

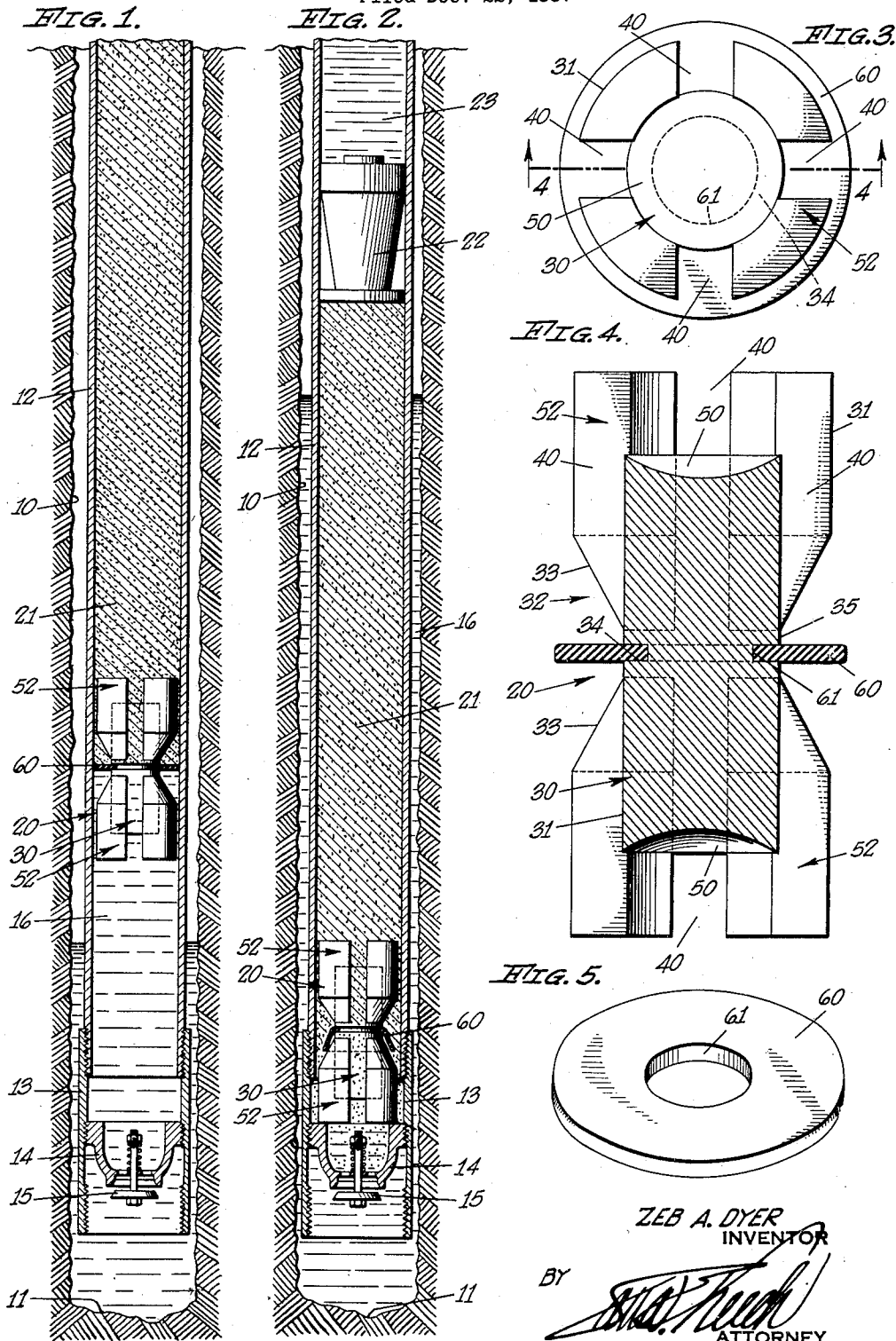
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LOWER CEMENTING PLUG

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LOWER CEMENTING PLUG

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9 Claims. (Cl. 166—1)

This invention relates to the art of sinking deep wells, and has particular utility in the cementing off of casing installed in such wells.

The cementing-off operation is generally accomplished by running a column of liquid cement down the casing preceded by a "lower" cementing plug and followed by an "upper" cementing plug. When the lower plug strikes the cementing valve at the lower end of the casing, the lower plug yields to permit the cement to pass by it, through the valve, and downwardly into the lower end of the well from whence it flows upward between the casing and the walls of the well.

After the charge of cement has hardened, a drill on a string of drill pipe is inserted into the casing and the cement plugs and cement valve are drilled out and the drilling operation continued downwardly to deepen the well.

Heretofore it has been the general practice to form the lower cement plugs of a single body of vulcanized rubber. These plugs were thus relatively expensive, particularly in view of the fact they could only be used once and then were destroyed by the drill in deepening the well.

It is the object of my invention to provide a relatively inexpensive cementing plug for use in the cementing of deep wells.

In cementing operations hitherto it has been necessary to insert the lower cementing plug in the casing with a particular end thereof disposed downwardly in order for this plug to allow the cement to be forced downwardly past the lower cementing plug after the latter had come into contact with the cementing valve plug at the bottom of the casing. Due to carelessness these lower cementing plugs are sometimes inserted bottom side up with the result that it is not possible to force the cement downwardly out of the lower end of the casing and the entire cementing operation, therefore, fails.

It is another object of my invention to provide a lower cementing plug for use in cementing deep wells which cannot be placed in the well to cause it to fail to perform its function satisfactorily.

The manner of accomplishing the foregoing objects as well as further objects and advantages will be made apparent in the following description taken in connection with the accompanying drawing in which—

Fig. 1 is a fragmentary vertical sectional view of the bottom end of an oil well and illustrates a preferred embodiment of my invention being used in a cementing operation for cementing the lower end of a string of casing in said well.

Fig. 2 is a view similar to Fig. 1 and illustrates a later step in said cementing operation.

Fig. 3 is a plan view of the aforesaid preferred embodiment of my invention.

Fig. 4 is a vertical sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a perspective view of a separate flexible rubber washer which is included as a part of the aforesaid preferred embodiment of my invention.

Referring specifically to the drawing, I have shown in Figs. 1 and 2 thereof a lower portion of an oil well 10. Extending down the well 10 to a point near the bottom 11 thereof is a casing 12 which has been inserted into the well 10 preparatory to cementing the lower end of this casing into the well. When the casing 12 was inserted in the well it carried on the lower end thereof a float collar 13, the interior of which is provided with a cast iron plug 14, having a back pressure valve 15. After the casing 12 has been lowered, its lower end disposed as in Fig. 1, the interior of the casing is filled with screened rotary mud 16 on top of which a lower cementing plug 20 comprising the preferred embodiment of my invention is inserted in the upper end of the casing. A mass of cement 21 is now introduced on top of the plug 20, an upper plug 22 is inserted in the casing above cement 21 and rotary mud 23 is pumped into the casing 12 to force the plugs 20 and 22, and the charge of cement 21 disposed therebetween down through the casing 12.

The plug 20 includes a body 30 which may be formed of molded rubber, Bakelite, wood or any other suitable material. The exterior surface 31 of this body is substantially cylindrical and of a diameter which will permit the plug to slide freely in the casing 12 with which it is designed to be used. Formed centrally in the outer cylindrical surface 31 of the body 30 is an annular channel 32, having sloping faces 33 and an annular groove 34 which extends inwardly from the bottom 35 of said channel. The groove 34 is preferably formed on a plane which lies at right angles to the longitudinal axis of the body 30 and equidistant from the ends thereof.

Formed longitudinally in the outer surface 31 of the body 30 on each side of the plane of the groove 34 is a series of passageways 40 which communicate between the channel 32 and the opposite ends of the plug. At each end of the plug there is preferably provided a central cavity 50 with which all of the passageways 40 adjacent that end of the plug communicate. Thus producing a castellated head 52 on each end of the plug. While the plug of my invention may oper-

ate suitably with any number of passageways 40, I have found that it is preferable to have three or more of these passageways, the reason for this being made clear hereinafter.

5 Lodged in the groove 34 so as to bisect the channel 32 is an annular washer 60, this washer having a slightly greater outside diameter than the inside of the casing 12, and having a central hold 61 which is of smaller diameter than that of the bottom of the groove 34. The washer 60 is made of relatively flexible rubber and after its being molded is stretched and slipped over the end of the body 30 after which it is allowed to snap into the groove as shown in Figs. 3 and 4.

10 The plug 20 of my invention is used in the normal manner of any lower cementing plug in the cementing into the well 10 of the casing 12. As the plug 20, the body of cement 21 and the upper plug 22 move downward through the casing 12, the plug 20 appears as shown in Fig. 1. Here it is seen that the washer 60 is in substantially undistorted condition, the outer rim of this washer making a snug contact with the inner surface of the casing. The available space above the washer 60 in this view is filled with the cement 21 while the available space below this washer is filled with rotary mud 16.

When the cementing operation has proceeded to the point where the lower castellated head 52 of the plug 20 has contact with the valve plug 14, downward motion of the plug 20 ceases and the application of further pressure by the plug 22 downward on the cement 21 causes the latter to deflect the washer 60 downwardly as shown in Fig. 2. This deflection permits the cement 21 to flow past the washer 60, downwardly through the passageways 40 and the cavity 50 of the lower castellated head 52 into the valve plug 14 from which the cement passes through the valve 14 and out through the float collar 13.

Because the body 30 of the plug 20 of my invention is formed with a castellated head 52 on each of its opposite ends, this plug is certain to function properly when it reaches the lower end of the well no matter how the plug is inserted in the top of the casing. Whichever castellated head 52 of the body 30 is pointed downwardly when it reaches the bottom end of the casing, this head 52 insures a ready flow of the cement 21 past the plug 20 and through valve plug 14. It is thus seen that the failure of a cementing operation by the improper placing of the lower plug in the upper end of the casing is impossible when the lower plug 20 of my invention is used.

55 What I claim is:

1. In a cementing plug for use in cementing casings in deep wells, the combination of: a body having a reduced middle portion adapted to receive an annular washer; an annular rubber washer mounted on said portion; and guide heads formed on opposite ends of said body of slightly less diameter than the outside diameter of said washer, there being longitudinal free fluid passages in said heads between the spaces adjacent opposite faces of said washer and opposite ends of said body.

2. In a cementing plug for use in cementing casings in deep wells, the combination of: a body having a reduced middle portion adapted to receive an annular washer; an annular rubber washer mounted on said portion; and fluted guide

heads formed on opposite ends of said body of slightly less diameter than said washer.

3. In a cementing plug for use in cementing casings in deep wells, the combination of: a body having a reduced middle portion adapted to receive an annular washer; an annular rubber washer mounted on said portion; and guide heads formed on opposite ends of said body of slightly less diameter than the outside diameter of said washer, there being longitudinal free fluid passages in said heads between the spaces adjacent opposite faces of said washer and opposite ends of said body, there being also relatively large central cavities formed in opposite ends of said body, said cavities communicating with said passages.

4. In a cementing plug for use in cementing casings in deep wells, the combination of: a body having a reduced middle portion adapted to receive an annular washer; an annular rubber washer mounted on said portion; and fluted guide heads formed on opposite ends of said body of slightly less diameter than said washer, there being relatively large central cavities formed in opposite ends of said body, said cavities communicating with the flutes in said heads.

5. In a cementing plug for use in cementing casings in deep wells, the combination of: a substantially integral body having a reduced middle portion adapted to receive an annular washer; an annular rubber washer mounted on said portion; and guide heads formed on opposite ends of said body of slightly less diameter than the outside diameter of said washer, there being longitudinal free fluid passages in said heads between the spaces adjacent opposite faces of said washer and opposite ends of said body.

6. A bottom cementing plug of the type described comprising a member having enlarged end portions, having a reduced middle portion, having an annular flexible wiper extending outwardly from said reduced portion, and having fluid passageways extending from each end to the reduced portion but short of the wiper.

7. A cementing plug of the type described comprising a member having enlarged fluted end portions, having a reduced middle portion, and having an annular flexible wiper extending outwardly from said reduced portion.

8. A cementing plug of the type described comprising a substantially cylindrical solid body portion having formed thereon at each end segmental end portions with curved outer surfaces, the curved outer surfaces forming an enlarged interrupted cylindrical surface, said body portion and said segmental end portions defining a cup-like recess at each end of the plug and defining radially disposed grooves communicating therewith and adapted to act as fluid passageways, the inner end portions of said segmental end portions being inwardly tapered, and a flexible wiper encircling the middle of said body portion and extending beyond the outer diameter of the end portions of the plug.

9. A cementing plug of the type described comprising a member of a rubber composition having enlarged fluted end portions, having a reduced middle portion, and having an annular flexible wiper extending outwardly from said reduced portion.

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