A method and apparatus for cleaning oil wells to increase the flow of oil is disclosed. The combination pressure and surge wash tool has a nipple assembly. A by-pass port is coupled to the nipple assembly. A diverter cup is coupled to the by-pass port. A plurality of pressure wash cups are positioned on the tool. A pressure wash port is located between the plurality of pressure wash cups. A pump shoe assembly is coupled to a bottom pressure wash cup.
COMBINATION SURGE/PRESSURE WASH TOOL FOR OIL WELLS AND METHOD THEREFORE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

This invention relates to oil wells and oil recovery, and more specifically, to a combination surge and/or pressure wash tool which can be used with a solvent or other fluid to clean perforations of an oil well in order to increase the productivity of the oil wells.

[0002] 2. Description of the Prior Art

Wells are drilled into the ground in order to capture oil, gas, water and the like which may be stored underground. In a typical well, a vertical borehole is drilled. For many applications, more than one borehole needs to be drilled. The borehole is drilled by using a rotary drill bit which is attached to the end of a drill string. The drill string is typically constructed of a series of connected links of drill pipe which extend between surface equipment and the drill bit. In general, a drilling fluid, is pumped from the surface through the interior surface or flow channel of the drill string to the drill bit. The drilling fluid is used to cool and lubricate the drill bit. The drilling fluid is further used to remove debris and rock chips from the borehole created by the drilling process. The drilling fluid returns to the surface, carrying the cuttings and debris, through the space between the outer surface of the drill pipe and the inner surface of the borehole.

When a well is drilled into the ground, the well will often encounter various problems with undesirable foreign matter which at least partially blocks the production tube or drill string of the finished well. This will obstruct the pumping or flow of the fluid from the well thereby slowing and/or stopping production from the well.

This is particularly true in the oil industry. Subterranean crude oil deposits generally have a lot of undesirable substances mixed therein. One of these substances is called paraffin. Paraffin is a hydrocarbon which hardens to form a wax-like material as it cools. When the crude oil is pumped up from the well, the paraffin tends to cool as it rises up the production tube string of a producing well. When the paraffin rises to a depth where the ambient temperature is around 160 degrees Fahrenheit, it begins to solidify and adhere to the walls of the production tube string. The problem becomes worse with decreasing temperatures nearer the surface.

The debris as well as the solidifying paraffin will eventually block the oil flow from below. When this occurs, treatment of the production string is required in order to remove the debris and the paraffin buildup so that the oil may more freely flow to the surface.

Treatment may be done by a variety of different methods. For example, treatment may be done by mechanical devices, electrical heating, hot water, and/or solvents introduced into the well. However, all of these methods and apparatus are extremely time consuming and expensive to implement.

Therefore, a need existed to provide an improved apparatus and method for removing foreign matter from a well to increase the output flow of the well. The improved apparatus and method must be able to quickly clean the borehole of the well to increase the output flow of the well. The improved apparatus and method must further be cheaper and easier to use than prior art methods and devices.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, it is an object of the present invention to provide an improved apparatus and method for removing foreign matter from a well to increase the output flow of the well.

It is another object of the present invention to provide an improved apparatus and method to quickly clean the borehole of the well to increase the output flow of the well.

It is still another object of the present invention to provide an improved apparatus and method to quickly clean the borehole of the well to increase the output flow of the well that is cheaper and easier to use than prior art methods and devices.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

In accordance with one embodiment of the present invention a combination surge and pressure wash tool for cleaning wells is disclosed. The combination pressure and surge wash tool has a nipple assembly. A by-pass port is coupled to the nipple assembly. A diverter cup is coupled to the by-pass port. A plurality of pressure wash cups are positioned on the tool. A pressure wash port is located between the plurality of pressure wash cups. A pump shoe assembly is coupled to a bottom pressure wash cup.

In accordance with another embodiment of the present invention a method of cleaning an oil well to increase oil flow is disclosed. The method comprises the steps of: adding a water and oil soluble fluid into the oil well; coupling a surge and pressure wash tool to a tubing string of the oil well; moving the surge and pressure wash tool to a bottom of the oil well; and raising the surge and pressure wash tool in a quick manner.

The foregoing and other objects, features, and advantages of the invention will be apparent from the following, more particular, description of the preferred embodiments of the invention, as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, as well as a preferred mode of use, and advantages thereof, will be best understood by reference to the following detailed description of illustrated embodiments when read in conjunction with the accompanying drawings, wherein like reference numerals and symbols represent like elements.

FIG. 1 is a simplified front view of the combination surge/pressure washer of the present invention.

FIG. 2 is a simplified front view of the combination surge/pressure washer of the present invention in a downward movement on a tubing string of an oil well.
FIG. 3 is a simplified front view of the combination surge/pressure washer of the present invention in an upward movement on a tubing string of an oil well.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, a combination surge/pressure wash tool 10 (hereinafter tool 10) is shown. The tool 10 is to be used in the oil industry to help clean and purge undesirable foreign matter which will partially fully block the production tube or drill string of the finished well. The tool 10 and method of using the tool 10 will help to clear any obstruction in the well thereby increasing the production from the well.

The tool 10 is designed to work in both shallow and deep wells as well as low or high fluid level wells. The tool 10 is further designed to handle the different pressures encountered during surge and pressure washing workovers. The tool 10 can be easily modified to convert from a pressure wash tool to a surge wash tool.

The tool 10 is comprised of a combination of parts to form a tubular shaped device. The tool 10 has a hollow interior in order to allow fluids to flow through the tool 10. The tool 10 has a collar 12 located on the top section of the tool 10. The collar 12 is generally circular in shape and will have central opening there through. The collar 12 is used to attach the tool 10 to the tubing string of the well. The collar 12 is coupled to a perforated nipple assembly 14. The perforated nipple assembly 14 is conical in shape. The perforated nipple assembly 14 will have a tubular top section which narrows down in width similar to a funnel. A plurality of annulus 16 are located around the outer top perimeter of the tubular top section of the perforated nipple assembly 14. The annulus 16 allows a fluid to enter and flow through the tool 10 when the tool 10 is configured as a surge wash tool.

A connector assembly 18 is coupled to the perforated nipple assembly 14. The connector assembly 18 is used to couple the perforated nipple assembly 14 to a by-pass port 20. The connector assembly 18 may be formed of a variety of components. In the embodiment depicted in the Figures, the connector assembly 18 is comprised a male and female connector 18A which is coupled to the tubular top section of the perforated nipple assembly 14. A collar 18B is then coupled to the male and female connector 18A and the by-pass port 20.

The by-pass port 20 is coupled to the collar 18B. The by-pass port 20 extends down to the bottom of the tool 10. The by-pass port 20 will transport a fluid within the tool 10. The by-pass port will further allow a fluid to enter the tool 10 during certain operating conditions which will be explained below.

A spacing device 22 is coupled to a top section of the by-pass port 20. In the embodiment depicted in the Figures, the spacing device 22 is a combination nut 22A and a spacer 22B. Coupled to the spacing device 22 is a diverter wash cup 24. The diverter wash cup 24 is conical in shape. The diameter of the bottom section being slightly smaller than the diameter of the top section. The diverter wash cup 24 is used to divert fluid with sand from the by-pass port 20 and out of the bottom of the tool 10.

Coupled to a bottom of the diverter wash cup 24 is a pair of holding devices 26. The first holding device 26 is used to hold the diverter wash cup 24 in position. The second holding device 26 is coupled directly below the first holding device 26. The second holding device 26 is used to hold a wash cup 28. The wash cup 28 is also conical in shape. The diameter of the bottom section being slightly larger than the diameter of the top section. The wash cup 28 is used to create a suction in the well which help to draw in and purge out a fluid within the tool 10.

A spacer 30 is coupled below the first wash cup 28. A holding device 26 is coupled below the spacer 30. The holding device 26 is used to secure a second wash cup 32. The second wash cup 32 is similar to the first wash cup 28. The second wash cup 32 is conical in shape. The diameter of the bottom section being slightly larger than the diameter of the top section. The wash cup 32 is used to create a suction in the well and to help to draw in and purge out a fluid within the tool 10.

Located below the second wash cup 32 is a pressure wash port 34. The pressure wash port 34 allows a fluid to exit the tool 10. In operation, the movement of the tool 10 will cause a fluid to exit the pressure wash port 34 at an elevated pressure. The pressurized fluid will clean debris which is hindering the flow of oil out of the well. Thus, the pressure wash port 34 allows the tool 10 to clean and open clogged wells.

The tool 10 will further have a third wash cup 36 located below the pressure wash port 34. The third wash cup 36 is similar to the previous mentioned wash cups 28 and 32. The wash cup 36 is conical in shape. The diameter of the bottom section being slightly smaller than the diameter of the top section. The wash cup 36 is used to help to draw in and purge out a fluid within the tool 10. A holding device 38 is coupled to a bottom section of the third wash cup 36. The holding device 38 is used to hold the third wash cup 36 in position on the tool 10.

A fourth wash cup 42 is coupled below the third wash cup 36. A spacer 40 may be positioned between the third wash cup 36 and the forth wash cup 42. The fourth wash cup 42 is also conical in shape. The diameter of the bottom section being slightly smaller than the diameter of the top section. The wash cup 42 is also used to help to draw in and purge out a fluid within the tool 10. A holding device 44 is used to secure the fourth wash cup 42 in position on the tool 10.

A pump shoe assembly 46 is coupled below the fourth wash cup 42. The pump shoe assembly 46 helps to control the intake and the dispersal of fluid in the tool 10. The pump shoe assembly 46 has a connector 48 positioned below the fourth wash cup 42. In the embodiment depicted in the Figures, the connector 48 is a male/female connector. A pump shoe valve 50 is coupled to the connector 48. The pump shoe valve 50 has a swing flap internal to the pump shoe valve 50. The movement of the tool 10 will control the movement of the swing flap. A ported blow plug 52 is coupled to the bottom of the pump shoe valve 50.

The tool 10 can be used in both deep and shallow wells and in low and high fluid wells. The tool 10 is easily converted from a surge wash tool to a pressure wash tool by removing the perforated nipple assembly 14 and replacing it with a non-ported nipple assembly. The by-pass port 20 is covered with a spacer between locking nuts. The pump shoe
The ported blow plug 52 is replaced with a non-ported blow plug. The change from a surge wash tool to a pressure wash tool will reduce the washing distance from 45 to 70 feet down to 2 feet of the distance between the two wash cups on either side of the pressure wash port 34. The pressure wash tool is used in deeper and high pressure wells. The pressure wash tool also requires a high pressure pump that pumps a treated fluid down the tubing string and out the pressure wash port 34.

**OPERATION**

**[0033]** Referring to the Figures wherein like numerals and symbols represent like elements, the operation of the tool 10 will be disclosed. The tool 10 is designed to be coupled to the tubing string of an oil well. The tubing string is held by the oil rig’s derrick which is attached to the oil rig’s blocks and travels the height of the oil rig’s derrick. The up and down movement of the well causes the tool 10 to clean debris in the borehole. Pressure is applied to well perforations on the downward movement of the tool 10 and suction is applied to the well perforations on the upward movement of the tool 10.

**[0034]** As stated above, the tool 10 runs on the tubing string of the well so that the washing action of the tool 10 is the distance that the rig’s blocks travel up and down the derrick length, approximately 45 to 70 feet per run.

**[0035]** In order to treat a well, a fluid is added to the well. In accordance with one embodiment of the present invention, the fluid is added at least two days prior to using the tool 10. This will allow a sufficient amount of time for the fluid to circulate within the well and breakdown any build-up/debris. The fluid may be any type of solvent or acid. However, the fluid should preferably be one which is oil and water soluble.

**[0036]** The tool 10 is coupled to the tubing string. On the downward motion of the tubing string, the tool 10 will enter and move down the borehole of the oil well. The tubing string and the tool 10 are free floating until the tool 10 passes the bottom perforation. Then the blocks are moved up the oil derrick moving the tubing string with the tool 10 up the borehole.

**[0037]** A fluid may be injected into the tool 10. A high pressure pump may be used to inject the fluid into the plurality of annulus 16 which are located around the outer top perimeter of the tubular top section of the perforated nipple assembly 14.

**[0038]** As the tool 10 is lowered, the swing flap internal to the pump shoe valve 50 is in a closed position. Fluid in the well that is located below the bottom wash cup 42 will be forced to enter the tool 10 through the ported blow plug 52. The fluid in the well will pass through a hole in the swing flap and exit at the by-pass port 20. The fluid in the well as it travels through the tool 10 will mix with fluid being injected into the tool 10. This combined fluid will then be used to clean the well. The fluid injected into the tool 10 will also exit the tool 10 at the pressure wash port 34 further cleaning the well.

**[0039]** On the upward movement of the tool 10, a suction is created below each of the wash cups. The draws fluid and sand into the wellbore. The by-pass port 20 allows fluid to enter during the upward movement of the tool 10. Fluid and any debris/sand is sent through the tool 10 and out the ported blow plug 52. The swing flap is now in the open position thus allowing the fluid and the debris/sand to exit and be deposited at the bottom of the well.

**[0040]** While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A combination surge and pressure wash tool for cleaning wells comprising, in combination:
   - a nipple assembly;
   - a by-pass port coupled to the nipple assembly;
   - a diverter cup coupled to the by-pass port;
   - a plurality of pressure wash cups positioned on the tool;
   - a pressure wash port located between the plurality of pressure wash cups; and
   - a pump shoe assembly coupled to a bottom pressure wash cup.

2. A combination surge and pressure wash tool for cleaning wells in accordance with claim 1 wherein the nipple assembly is a perforated nipple assembly having a plurality of annulus located around an outer top perimeter.

3. A combination surge and pressure wash tool for cleaning wells in accordance with claim 1 wherein the nipple assembly is a non-port nipple assembly.

4. A combination surge and pressure wash tool for cleaning wells in accordance with claim 1 further comprising a collar assembly coupled to a top section of the tool.

5. A combination surge and pressure wash tool for cleaning wells in accordance with claim 1 wherein the by-pass port allows fluid to enter the tool on an upward movement of the tool.

6. A combination surge and pressure wash tool for cleaning wells in accordance with claim 1 wherein the diverter cup diverts fluid with debris down the tool and out the pump shoe assembly.

7. A combination surge and pressure wash tool for cleaning wells in accordance with claim 1 wherein the plurality of wash cups create a suction below each of the plurality of cups.

8. A combination surge and pressure wash tool for cleaning wells in accordance with claim 1 wherein the pressure wash port allows fluid to exit the tool at an elevated pressure to clean the wells.

9. A combination surge and pressure wash tool for cleaning wells in accordance with claim 1 wherein the pump shoe assembly comprises:
   - a connector coupled to a bottom section of the tool;
   - a pump shoe valve coupled to the connector; and
   - a blow plug coupled to the pump shoe valve.

10. A combination surge and pressure wash tool for cleaning wells in accordance with claim 9 further comprising a collar assembly coupled to the pump shoe valve and the blow plug.
11. A combination surge and pressure wash tool for cleaning wells in accordance with claim 9 further comprising a swing flap internal to the pump shoe valve wherein the swing flap is open on an upward movement of the tool and closed on the downward movement of the tool.

12. A method of cleaning an oil well to increase oil flow comprising the steps of:

- adding a water and oil soluble fluid into the oil well;
- coupling a surge and pressure wash tool to a tubing string of the oil well;
- moving the surge and pressure wash tool to a bottom of the oil well; and
- raising the surge and pressure wash tool in a quick manner.

13. The method of claim 12 further comprising the step of injecting the water and oil soluble fluid into the surge and pressure wash tool.

14. The method of claim 12 further comprising the steps of:

- moving the surge and pressure wash tool to a bottom of the oil well after raising the surge and pressure wash tool in a quick manner; and
- raising the surge and pressure wash tool in a quick manner.

15. The method of claim 12 wherein the step of providing the surge and pressure wash tool.

16. The method of claim 15 wherein the step of providing surge and pressure wash tool further comprises the steps of:

- providing a by-pass port coupled to the nipple assembly wherein the port by-pass port allows fluid to enter the tool on an upward movement of the tool;
- providing a diverter cup coupled to the by-pass port wherein the diverter cup diverts fluid with debris down the tool and out a bottom section of the tool;
- providing a plurality of pressure wash cups positioned on the tool for creating a suction below each of the plurality of cups;
- providing pressure wash port located between the plurality of pressure wash cups wherein the pressure wash port allows fluid to exit the tool at an elevated pressure to clean the wells; and
- providing a pump shoe assembly coupled to a bottom pressure wash cup.

17. The method of claim 16 wherein the nipple assembly is a perforated nipple assembly having a plurality of annulus located around an outer top perimeter.

18. The method of claim 16 wherein the nipple assembly is a non-port nipple assembly.

19. The method of claim 16 wherein the pump shoe assembly comprises:

- a connector coupled to a bottom section of the tool;
- a pump shoe valve coupled to the connector; and
- a blow plug coupled to the pump shoe valve.

20. The method of claim 19 further comprising the step of providing a swing flap internal to the pump shoe valve wherein the swing flap is open on an upward movement of the tool and closed on the downward movement of the tool.

* * * * *