

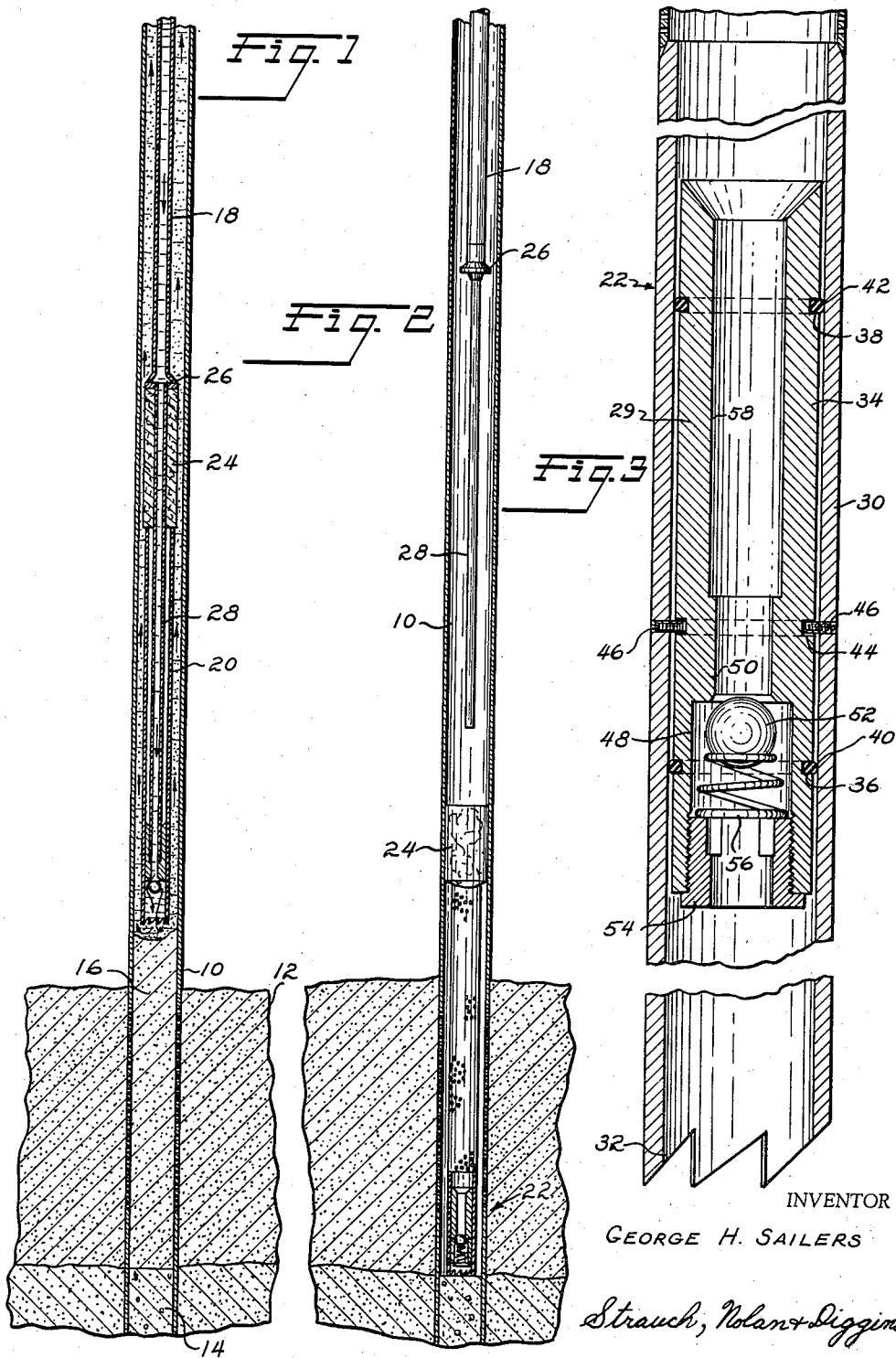
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SCREEN AND SET SHOE ASSEMBLY FOR WELLS

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1

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SCREEN AND SET SHOE ASSEMBLY FOR WELLS

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6 Claims. (Cl. 166-205)

The present invention relates to a screen assembly and especially to a screen and set shoe assembly for use in the finishing of oil wells.

In the finishing of certain types of oil wells a screen is positioned in the casing at the level of the oil bearing sand and acts as a filter to keep this sand and other abrasives out of the well bore. In some wells it is advisable to use in conjunction with the screen, a sand whose grains are of a diameter larger than that of the sand in the oil bearing formation, and when the larger sand is forced into the oil bearing formation it forms a filter which allows the passage of a greater volume of formation fluid from the formation on through the screen and into the well bore. When this large sand is used, some of it is left in the casing into which the screen is set, insuring a solid pack between the screen and casing, and thus between the screen and the oil bearing formation. Where no artificial sand or any other artificial pack is used in setting a screen, the formation sand enters the casing and packs around the screen. The artificial pack or formation sand settles tightly around the screen and makes it difficult if not impossible to pull the screen from set position without drilling or cutting, and protrusions of any kind which extend out from the screen make it much more difficult to pull.

When the casing is perforated, formation sand and oil enter the casing so that there is sand in the perforated casing when the screen and other finishing equipment are introduced. In order to move the screen through the sand to the proper position in the casing, a set shoe or pipe is secured to the bottom of the screen and wash water is forced through this pipe to displace the sand and move it up along the outside of the pipe and screen. When the screen is in desired position, the flow of wash water is cut off and a back pressure valve closes the pipe and prevents the entry of oil or sand into the interior of the screen except after passage through the sand and filter.

Heretofore, back pressure valves have been threaded or otherwise secured on the pipe and have had a different, usually greater diameter, than the screen or pipe. Once the pipe and screen are in place, the sand settles and the back pressure valve becomes embedded and locks the entire assembly firmly in the casing. This makes it difficult if not impossible to pull the screen and pipe and when it is necessary to remove or replace the screen, it is often necessary to drill the screen and pipe out of the casing, a procedure which is both difficult and expensive.

Back pressure valves have usually been secured at the bottom of the pipe and since the pipe carrying the wash water should engage the valve structure, unusually long wash water pipes have been required. All of this finishing equipment is at or near the bottom of the well bore where any unnecessary equipment or parts of unnecessarily large size increases the difficulties of accurate control and increases the possibilities of breakage or damage.

I have found that the foregoing difficulties can be overcome and one of the objects of the present invention

2

is to provide a screen assembly which may be readily inserted or removed.

Another object is to provide a screen assembly which permits unrestricted circulation return of the wash water used in setting.

Another object is to provide a back pressure valve which may be secured in any desired position within a set shoe.

Another object is to provide a simple efficient screen assembly in which the back pressure valve may be positioned close to the screen.

Another object is to provide an internally contained insert back pressure valve which fits inside the screen liner so as to eliminate all protrusions which would make the screen difficult to pull.

These and other objects and advantages reside in novel features of construction, arrangement and combination of parts as will hereinafter be more fully described and claimed.

Referring to the drawing,

Figure 1 is a vertical section of the lower portion of an oil well showing the screen assembly and setting assembly in the course of being set in position.

Figure 2 is a section similar to Figure 1 showing the screen in position.

Figure 3 is an enlarged vertical section showing the back pressure valve.

As shown in Figures 1 and 2, according to modern finishing methods, the casing pipe 10 extends down into the oil sand indicated generally at 12 and is preferably closed at the bottom by a cement plug 14. The cement forming the plug 14 is usually pumped into the casing 10 so that it not only fills the lower end of the pipe but usually some of the cement passes out through the bottom of the casing and comes up along the outer surface of the casing 10.

At the level of the oil bearing sand 12, the casing 10 is perforated in the usual fashion as by shots or explosive charges and the oil and sand enter and fill the lower end of the pipe as indicated at 16 in Figure 1. The finishing assembly is secured to tubing 18 and in order to position the finishing assembly at the bottom of the well bore, it is necessary to move it down through the sand 16.

The finishing assembly consists of a substantially cylindrical screen 20 and a set shoe assembly indicated generally at 22 is welded or otherwise secured at its lower end. A collapsible packing member 24 is secured to the upper end of the screen. A setting tool 26 secured to the bottom of the tubing 18 is attached to the upper end of the packing member 24 and a wash pipe 28 extends down through the packing member and screen into the back pressure valve indicated generally at 29 in the set shoe assembly 22.

Water under pressure passes downward through the tubing 18 and wash pipe 28 and moves the sand 16 up along the sides of the finishing assembly permitting the finishing assembly to pass down through the sand 16 within the casing 10 until it reaches the cement plug 14. The collapsible packing is then collapsed to form a seal between the upper end of the screen 20 and the inner wall of the casing 10. The sand fills the space between the screen and the casing and the screen is provided with a plurality of openings sufficiently small to prevent the entry of sand into the casing while permitting the free entry of oil.

The set shoe assembly 22 shown in detail in Figure 3 comprises a set shoe or pipe 30 which is welded or otherwise secured at its upper end to the bottom of the screen 20. The lower end of the pipe 30 is provided with drag teeth 32 which in set position, engage the top of the cement plug 14. When the teeth 32 engage the plug

3

14, they prevent rotation of the pipe 30 and screen 20 so that by twisting the tubing 18, the setting tool 26 may be broken loose from the packing members 24 and screen 20 and the tubing, setting tool and wash pipe are then removed.

The back pressure valve is mounted within the pipe 30 and comprises a sleeve or housing 34 within the pipe 30. This housing has one or more grooves 36 and 38 within which O-rings 40 and 42 are mounted for sealing engagement with the inner wall of the pipe 30. The housing 34 is also provided with a groove 44 and one or more set screws 46 are threaded through the pipe 30 at the proper level to engage in the groove 44 to fix the housing in any desired position within the pipe. Prior to engaging set screws 46 in grooves 38 the sleeve or housing 34 is slidable in pipe 30 so that the back pressure valve may be mounted at any desired distance from the lower end of tube 30 by merely selecting an appropriate location for the set screws.

The sleeve or housing 34 has an enlarged chamber 48 at its lower end and an inwardly projecting shoulder 50 at the top of the chamber 48 forms a seat for a ball 52.

An annular plug cap 54 is threaded into the lower end of the chamber 48 and a coil spring 56 engages the plug 54 and ball 52 to urge the ball against the seat 50. The upper end of the sleeve or housing 34 has a cylindrical bore or seat 58 for receiving the wash water pipe 28. It is apparent that wash water coming down the pipe 28 readily passes the valve and goes out through the bottom of the pipe 30 while oil and sand coming up through the pipe 30 are stopped by the ball 52.

Since the pipe 30 has a smooth outer surface and the entire back pressure valve is wholly within the pipe 30, there are no projections, enlargements or shoulders to impede either insertion or removal of the screen assembly. The entire finishing assembly may thus be removed and replaced or moved to another location without damage to either the screen assembly or the casing.

From the foregoing it will be apparent that I am able to attain the objects of my invention and provide a screen assembly and back pressure valve which can be easily inserted and removed from an oil well casing.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

4

1. A set shoe assembly for an oil well filter screen comprising an elongate cylindrical set shoe, a sleeve mounted entirely within said set shoe and slidable therein, sealing means between said set shoe and said sleeve, means for releasably positioning said sleeve at a desired level within said set shoe, and a one-way valve positioned in the lower portion of said sleeve, said valve permitting passage of fluid downwardly through said sleeve and preventing passage of fluid upwardly through said sleeve.

2. A set shoe assembly as set forth in claim 1 wherein said set shoe surrounds the full length of said sleeve and said set shoe extends a distance below the lower end of said sleeve.

3. A set shoe assembly as set forth in claim 2 wherein said set shoe and said sleeve are cylindrical, and said set shoe is provided with drag teeth at its lower end.

4. A set shoe assembly as set forth in claim 1 wherein said sleeve has a chamber formed in its lower end, and including an inwardly projecting shoulder in said sleeve forming a valve seat at the upper end of said chamber, a ball in said chamber, a plug cap screw-threaded into the lower end of said sleeve and having a central aperture therethrough, and a spring positioned between the upper end of said plug cap and said ball to yieldably press said ball upwardly into seating engagement with said shoulder.

5. A set shoe assembly as set forth in claim 1 wherein said sleeve has an axial central bore formed in its upper end to receive a wash water pipe.

6. An oil well screen assembly comprising a substantially cylindrical annular filter screen, an elongate substantially cylindrical annular set shoe rigidly secured to the lower end of said screen, a sleeve mounted in said set shoe and slidable therein, sealing means between said set shoe and said sleeve, means for releasably positioning said sleeve at a desired level within said set shoe, said set shoe and said sleeve having diameters no greater than the diameter of said screen, a one-way valve positioned in the lower portion of said sleeve, said valve permitting passage of liquid downwardly through said sleeve and preventing passage of fluid upwardly through said sleeve, said sleeve having a seat formed in its upper end for receiving the lower end of a wash water pipe.

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