TUBULAR VALVING SYSTEM AND METHOD

CROSS REFERENCE

This application claims the benefit of the filing date of United States Patent Application Serial Number 12/540,868 filed August 13, 2009, for "TUBULAR VALVING SYSTEM AND METHOD."

BACKGROUND

[0001] Tubular valves that control occlusion of ports that fluidically connect an inner bore of a tubular with an outside of the tubular are commonly used in several industries including the downhole completion industry. Such valves are deployed in boreholes to control fluid flow in both directions, inside to outside of the tubular as well as outside to inside of the tubular, through ports. New systems and methods that improve control over the opening of such ports along a tubular are always of interest to operators of such systems.

BRIEF DESCRIPTION

[0002] A tubular valving system comprising a tubular having a plurality of ports; a plurality of sleeves disposed at the tubular covering the plurality of ports; a plug runnable within the tubular and seatingly engagable with the plurality of sleeves such that attainment of a first pressure applied against the plug and one of the plurality of sleeves causes movement of the one of the plurality of sleeves to thereby uncover at least one of the plurality of ports covered by the one of the plurality of sleeves; at least one of the plurality of sleeves being yieldable to allow passage of the plug upon attainment of a second pressure applied thereagainst; and a plurality of occlusive members occluding the plurality of uncovered ports until a later time.

[0003] A method of valving a plurality of ports in a tubular comprising running a plug within the tubular; sequentially seatingly engaging the plug with a plurality of sleeves covering a plurality of ports in the tubular; pressuring up against the plug to a first pressure; moving the plurality of sleeves; uncovering the plurality of ports; pressuring up against the plug to a second pressure; yieldably defeating at least one of a plurality of seats disposed at the plurality of sleeves; and removing a plurality of occlusive members from the plurality of ports that are uncovered.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

[0005] FIG. 1 depicts a schematical sectional view of a tubular valving system disclosed herein;

[0006] FIG. 2 depicts a schematical sectional view of the tubular valving system of FIG. 1, shown in an alternate position; and

[0007] FIG. 3 depicts a schematical sectional view of an alternate embodiment of a tubular valving system disclosed herein.

DETAILED DESCRIPTION

[0008] A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

[0009] Referring to Figures 1 and 2, an embodiment of a tubular valving system is illustrated generally at 10. The valving system 10 includes, a tubular 14 having a plurality of ports 18, a plug 22, disclosed herein as a ball, runnable within the tubular 14, and a plurality of sleeves 26 seatingly receptive to the plug 22. Each of the sleeves 26 is slidably sealingly engaged with the tubular 14 such that the sleeves 26 cover one or more of the ports 18A when in a first position as illustrated by the sleeve 26A while the sleeves 26 uncover the ports 18B when in a second position as illustrated by the sleeve 26B by longitudinal alignment of openings 28 in the sleeve 26B with the ports 18B. The sleeves 26 have a yieldable seat 30, illustrated herein as a ball seat that is sealingly engagable with one of the plugs 22 run thereagainst. At selected pressures applied across the seated plug 22 the sleeve 26 is urged to move relative to the tubular 14. As such, the sleeve 26 is movable from the first position to the second position, for example, to uncover the ports 18 covered thereby. When pressure is increased beyond a selected threshold pressure the yieldable seat 30 yields permitting the plug 22 to pass thereby and travel to another of the sleeves 26. By setting the pressure needed to yield the yieldable seat 30 to a greater value than the pressure needed to move the sleeve 26, the sleeve 26 is sure to move prior to yielding of the yieldable seat 30. Occlusive members 34 occlude the ports 18 until sometime after the sleeves 26 have become uncovered as will be discussed below.

[0010] The occlusive members 34 disclosed in this embodiment include collars 36 that are slidably sealingly engaged with the tubular 14 such that the ports 18 are occluded when the collars 36 are in a first position as illustrated by the collars 36 in Figure 1 and the ports 18 are not occluded, or removed, when the collars 36 are in a second position as illustrated in Figure 2, wherein openings 38 in the collars 36 are aligned with the ports 18.

[0011] The collars 36 of the occlusive members 34 in this embodiment are moved from the first position to the second position in response to a drop in pressure within the tubular 14 that allows biasing members 42, illustrated herein as compression springs, to move the collars 36 to the second position. Release members 46, shown in this embodiment as shear screws that longitudinally fix the collars 36 to the tubular 14 until after the release members 46 have been released, prevent movement of the collars 36 to the second position. Release of the release members 46 is accomplished by increasing pressure within the tubular 14 that acts on differential areas on the collars 36 to urge the collars 36 in a longitudinal direction opposite to the direction that aligns the openings 38 with the ports 18. By setting this releasing pressure of the release members 46 to a greater value than the pressure needed to yield the yieldable seats 30, the yieldable seats 30 are sure to yield prior to release of the release members 46. Once the release members 46 have been released the biasing members 42 are configured to move the collars 36 from the first position to the second position upon a drop in pressure below a selected threshold pressure. The collars 36 disclosed herein are similar to a device disclosed in U.S. Patent No. 7,503,390 to Gomez, which is incorporated herein in its entirety by reference.

[0012] Increasing pressure within the tubular 14 to a pressure able to cause release of the release members 46 may be achieved against the plug 22 seated on a non-yieldable seat 50 that may be located on a slidable sleeve 54, as illustrated, or on a seat (not shown) longitudinally fixed to the tubular 14 depending upon the needs of each specific application.

[0013] Referring to Figure 3, an alternate embodiment of a tubular valving system is illustrated generally at 110. The system 110 includes several of the same elements of the system 10 and as such like elements are numbered alike and in the interest of brevity are not described again in detail hereunder. A primary difference between the system 110 and the system 10 is that occlusive members 134 in the system 110 replace the occlusive members 34 in the system 10. The occlusive members 134 include dissolvable material 138 that occludes the ports 18, yet removes the occlusion once dissolved. Optional collars 142 that are sealedly attached to the tubular 14 can structurally support the dissolvable material 138. The

dissolvable material 138 is substantially isolated from conditions within the tubular 14 that can promote dissolving of the dissolvable material 138, such as chemicals, fluids and pressure, for example, by the sleeves 26 when the sleeves 26 are in the first position. Such conditions can be conditions anticipated to be encountered downhole in a wellbore. Movement of the sleeves 26 to the second position exposes the dissolvable material 138 to conditions within the tubular 14 thereby initiating dissolving of the dissolvable material 138.

[0014] Since increases in pressure are used to move the sleeves 26, it may be desirable to limit any leak paths from the tubular 14 until all of the sleeves 26 have been moved. Delays in dissolving the dissolvable materials 138, and subsequent removal of occlusion of the ports 18 thereby may be desirable. Such delays could be controlled by a rate of dissolving as estimated by selected physical and chemical properties of the dissolvable material 138 once exposed to the conditions within the tubular 14. Alternately, the conditions within the tubular 14 may be controlled by an operator such that dissolving of the dissolvable material 138 is not initiated until an operator alters the conditions within the tubular 14 thereby exposing the dissolvable material 138 thereto such as by pumping specific chemicals within the tubular 14.

[0015] Alternate embodiments can have a plurality of the tubular valving systems 10, 110 distributed along the tubular with the systems 10, 110 located further from surface having seats 30 receptive to larger plugs 22 than systems 10 nearer to the surface. In such embodiments the occlusive members 34, 134 are isolated from the conditions within the tubular 14 that results in removal of the occlusion of the ports 18 until after the sleeves 26 that cover the ports 18 have been moved to the second position.

[0016] While the invention has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the claims. Also, in the drawings and the description, there have been disclosed exemplary embodiments of the invention and, although specific terms may have been employed, they are unless otherwise stated used in a generic and descriptive sense only and not for purposes

of limitation, the scope of the invention therefore not being so limited. Moreover, the use of the terms first, second, etc. do not denote any order or importance, but rather the terms first, second, etc. are used to distinguish one element from another. Furthermore, the use of the terms a, an, etc. do not denote a limitation of quantity, but rather denote the presence of at least one of the referenced item.

What is claimed is:

1. A tubular valving system, comprising:

a tubular having a plurality of ports;

a plurality of sleeves disposed at the tubular covering the plurality of ports;

a plug runnable within the tubular and seatingly engagable with the plurality of sleeves such that attainment of a first pressure applied against the plug and one of the plurality of sleeves causes movement of the one of the plurality of sleeves to thereby uncover at least one of the plurality of ports covered by the one of the plurality of sleeves, at least one of the plurality of sleeves being yieldable to allow passage of the plug upon attainment of a second pressure applied thereagainst; and

a plurality of occlusive members occluding the plurality of uncovered ports until a later time.

2. The tubular valving system of claim 1, wherein the plug is a ball.

3. The tubular valving system of claim 1, wherein the plurality of occlusive members are dissolvable.

4. The tubular valving system of claim 3, wherein the plurality of occlusive members dissolve after a selectable amount of time after exposure to specific conditions.

5. The tubular valving system of claim 4, wherein the specific conditions are anticipated to be encountered downhole.

6. The tubular valving system of claim 4, wherein the specific conditions include a chemical that is pumpable within the tubular.

7. The tubular valving system of claim 1, wherein the plurality of occlusive members include collars.

8. The tubular valving system of claim 7, wherein the collars are configured to remove occlusion of the plurality of ports in response to a reduction in pressure.

9. The tubular valving system of claim 8, further comprising a plurality of release members maintaining the collars in occlusive engagement with the plurality of ports.

10. The tubular valving system of claim 9, wherein the plurality of release members are configured to release at a release pressure.

11. The tubular valving system of claim 10, wherein the release pressure is greater than a sleeve yielding pressure.

12. The tubular valving system of claim 9 wherein the plurality of release members are shear screws.

13. A method of valving a plurality of ports in a tubular, comprising:

running a plug within the tubular;

sequentially seatingly engaging the plug with a plurality of sleeves covering a plurality of ports in the tubular;

pressuring up against the plug to a first pressure;

moving the plurality of sleeves;

uncovering the plurality of ports;

pressuring up against the plug to a second pressure;

yieldably defeating at least one of a plurality of seats disposed at the plurality of sleeves; and

removing a plurality of occlusive members from the plurality of ports that are uncovered.

14. The method of valving a plurality or ports in a tubular of claim 13, further comprising dissolving the plurality of occlusive members.

15. The method of valving a plurality or ports in a tubular of claim 13, further comprising exposing the plurality of occlusive members to conditions dissolvable thereof.

16. The method of valving a plurality or ports in a tubular of claim 13, wherein the removing the plurality of occlusive members includes moving the plurality of occlusive members relative to the tubular.

17. The method of valving a plurality or ports in a tubular of claim 16, wherein the moving is in response to a drop in pressure.

18. The method of valving a plurality or ports in a tubular of claim 13, further comprising releasing a plurality of release members engaged between the tubular and the plurality of occlusive members.

19. The method of valving a plurality or ports in a tubular of claim 18, wherein the releasing the plurality of release members includes building pressure to a third pressure.

20. The method of valving a plurality or ports in a tubular of claim 19, wherein the third pressure is greater than the second pressure.