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CEMENTING AND FLOATING EQUIPMENT FOR WELL CASING

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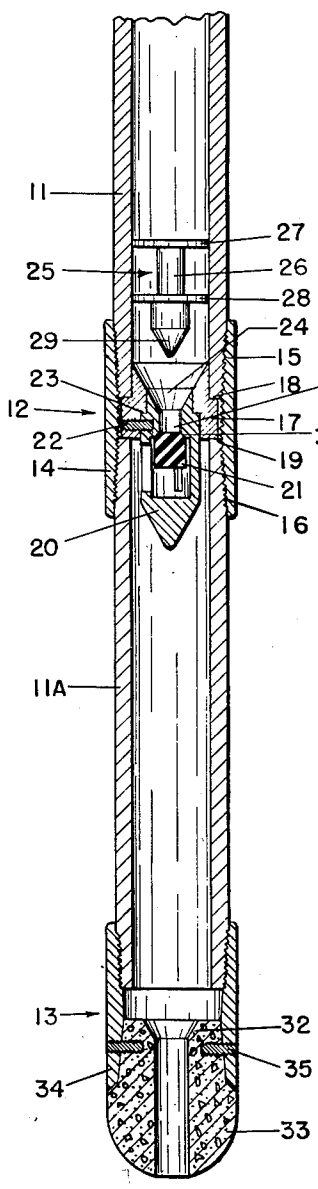

Fig 1

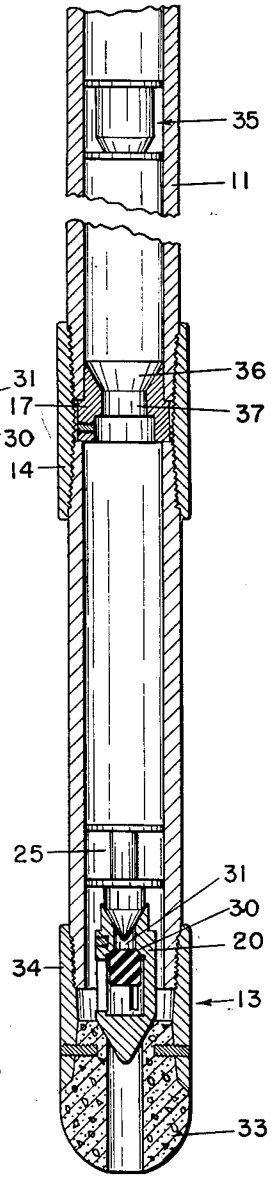

Fig 2

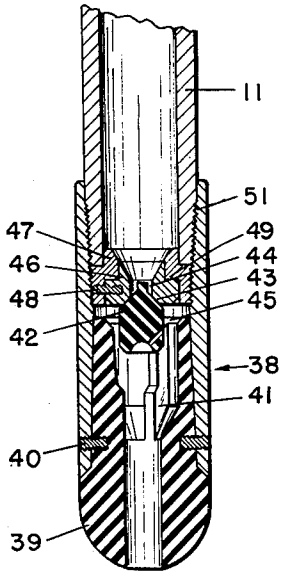

Fig 3

INVENTOR
ALBERT D STODDARD
BY Earl Babcock.

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CEMENTING AND FLOATING EQUIPMENT FOR WELL CASING

Albert D. Stoddard, Duncan, Okla., assignor to Halliburton Oil Well Cementing Company, Duncan, Okla.

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2 Claims. (Cl. 166—1)

This invention relates to apparatus for cementing wells and more particularly to float collars or shoes adapted for use in lowering casing or other conduit into oil wells or the like.

It is often desirable when lowering a long string of pipe into a well to maintain a seal therein so that the mud pressure or pressure of other fluid in the well will relieve the strain on the rig equipment to some extent, due to the buoyancy of the empty string. To use a float collar or float shoe for this purpose is well known to those skilled in the art.

In operating floating and guide equipment difficulties have sometimes resulted from the float valve and passageway through the guide shoe becoming clogged. This is apt to happen when cementing a well and then it is particularly hazardous because of the danger of the cement hardening before it is in place behind the casing. The use of various aggregate material, rock, chert, paper pulp, fibrous material, etc., now commonly added to cement in oil wells has created a problem which the apparatus of the present invention is intended to solve.

The present invention relates to a novel construction of cementing, floating and guide equipment which has certain advantages over the similar devices heretofore employed for the purpose, the chief advantage of the present construction being in the provision of a float collar or shoe whose float valve and guide nose may be pumped out of the casing after it has been lowered to the position where it is to be set. By pumping the float valve and guide nose out, the passage through the string of casing will be unrestricted for the flow of cement or any other material down through the casing.

It is an object of this invention, therefore, to provide a float valve which will seal off the casing and prevent upward flow of fluid therethrough when lowering it in a hole but which may be later pumped out the lower extremity of the casing.

It is another object of this invention to provide a guide nose which may be pumped out the lower extremity of the casing after the same is in position in the hole.

It is another object of this present invention to provide a float collar and guide shoe nose which may easily be drilled up in the process of completing an oil well.

It is still another object of this invention to provide floating and guide means which will have a comparatively unrestricted passage for conveying cement or other fluid through a casing after the same has been lowered into a well.

Other objects and advantages reside in certain novel features of construction and arrangement, as will be more apparent from the following description taken in accordance with the accompanying drawing, in which:

Figure 1 is a vertical cross-sectional view of a portion of an oil well casing provided with a float collar and guide shoe constructed in accordance with the present invention;

Figure 2 is a vertical cross-sectional view of a portion of an oil well casing with a float collar and guide shoe therein, the float valve having been pumped out of the float collar and now resting in the guide shoe; and

Figure 3 is a vertical cross-sectional view of a portion of another embodiment of the invention, the view showing an oil well casing with a float and guide shoe secured to the lower extremity of the said casing.

Referring to the drawing in detail, and first to Figure 1, it will be seen that an oil well casing is illustrated at 11. Carried near the lower extremity of this casing is a float collar 12 and guide shoe 13.

The float collar of the embodiment of the invention shown in Figures 1 and 2 is mounted in a coupling 14 which is threaded to the casing 11 at 15 and to the casing 11—A at 16. This float collar consists of the ring 17 which is clamped between the shoulder 18 of casing section 11 and shoulder 19 of casing section 11—A. Releasably secured to this ring is the float valve assembly including a cage 20 which carries a valve 21. The float valve 21 is an ordinary check valve adapted to seat at 30 to prevent upward movement of fluid through the opening 31.

The float valve cage 20 is held in position in the ring 17 by shear pins 22 and by the shoulder 23 abutting against the lower side of the ring 17. The shoulder 23 takes the upward stress when the valve is closed so there is no strain on the pins 22 at that time.

On the upper surface of float valve cage 20 is a conical recess 24, adapted to receive a tapered projection 29 on the bottom of a cement plug 25. Except for the projection 29, the bottom cement plug 25 is of the usual type consisting of a mandrel 26 made of wood or like material with flexible washers 27 and 28 carried thereon.

If the plug 25 is pumped downwardly through the casing, it will seat on the upper surface of the float valve cage 20. Then by exerting a predetermined amount of hydraulic pressure thereon

from a pump at the surface, the pins 22 may be sheared and the valve cage 20 may be pumped from the ring 17. The mandrel 26 is small enough to pass through the opening 37 and washers 27 and 28 are flexible so they will fold up and pass through the opening 37. The valve cage 20 and plug 25 may then pass down through the casing 11—A and seat at 32 in the guide shoe 13. Such a position is shown in Figure 2.

The guide shoe 13 is provided with a nose 33 which as usual is hollow and is semispherical in shape so that it will act to guide the lower end of the casing while it is being lowered into the well. The guide shoe nose 33 differs from the usual construction in that it is held in position in the coupling 34 against downward movement by shear pins 35. It may be pumped out of the coupling 34 by an excessive amount of pump pressure when the valve and plug rest upon the seat at the upper end of the passageway which extends from end to end thereof, as shown in Figure 2. When the parts mentioned are pumped out the inside of the casing is left unrestricted for the passage of cement or other sealing fluid therethrough.

After the guide shoe nose 33 and valve cage 20 have been pumped from the casing and the cement or other sealing fluid has been pumped out around the casing or into the formation, the top plug 35 may seat at 36 on the ring 17. The top plug 35 is made large enough that it will not pass through the opening 37. The operator will then know its position because of the increase in load on the pump, and will thus know the position of the cement, in accordance with known practices.

The apparatus illustrated in Figures 1 and 2 consists of a guide shoe and float collar which are shown as two separate pieces of equipment, so as to make it convenient for the operator to place the float collar a given distance above the lower extremity of the casing so that he may leave a predetermined amount of cement or sealing fluid in the casing. However, this float collar and guide shoe may be incorporated into a single piece of equipment by merely placing the float valve assembly in, or directly above, the guide shoe.

Such an arrangement is illustrated in Figure 3. The float collar and guide shoe of this embodiment of the invention are both housed in a single coupling or shoe 38 which is threaded to the casing 11 at 51. Secured in the lower end of the shoe 38 is a guide nose 39, said nose being made of a hard rubber or similar material which is capable of withstanding severe shock but may be readily drilled up in the process of completing the well. The nose 39 extends up into the shoe 38 and is secured therein by shear pins 40. The upper portion of the passageway in the nose is provided with splines 41 which guide and form a cage for valve body 42, preferably made of hard rubber, "Bakelite," or similar material. The valve body 42 is adapted to seat at 43 to prevent fluid flowing up through the passageway 44 and into the casing 11. However, in case it is desired to pump fluid down through the casing and out the lower end, the valve will pump off the seat 43 and allow fluid to pass therethrough. Above the splines 41, the nose is provided with a seat 45, the purpose of which will be described presently.

The member 46 which provides the valve seat 43 is attached to the ring 47 by shear pins 48. The ring 47 is fixed to the shoe as by threads. The member 46 is provided with a shoulder 49 which abuts against the ring 47, thus preventing the said member 46 from moving in an upwardly direction. After the pins 40 and 48 have sheared, the only member remaining fixed to the shoe 38 is the ring 47. The upper surface of this ring is provided with a tapered seat like that on the ring 17 in Figures 1 and 2 adapted to receive a top plug 35. A bottom plug like that shown at 25 in Figure 1 will pass through the opening in the ring 47.

In operating the arrangement of Figure 3, the procedure being similar to that described above in connection with Figures 1 and 2, as cement is pumped into the casing between a bottom plug 25 and a top plug 35, the fluid in the well beneath the plug 25 will flow downwardly through the float valve and guide shoe and up around the outside of the casing. When the slug of cement reaches the guide shoe, the plug 25 will seat in the inner member 46. Hydraulic pressure on the column of fluid in the well exerted by the pump at the surface will then shear pins 48. The inner member will then drop down and rest upon the seat 45 in the nose. The pump pressure will then be transmitted to the pins 40 so that they will shear and the inner member 46, valve body 42 and the nose 39 will pass on down out of the casing.

The guide shoe noses 33 and 39 and the float valves and their associated parts, with the exception of the metallic couplings, 14, 34 and 38 are preferably made of a non-metallic material such as concrete, hard rubber, "Bakelite" or other similar material which is capable of withstanding severe shock but may be readily drilled up in the process of completing the well.

The arrangements of the present invention provide means whereby the passageway down through the casing may be closed until the casing is in a position where it is desired to set the same. Then by the procedure described above, the passageway is cleared so that materials may be pumped readily down through and out the lower extremity of the casing.

Only two embodiments of this invention have been shown and described herein. It will be evident to those skilled in the art that other embodiments and arrangements may be used without departing from the spirit of the present invention and the scope of the annexed claims.

I claim:

1. Apparatus for cementing casing in wells comprising, in combination, a float valve assembly, a bottom cementing plug and a top cementing plug, said float valve assembly including a ring secured in the casing and having a seat on its upper surface adapted to receive said top plug, an apertured inner member having a seat on its upper surface around the aperture therein adapted to receive said bottom plug, shearable means securing said inner member to said ring and a valve body adapted to seat on the lower surface of said inner member to close the aperture therein, the arrangement being such that fluid beneath said cementing plugs may flow downward but not upward through the casing until said bottom plug seats on said inner member, after which hydraulic pressure exerted on said bottom plug may shear said securing means and cause the bottom plug, said inner member and valve body to pass on down in said casing, leaving said ring open and unobstructed until the top plug comes to rest thereon.

2. Apparatus for cementing casing in wells

comprising, in combination, a float valve assembly, a guide shoe, a bottom cementing plug and a top cementing plug, said float valve assembly including a ring secured in the casing and having a seat on its upper surface adapted to receive said top plug, an apertured inner member having a seat on its upper surface around the aperture therein adapted to receive said bottom plug, shearable means securing said inner member to said ring and a valve body adapted to seat on the lower surface of said inner member to close the aperture therein, and said guide shoe being mounted on the lower end of said casing some distance beneath said float valve assembly and including a hollow nose and shearable means securing the nose in the shoe, the arrangement being such that fluid beneath said cementing plugs may flow downward but not upward through the casing until said bottom plug seats on said inner member, after which hydraulic pressure exerted on said bottom plug may shear said means securing said inner member and cause said bottom plug and said inner member to move on downward in the casing, seat on said nose and close the passage therethrough to enable the hydraulic pressure to cause the means securing said nose to shear whereupon the bottom plug, inner member and hollow nose may be forced out of the casing, thus leaving the casing unobstructed except for the ring until the top plug comes to rest on said ring.

ALBERT D. STODDARD.