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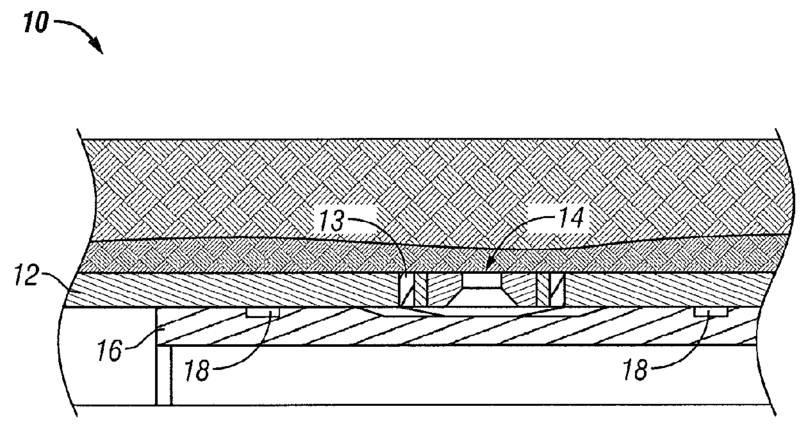

FIG. 1

(57) Abstract: A telescoping unit for a downhole tool including an innermost portion of the telescoping unit; a block defining a restriction disposed within the innermost portion of the telescoping unit; and an erodable coating on the block to segregate the block from downhole fluids and method.

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FRACTURING SYSTEM AND METHOD

CROSS REFERENCE

This application claims the benefit of the filing date of United States Patent Application Serial Number 12/501,203 filed July 10, 2009, for "FRACTURING SYSTEM AND METHOD."

BACKGROUND

[0001] In the downhole drilling and completion industry, downhole fracturing processes generally include openings in a tubing string in a borehole in which the tubing string is deployed. Pressure is applied to the tubing string, for example, from a surface location. The pressure applied to the inside of the tubing string is allowed to propagate to outside of the tubing string through the openings noted. The pressure is contained in zones using seals between the tubing string and the formation so that the applied pressure has nowhere to go but into the formation. This results in fractures in the formation and a rush of fluid into the fracture point. Proppant entrained in the fluid will keep the fracture open when the pressure is relieved. While the method works well and is used widely in the art, the fracture will generally occur at the weakest point of the interval being fractured so that there is little specificity or distribution of fractures. The inventor hereof believes that greater control of the location and distribution of fracturing would be well received by the art.

SUMMARY

[0002] A telescoping unit for a downhole tool including an innermost portion of the telescoping unit; a block defining a restriction disposed within the innermost portion of the telescoping unit; and an erodable coating on the block to segregate the block from downhole fluids.

[0003] A telescoping unit for a downhole tool including an innermost portion of the telescoping unit; and a block defining a restriction disposed within the innermost portion of the telescoping unit, the block being resistant to dissolution and susceptible to rapid erosion by flowing proppant to remove the block from the telescoping unit substantially entirely within minutes of a start of proppant fluid flowing therethrough.

[0004] A fracturing system including at least a portion of a tubing string; one or more telescoping units in the at least a portion of a tubing string; one or more barriers in operable communication with the one or more telescoping units; and a restriction disposed in an inside dimension of the one or more telescoping units.

[0005] A method for fracturing a formation adjacent a borehole including shifting one or more barriers to expose to tubing fluid one or more telescoping units disposed within a tubing string; pressuring up on the tubing string to deploy the one or more exposed telescoping units; pressuring further to fracture the formation in the vicinity of the one or more exposed telescoping units; flowing a fluid from the tubing through the one or more exposed telescoping units into the formation; eroding a coating covering a block defining a restriction in the one or more exposed telescoping units; and dissolving the block with downhole fluids to which it is exposed pursuant to the eroding of the coating.

[0006] A method for fracturing a formation adjacent a borehole including shifting one or more barriers to expose to tubing fluid one or more telescoping units disposed within a tubing string; pressuring up on the tubing string to deploy the one or more exposed telescoping units; pressuring further to fracture the formation in the vicinity of the one or more exposed telescoping units; flowing a fluid from the tubing through the one or more exposed telescoping units into the formation; and eroding a block defining a restriction thereby removing the block from the one or more exposed telescoping units.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Referring now to the drawings wherein like elements are numbered alike in the Figures:

[0008] Figure 1 is a schematic view of a telescopic fracturing tool as described herein in a pre-deployment position;

[0009] Figure 2 is a schematic view of the tool depicted in Figure 1 but in the deployed position;

[0010] Figure 3 is an enlarged view of the circumscribed area 3-3 in Figure 2; and

[0011] Figure 4 is another embodiment depicted, as is Figure 3.

DETAILED DESCRIPTION

[0012] Referring to Figure 1, a fracturing system 10 is illustrated. It is to be understood that the illustrated configuration can be duplicated along a tubing string 12 to provide for as many telescoping unit(s) 14 as is/are required or desired in any particular system. The telescoping unit(s) 14 are disposed within the string 12 using an attachment 13 such as threads, a press fit, welding, etc. Each of the telescoping units 14 is initially closed from the environment inside of the tubing string by a barrier 16 such as for example a sliding sleeve. This ensures that there is no pressure differential across the unit(s) 14 during the run in phase of tool use.

[0013] The barrier, in one embodiment, is configured with seals 18 both uphole and downhole of the telescoping unit(s) 14 to ensure that the barrier and not the unit(s) 14 bear any differential pressure, which prevents fluid flow thereacross, and that any fluidic factors present inside of tubing string 12 are not transmitted to the telescoping unit(s) 14. One or more of the barriers 16 may be moved to expose the telescopic unit(s) 14 when the time to fracture the formation has arrived. This may be accomplished using a shifting tool or a droppable plug, etc. In one embodiment, different size drop plugs, counting plugs (such as those described in US Application Nmber12/437,412 filed May 7, 2009, US Application Serial Number 12/470,927 filed May 22, 2009 and US Application Serial Number 12/470,931 filed on May 22, 2009, could be employed.

[0014] To render a telescoping unit 14 effective for fluid flow, the inside diameter must be of a sufficient size D to accommodate a sufficient amount of flow. Commonly, the size is about .375 inch to about 1 inch in diameter. This size does not promote a sufficient pressure drop thereacross to allow for effective deployment of the unit(s) 14 based upon tubing pressure. In order to remedy this, and as will be best understood by viewing Figures 3 and 4, telescoping unit(s) 14 are configured with a restriction 20 provided by a block 22 at an innermost telescopic portion 24 of the telescoping unit 14. The restriction promotes a sufficient pressure drop across the unit(s) 14 that they will completely radially deploy. While the illustration of Figure 3 is of a nozzle configuration, it is equally effective to configure the restriction in a tubular form such as that shown in Figure 4. The geometry of the restriction 20 is unimportant.

[0015] The astute reader will question the earlier statement herein that a sufficient inside diameter of the unit(s) 14 is needed but then that a restriction 20 is placed within this dimension D. Referring more closely to Figures 3 and 4, it will be appreciated that the block 22 defining restriction 20 comprises a structure that has a base material 30 for structural integrity sufficient to withstand the pressure differential created thereby and a coating 32 to protect the base material. In one embodiment the base material 30 comprises a water based or other downhole fluid soluble material such as aluminum or magnesium alloy, one possibility being the commercially available “dissolvable” alloy from TAFA Incorporated, Concord, New Hampshire. The coating 32 comprises a water and downhole fluid impervious (or at least dissolution resistant) material such as Teflon, polyurethane, rubber, metal coatings such as aluminum, copper, etc. The coating 32 is applied to the soluble material 30 by any known and suitable process for the particular coating selected. In an alternate embodiment, the base material and coating can comprise all erodable material and not require dissolution at all. In such event there could be layers of material if desired or the block 22 can be made of one layer of erodable material. Materials include polyurethane, copper and other materials exhibiting properties of strength sufficient to withstand the anticipated pressure differential in use without fracturing and at the same time being easily erodable such that complete removal through erosion pursuant to proppant flow therethrough will occur within seconds to minutes after flow commences.

[0016] In the first embodiment discussed, the construction as stated provides significant advantage in that the coating 32 will resist the downhole fluid chemically but is erosively susceptible. Because of this, as proppant flow begins after fracturing of the formation through the unit(s) 14, the coating is quickly eroded away thereby exposing the soluble material base 30 to the downhole fluids, to which it is chemically susceptible. The base material 30 will then quickly be dissolved and thereby removed from the units 14. At this point the innermost portion 24 of the unit(s) 14 is at dimension D. In the second embodiment discussed, the entire block is eroded resulting similarly in the innermost portion 24 of the unit(s) 14 being at dimension D.

[0017] In operation, once a selected number (one or more) of the telescoping units 14 is/are exposed to tubing pressure by removing the barrier(s) 16, the pressure in the tubing is raised from the surface. The fluid pressure acts to deploy the unit(s) 14, taking advantage of the pressure differential occasioned by the restriction 20 in each "unbarriered" unit 14. Since fluid is not actually flowing to any appreciable extent at this point, the coating 32 (or Block 22) is not eroded. Rather, the pressure differential simply deploys the unit(s) 14 into proximity or contact with a formation wall. Pressure is raised higher until fracturing occurs in the formation. At this point the fluid in the tubing begins to flow into the formation carrying proppant with it to maintain the fractures open. As the proppant filled fluid or even fluid that does not contain proppant moves through the restriction 20, it erodes the coating 32 (or simply the whole block 22) thereby exposing the base material 30 to fluids within which it is soluble. It will be noted that erosion may be faster in the embodiment of Figure 3 than in the embodiment of Figure 4 because the nozzle-type cross-section of Figure 3 will increase velocity of fluid flowing therethrough, the velocity of flowing proppant particles being directly related to impact force of the particles with the coating, which of course is directly related to speed of erosion. In either of the illustrated embodiments or other similar embodiments, erosion of the coating layer occurs within a very short time frame such as a few seconds to a few minutes of the proppant or nonproppant fluid moving into the formation. Once this occurs, either block is erosively removed or the protection offered the soluble base material 30 by the coating 32 is breached and the base material will quickly dissolve, again on the order of several seconds to several minutes.

[0018] Finally it is to be understood while one or more embodiments have been shown and described, modifications and substitutions may be made thereto without departing from the spirit and scope of the invention. Accordingly, it is to be understood that the present invention has been described by way of illustrations and not limitation.

CLAIMS

1. A telescoping unit for a downhole tool comprising:

an innermost portion of the telescoping unit;

a block defining a restriction disposed within the innermost portion of the telescoping unit; and

an erodable coating on the block to segregate the block from downhole fluids.

2. A telescoping unit as claimed in claim 1 wherein the block comprises a dissolvable material.

3. A telescoping unit as claimed in claim 2 wherein the dissolvable material is responsive to downhole fluids.

4. A telescoping unit as claimed in claim 1 wherein the coating is resistant to dissolution by downhole fluids.

5. A telescoping unit as claimed in claim 1 wherein the coating is chemically impervious to downhole fluids.

6. A telescoping unit as claimed in claim 2 wherein the dissolvable material is at least in part an aluminum alloy.

7. A telescoping unit as claimed in claim 2 wherein the dissolvable material is at least in part a magnesium alloy.

8. A telescoping unit as claimed in claim 1 wherein the coating is erodable by fluid flow.

9. A telescoping unit as claimed in claim 1 wherein the coating is erodable by proppant in a proppant laden fluid flowing therethrough.

10. A telescoping unit for a downhole tool comprising:

an innermost portion of the telescoping unit; and

a block defining a restriction disposed within the innermost portion of the telescoping unit, the block being resistant to dissolution and susceptible to rapid erosion by flowing proppant to remove the block from the telescoping unit substantially entirely within minutes of a start of proppant fluid flowing therethrough.

11. A fracturing system comprising:

at least a portion of a tubing string;

one or more telescoping units in the at least a portion of a tubing string;

one or more barriers in operable communication with the one or more telescoping units; and

a restriction disposed in an inside dimension of the one or more telescoping units.

12. A fracturing system as claimed in claim 11 wherein the restriction is defined by a block disposed within the innermost portion of the one or more telescoping units.

13. A fracturing system as claimed in claim 12 wherein the block is formed at least in part of a dissolvable material.

14. A fracturing system as claimed in claim 12 wherein the block includes a coating that is resistant to chemical effects of downhole fluids.

15. A fracturing system as claimed in claim 14 wherein the coating is erodable.

16. A fracturing system as claimed in claim 14 wherein the coating is erodable by flowing fluid.

17. A fracturing system as claimed in claim 14 wherein the coating is erodable by proppant entrained in a flowing proppant laden fluid.

18. A method for fracturing a formation adjacent a borehole comprising:

shifting one or more barriers to expose to tubing fluid one or more telescoping units disposed within a tubing string;

pressuring up on the tubing string to deploy the one or more exposed telescoping units;

pressuring further to fracture the formation in the vicinity of the one or more exposed telescoping units;

flowing a fluid from the tubing through the one or more exposed telescoping units into the formation;

eroding a coating covering a block defining a restriction in the one or more exposed telescoping units; and

dissolving the block with downhole fluids to which it is exposed pursuant to the eroding of the coating.

19. A method as claimed in claim 18 wherein the eroding is by flowing fluid.

20. A method as claimed in claim 19 wherein the fluid is proppant laden.

21. A method for fracturing a formation adjacent a borehole comprising:

shifting one or more barriers to expose to tubing fluid one or more telescoping units disposed within a tubing string;

pressuring up on the tubing string to deploy the one or more exposed telescoping units;

pressuring further to fracture the formation in the vicinity of the one or more exposed telescoping units;

flowing a fluid from the tubing through the one or more exposed telescoping units into the formation; and

eroding a block defining a restriction thereby removing the block from the one or more exposed telescoping units.

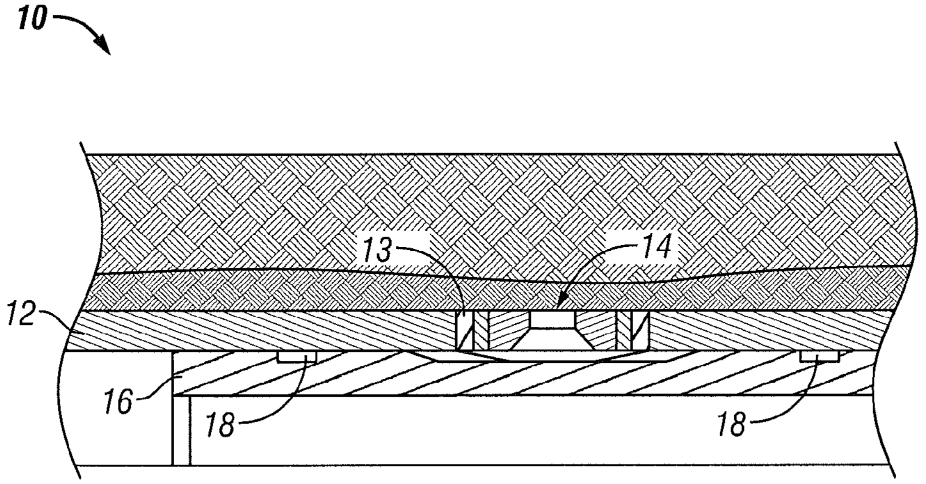

FIG. 1

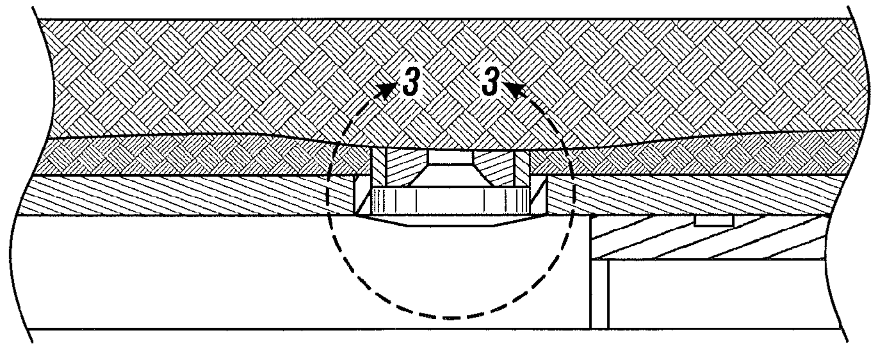

FIG. 2

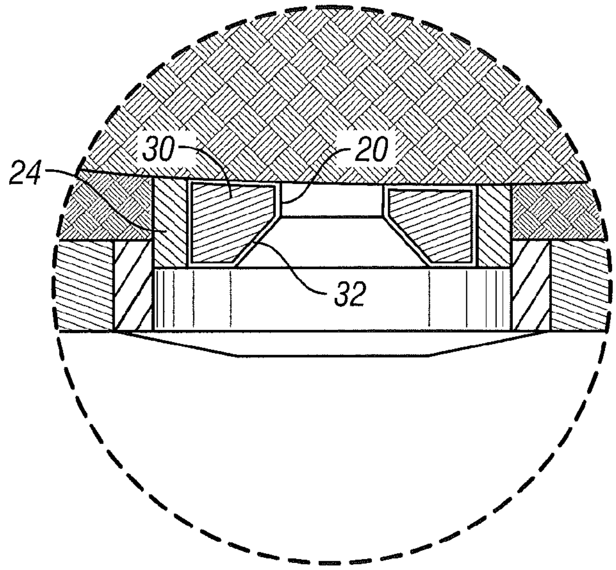

FIG. 3

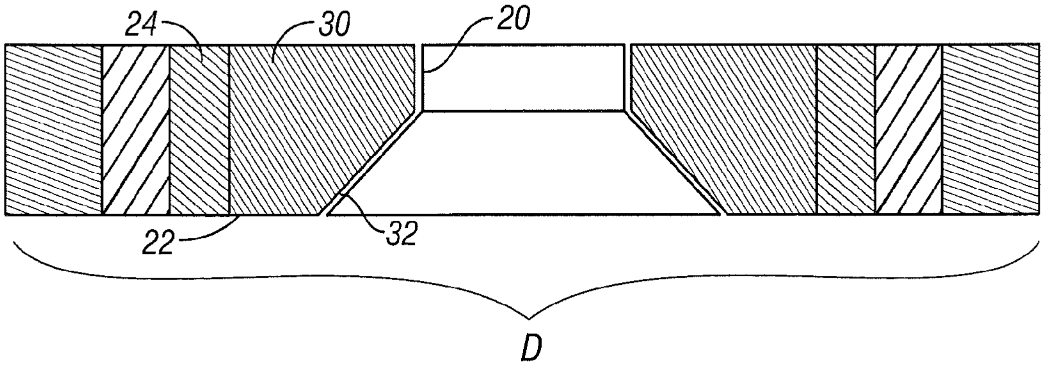

FIG. 4