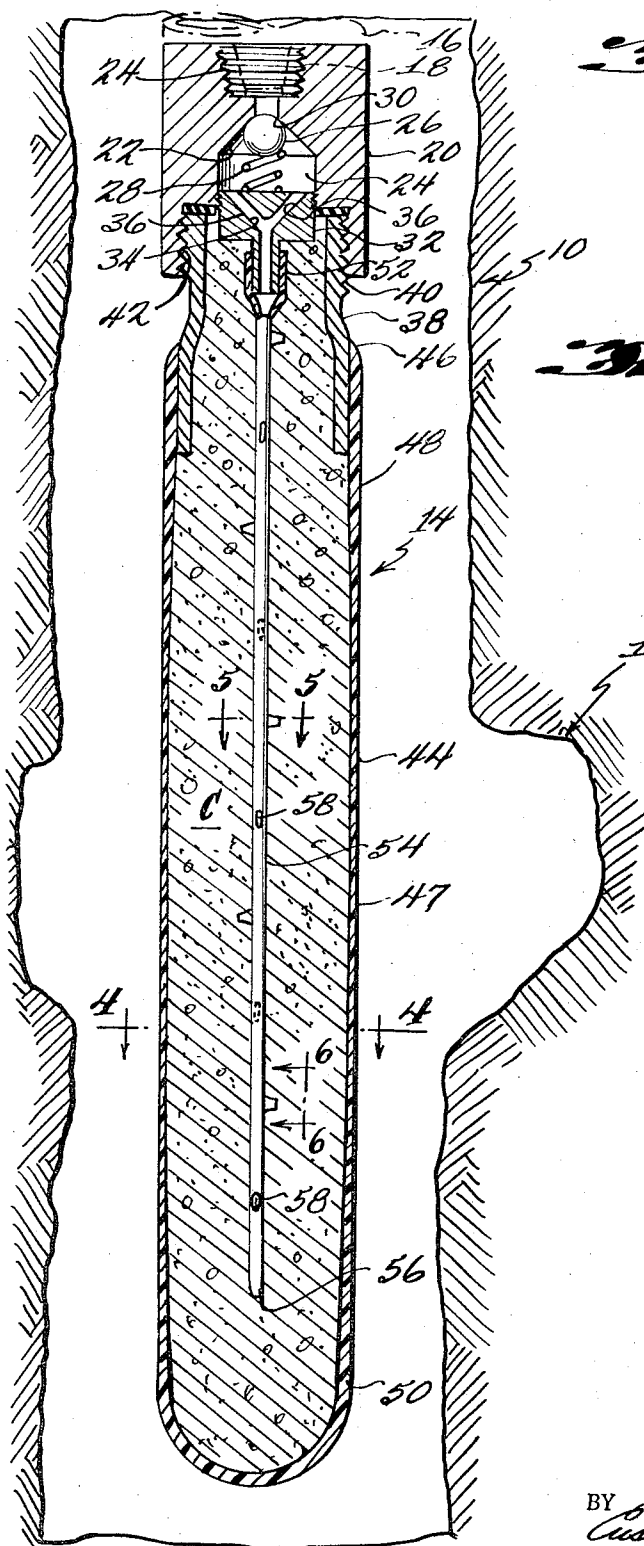


Fig. 6

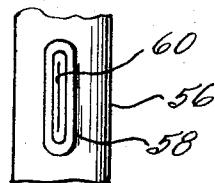


Fig. 1

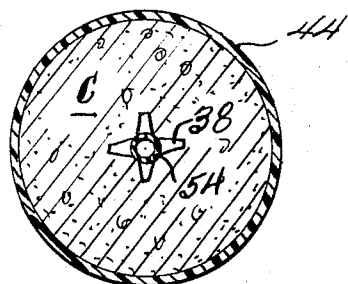


Fig. 4

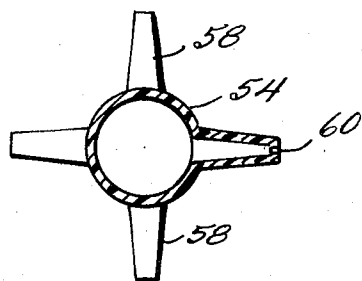


Fig. 5

INVENTOR

JOHN P. MARTIN

BY

Cushman, Darby & Cushman
ATTORNEYS

Jan. 31, 1967

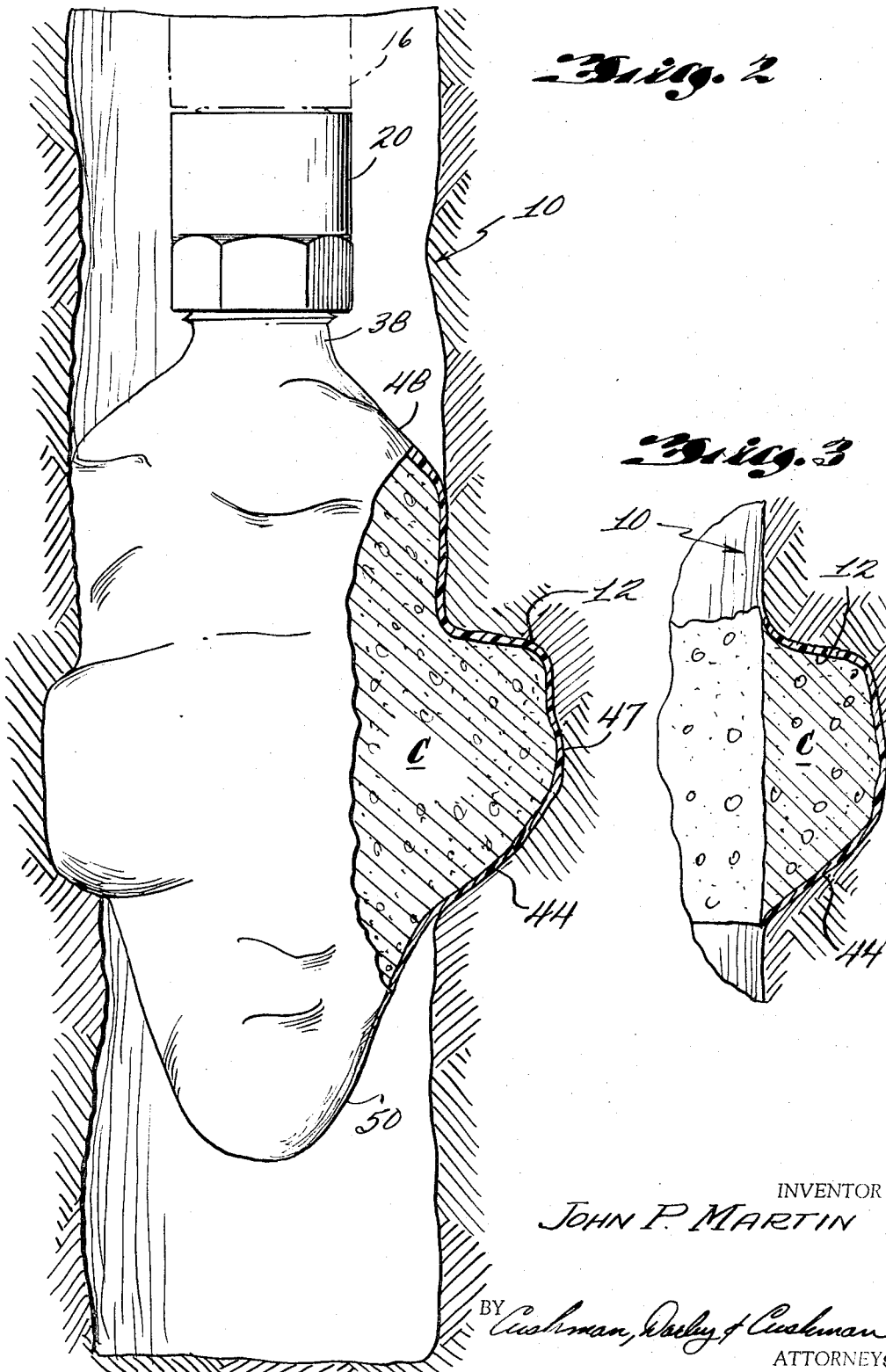
J. P. MARTIN

3,301,329

TOOL FOR CEMENTING AND/OR PLUGGING A WELL OR THE LIKE

Filed May 15, 1964

2 Sheets-Sheet 2



1

3,301,329

TOOL FOR CEMENTING AND/OR PLUGGING A WELL OR THE LIKE

John P. Martin, Apartado, Postal 1351, Guatemala,
Guatemala, assignor, by direct and mesne assignments,
of one-half to John N. Loomis

Filed May 15, 1964, Ser. No. 367,830

10 Claims. (Cl. 166—187)

The present invention relates to a tool for cementing wells, and more particularly, to a tool useful in cementing wells at any pre-selected point in the well. In this respect, the tool's operation is not dependent upon whether or not the tool is positioned at the bottom of the well hole or is anchored to a wall of the well at a particular elevation. The tool requires no special anchoring means but merely needs to be supported on the lower end of a drill string or stand.

Oftentimes in the treatment of wells, a down hole tool for cementing the well is used to improve the well operation. In instances where there is a fissure causing circulation problems in the well by reducing down hole pressure, it has been the practice to cement the well at this break in the wall of the well and then drill out the cement after the cement has set so as to provide a positive seal for the fissure in the wall of the well. Apparatus heretofore utilized for such operations where cementing of a well is desirable have required that the tool be anchored within the well to the wall of the same adjacent the site where the cement is to be placed. In other instances, such apparatus could only be used at a bottom of the well wherein a portion of the apparatus was positively supported directly on the bottom. Also, such prior apparatus involved many moving parts as they had to provide for the pumping of a cement slurry from the surface of the well downwardly through the drill string pipe into and through a costly and expensive tool. Since the tool was usually left in position as the cement set and then was later drilled out, it was heretofore a rather costly operation to cement a well.

While the present invention is primarily used to repair a hole in the well wall or the like, it may have use at any place and for any operation in a well where it is necessary to cement.

An important object of the present invention is to provide an improved tool in which a well may be cemented at any pre-selected elevation, the tool having a minimum of moving parts.

Another object of the present invention is to provide an improved cementing tool in which the cement in dry form can be carried by the tool to the site where the cementing is to take place, and then water can be mixed with the cement in sufficient quantity to provide the necessary slurry for setting up and sealing off a fissure or hole in the wall of the well.

Still another object of the present invention is to provide an improved cementing tool which is relatively inexpensive to manufacture and which can be operated as a "single use" tool in that it may be discarded after use.

A further object of the present invention is to provide an improved cementing tool for well operation, the tool being such that a minimum amount of cement can be used to provide the necessary repairs to the wall of a well.

These and other objects and advantages of the present invention will appear more fully by reference to the following specification, appended claims, and drawings in which

FIGURE 1 is a vertical sectional view of the tool of the present invention positioned in a well hole at a pre-selected point where there is a fissure or in the well wall;

2

FIGURE 2 is a view similar to FIGURE 1 but the view being shown partly in elevation with the expandible sock of the improved tool of the present invention in its expanded sealing position;

FIGURE 3 is a fragmentary view similar to FIGURE 2 but illustrating the well after the improved tool has been drilled out of the same and showing the cement set to provide a positive seal for the fissure or open hole;

FIGURE 4 is a sectional view taken on the line 4—4 of FIGURE 1 and illustrating the improved tool with the sock in the relaxed or expanded position;

FIGURE 5 is an enlarged sectional view taken on the line 5—5 of FIGURE 1, the view showing in detail one of the pressure operated slits in a projection on a base within the expandible sock for providing a valve action to control the flow of water into the dry cement;

FIGURE 6 is an enlarged view taken on the line 6—6 of FIGURE 1 and illustrating an end view of one of the slit in the projection on the hose within the expandible sock.

Referring now to the drawings, wherein like character and reference numerals represent like or similar parts, there is disclosed in FIGURE 1 a well hole generally indicated at 10, the well having a fissure or open hole 12 in its wall causing the loss of pressure and, thus, a loss of circulation from the well. While the tool of the present invention is primarily intended to provide open hole plugging within the well, it will be appreciated to those skilled in the art that the tool may also be used for casing plugging or plug back operations. Additionally, the tool may be used to provide temporary or permanent blocking of a formation face.

The improved tool of the present invention, which is generally designated at 14 is adapted to be detachably connected to the lower end of a drill string tube, stand or the like shown in broken lines at 16. In more detail, the drill string tube 16 which is hollow and capable of having fluids passed therethrough, such as drilling fluids, mud, or the like, is usually provided with a threaded end 18 having the usual tapered threads. The tool 14 is provided at its upper end with a sub or coupling sleeve 20 having a longitudinally extending passageway 22 therethrough, the passageway 22 being threaded at its upper end as indicated at 24 with tapered interior threads for receiving the tapered exterior threads of the threaded end 18 of the drill string tube 16. The passageway 22 is provided with an enlarged chamber 24 for housing a ball check valve 26. The ball check valve 26 is spring urged by means of a spring 28 onto an interior annular seat 30 provided in passageway 22 so that fluid can only pass through the sub 20 in a downward direction. The lower end of spring 28 abuts a fitting 32 threaded into the enlarged chamber 24, the fitting 32 being provided with a passageway 34 therethrough having the branches 36 opening to and in communication with the chamber 24.

Sub 20 is made of a drillable material such as Bakelite or the like so that it may be easily drilled through after the tool has been used to provide a cement plug for the well. In FIGURE 3, the sub 20 and the remaining portions of the tool have been drilled through after the cement has set leaving a permanent seal in the fissure or hole 12.

A rigid plastic sleeve 38 having exterior threads 40 at its upper end is threaded into interior threads 42 provided on the lower end of the sub 20. The sleeve 38 provides a means for attaching an elastomeric sock 44 to the sub. In more detail, the elastomeric sock 44 which is generally tubular and closed at its lower end is made of preferably rubber or a rubber substitute, the sock being molded permanently onto the rigid sleeve or nipple 38 as

3

indicated at 46. Sock 44 can vary in length and oftentimes is as long as fifteen to twenty feet depending upon the type of fissure or hole 12 to be plugged. It may be shorter if it is desired to plug just a very small fissure or hole 12. In order that sock 44 can expand in the area of its intermediate portion when pressure is applied interiorly thereto, the wall of the sock is made thinner at its intermediate portion 47 than on either of its ends 48 and 50, respectively. The weakened intermediate portion 47 of sock 44 will be the first portion to expand when pressure is applied interiorly of the sock and, thus, this portion is positioned adjacent the hole to be repaired.

Fitting 32, which is threaded into the lower end passageway 22 is provided with an elongated downwardly extending projection 52 over which the upper end of a flexible hose 54 is fitted and permanently secured. The hose 54 which is made of a soft plastic material is closed at its lower end 56 and extends downwardly within the center of the elongated sock 44. Hose 56 is provided along its length with the plurality of projections 58, defining longitudinally spaced teats, each of the projections 58 having an elongated slit 60 therein as shown in FIGURES 5 and 6, respectively. The walls of the slits 60 are normally held together by the inherent forces of the soft plastic material of the hose 54 but are capable of opening up when pressure is applied interiorly within the hose 54. Further, it will be noted that the projections or teats 58 extend radially from the hose 54 in various directions as clearly shown in FIGURES 4 and 5.

The interior of the sock 44 is filled with dry cement C and then the sock with the sleeve 38 is threaded into the lower end of the sub 20 with the hose 24 extending centrally down into the sock. The sub 20 with the sock 44 and sleeve 38 attached thereto is then secured to the lower end of the drill string pipe 16 and the assembly is lowered into the well to a position adjacent the fissure or hole 12. When the tool 14 has been so positioned in the well it is now ready for the application of water to the dry cement in order to form a slurry. Water is pumped down the drill string tube 16 from the drilling table at a pressure sufficient to open the ball check valve 26, the water then flowing through the enlarged chamber 24, branches 36 to the interior of the hose 54. The pressure of the water builds up within the hose 54 until it is sufficient to open the slits 60 of projections 58 thus permitting the water to escape through the slits 60 in the projections 58 into the dry cement where it mixes therewith. Since there is no opening to atmosphere in the sock 44 the water flowing into the dry cement under pressure will cause the sock to expand at its weakened or thinner intermediate portion 47 as shown in FIGURE 2. When sufficient water had flow into the dry cement and has caused a slurry and also caused the expansion of the sock to the irregular shape of the fissure or hole 12, the slurry of cement is allowed to set. While the slurry is setting, the drill string or stand is removed by unthreading the same from the sub 20. Pressure cannot escape from the tool as the slits 60 provide a one way check valve as does the valve 26. Once the slurry has hardened then the drill string tube is relowered into the well with a drill bit placed on its lower end and a drilling operation can then be accomplished to drill through the sub and cement such as shown in FIGURE 3. It will be noted that the cement has hardened in the fissure 12 and has sealed off the same even after the well 10 has been drilled therethrough.

Having set forth the nature, objects and advantages of the present invention, it will be perceived that certain

4

changes, adjustments and modifications may be made to the improved cementing tool of the present invention described herein and shown in the drawings without departing from the principles and spirit of the invention.

Therefore, terminology used throughout the specification and the details of the drawings are but for the purpose of description and not limitation, the scope of the invention being defined in the claims.

I claim:

1. In a tool for cementing a well at any pre-selected point in the well, the tool being detachably carried on a drill string pipe or the like, the combination comprising: a sub detachably connected to the drill string pipe and having a passageway therethrough for the flow of fluid; valve means within the passageway in said sub for permitting fluid to flow downwardly through the passageway; a rigid sleeve member detachably carried on the lower end of said sub; an elastomeric elongated sock attached to the lower end of said sleeve member; an elongated hose having a plurality of pressure operated slits therein spaced longitudinally along the same, said hose being closed at its lower end; and means connecting the upper end of said hose to the sub and placing the interior of the same in communication with the passageway in said sub beneath said valve means.

2. A tool as claimed in claim 1 in which said sock carries dry cement and in which water under pressure is passed downwardly past said valve means and into said hose and discharged through the slits therein to form a slurry in situ.

3. A tool as claimed in claim 2 in which said hose is made of a plastic material.

4. A tool as claimed in claim 1 in which said sub is made of a drillable material whereby the same may be drilled after the cement has set.

5. A tool as claimed in claim 4 in which said drillable material for said sub is Bakelite.

6. A tool as claimed in claim 1 in which said hose is provided with a plurality of projections each having an outer end in which at least one of said slits is provided.

7. A tool as claimed in claim 6 in which said projections extend radially of said hose, said projections being spaced circumferentially about said hose.

8. A tool as claimed in claim 1 in which said elastomeric sock is provided with a weakened wall intermediate its end portions whereby the intermediate portion of said sock can expand more easily than either end portions.

9. A tool as claimed in claim 1 in which said rigid sleeve member is made of a plastic material and in which the upper end of said sock is molded thereon.

10. A tool as claimed in claim 1 in which said elastomeric sock is made of rubber and in which said sock has a wall thickness at each of its ends greater than a wall thickness in its intermediate portion whereby said sock will expand more easily in its intermediate portion.

References Cited by the Examiner

UNITED STATES PATENTS

1,342,927	6/1920	Ruthven	166—187
1,834,434	12/1931	Starr	166—187
2,922,478	1/1960	Maly	166—187 X
3,032,115	5/1962	Smith	166—187
3,045,455	9/1962	Keltner	166—187 X

CHARLES E. O'CONNELL, *Primary Examiner.*

D. H. BROWN, *Assistant Examiner.*