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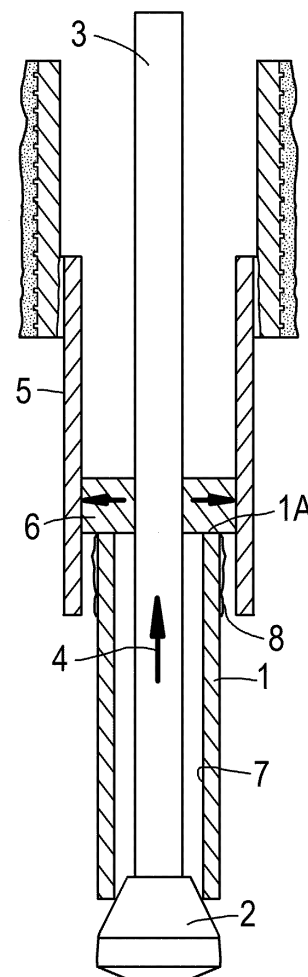
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(54) **METHOD AND SYSTEM FOR INHIBITING SLIP OF AN EXPANDABLE WELL TUBULAR ASSEMBLY**

(57) Slip is inhibited in an area of overlap between a lower well tubular(1) of which an upper end is expanded against a lower end of a previously installed upper tubular(5) by providing the lower well tubular(1) with an outer surface having an upper section(8) that has a larger roughness than an inner surface(7) of the lower well tubular(1).

Said upper section(8) may be roughened and/or coated with a coating(8) having a high friction coefficient, ($\mu_o > 0.055$) and the lower well tubular(1) may have an inner surface(7) coated with a lubricating coating ($\mu_i < 0.045$) and may be expanded an expansion cone(2) that presses the upper end of the lower tubular(1) against the lower end of the upper tubular(5).

Fig.1



Description

BACKGROUND OF THE INVENTION

[0001] The invention relates to a method and system for inhibiting slip of an expandable well tubular assembly wherein an upper end of a lower well tubular is expanded within a lower end of a previously installed well tubular.

[0002] Such a method and system are disclosed in International patent application WO2012104257.

[0003] In this known method a well tubular is expanded by moving an expansion cone therethrough. The expansion cone is connected to a drill string that is pulled up, whilst the upper end of the tubular is maintained in a fixed position within an previously installed well tubular by a radially expanded top anchor assembly.

[0004] When the expansion cone reaches the top anchor assembly the top anchor assembly needs to be retracted and pulled up by the expansion cone and then upward motion of partially expanded tubular needs to be prevented by friction between the outer surface thereof and the inner surface of the previously installed well tubular.

[0005] There is a need for an improved method and expandable well tubular wherein slip of an upper end of a partially expanded well tubular within a previously installed well tubular is inhibited.

SUMMARY OF THE INVENTION

[0006] In accordance with the invention there is provided a method for inhibiting slip in an area of overlap between lower well tubular of which an upper end is expanded against a lower end of a previously installed upper tubular, the method comprising providing the lower well tubular with an outer surface having an upper section that is configured to be expanded against the lower end of the upper well tubular and that has a larger roughness than other parts of the outer surface.

[0007] The upper section of the outer surface may be roughened and/or coated with a coating having a high friction coefficient (μ_o) of at least 0.055, optionally of at least 0.1, and the lower well tubular may have an inner surface coated with a lubricating coating having a lower friction coefficient (μ_i) than the friction coefficient (μ_o) of the coating on the upper section of the outer surface and the lower well tubular may be expanded by:

- lowering the unexpanded lower tubular through the upper tubular until the upper end of the lower tubular extends co-axially within the lower end of the upper tubular; and
- moving an expansion cone longitudinally through the lower tubular to radially expand the lower tubular and press the upper end of the lower tubular against the lower end of the upper tubular.

[0008] The invention also provides a well tubular for

use in the method according to the invention, the tubular being configured to be radially expanded and comprising an outer surface having an upper section that is configured to be expanded against the lower end of the another well tubular and that has a larger roughness than other parts of the outer surface.

[0009] The upper section of the outer surface of the well tubular may be roughened and/or coated with a coating having a high friction coefficient and the well tubular may have an inner surface which is coated with a lubricating coating having a low friction coefficient thereby providing a well tubular which is configured to be radially expanded by moving an expansion cone therethrough.

[0010] The inner surface of the tubular may be coated with a lubricating coating having a friction coefficient (μ_i) of at most 0.045, optionally of at most 0.025.

[0011] The upper section of the outer surface of the well tubular may be expanded against an inner surface of another well tubular and the tubulars may form part of a casing or liner assembly of a hydrocarbon fluid production well, which assembly may comprise:

- an expanded lower tubular having a length between 200 and 2000 meters and comprising a series of lower tubular sections that are interconnected by screw thread connections;
- an expanded upper tubular having a length between 200 and 2000 meters and comprising a series of upper tubular sections that are interconnected by screw thread connections; and
- an area of overlap between the upper section of the lower tubular and the lower section of the upper tubular wherein the outer surface of the lower tubular is expanded and in frictional engagement with the inner surface of the upper tubular, which area of overlap has a length between 10 and 100 meters, optionally between 30 and 70 meters.

[0012] These and other features, embodiments and advantages of the method and/or expandable well tubular according to the invention are described in the accompanying claims, abstract and the following detailed description of non-limiting embodiments depicted in the accompanying drawings, in which description reference numerals are used which refer to corresponding reference numerals that are depicted in the drawings.

[0013] Similar reference numerals in different figures denote the same or similar objects. Objects and other features depicted in the figures and/or described in this specification, abstract and/or claims may be combined in different ways by a person skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig.1 shows how a lower well tubular is expanded by moving an expansion cone therethrough; and

Fig 2 shows how the upper end of the lower well tubular is expanded within a lower end of an upper well tubular after completion of the expansion process.

DETAILED DESCRIPTION OF THE DEPICTED EMBODIMENTS

[0015] Fig.1 shows how a lower well tubular 1 is expanded by moving an expansion cone 2 therethrough. The expansion cone is connected to a drill string 3 that is pulled up as illustrated by arrow 4, whilst the upper end 1A of the lower tubular is maintained in a fixed position within an upper well tubular 5 by a radially expanded top anchor assembly 6.

[0016] When the expansion cone 2 reaches the top anchor assembly 6 the top anchor assembly need to be retracted and pulled up by the expansion cone as illustrated in Fig.2 and then upward motion of lower tubular 1 needs to be prevented by friction between the outer surface of the lower tubular and the inner surface of the upper tubular 5.

[0017] In accordance with the invention such upward motion or slip is inhibited by roughening an upper section of the outer surface of the lower well tubular 1 and/or providing said upper section with a high friction coating 8 having a friction coefficient μ_o of at least 0.055, optionally of at least 0.1.

[0018] Optionally an inner surface of the lower tubular 1 is coated with a lubricating coating 7 to lubricate the longitudinal movement of the cone 2 therethrough, which lubricating coating 7 may have a friction coefficient μ_i of at most 0.045, optionally of at most 0.025.

[0019] It will be understood from the foregoing that the method and well tubular according to present invention are well adapted to attain the ends and advantages mentioned as well as those that are inherent therein.

[0020] The particular embodiments disclosed above are illustrative only, as the present invention may be modified, combined and/or practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein.

[0021] Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below.

[0022] It is therefore evident that the particular illustrative embodiments disclosed above may be altered, combined and/or modified and all such variations are considered within the scope of the present invention as defined in the accompanying claims.

[0023] While any methods, systems and/or products embodying the invention are described in terms of "comprising," "containing," or "including" various described features and/or steps, they can also "consist essentially of" or "consist of" the various described features and steps.

[0024] All numbers and ranges disclosed above may vary by some amount. Whenever a numerical range with

a lower limit and an upper limit is disclosed, any number and any included range falling within the range is specifically disclosed. In particular, every range of values (of the form, "from about a to about b," or, equivalently, "from approximately a to b," or, equivalently, "from approximately a-b") disclosed herein is to be understood to set forth every number and range encompassed within the broader range of values.

[0025] Also, the terms in the claims have their plain, ordinary meaning unless otherwise explicitly and clearly defined by the patentee.

[0026] Moreover, the indefinite articles "a" or "an", as used in the claims, are defined herein to mean one or more than one of the element that it introduces.

[0027] If there is any conflict in the usages of a word or term in this specification and one or more patent or other documents that may be cited herein by reference, the definitions that are consistent with this specification should be adopted.

Claims

1. A method for inhibiting slip in an area of overlap between a lower well tubular of which an upper end is expanded against a lower end of a previously installed upper tubular, the method comprising providing the lower well tubular with an outer surface having an upper section that is configured to be expanded against the lower end of the upper well tubular and that has a larger roughness than an inner surface of the lower well tubular.
2. The method of claim 1, wherein the upper section of the outer surface is roughened and/or coated with a coating having a high friction coefficient and the lower well tubular has an inner surface coated with a coating having a lower friction coefficient than the friction coefficient of the coating on the upper section of the outer surface and the lower well tubular is expanded by:
 - lowering the unexpanded lower tubular through the upper tubular until the upper end of the lower tubular extends co-axially within the lower end of the upper tubular; and
 - moving an expansion cone longitudinally through the lower tubular to radially expand the lower tubular and press the upper end of the lower tubular against the lower end of the upper tubular.
3. The method of claim 2, wherein the upper section of the outer surface of the lower tubular has surface characteristics resulting in a friction coefficient μ_o of at least 0.055 during the expansion process.
4. The method of claim 3, wherein the upper section of

the outer surface of the lower tubular is coated with a high friction coating having a friction coefficient μ_o of at least 0.1.

5. The method of claim 2, wherein the inner surface of the lower well tubular is coated with a lubricating coating having a friction coefficient μ_i of at most 0.045 during the expansion process. 5
6. The method of claim 5, wherein the inner surface of the lower well tubular is coated with a lubricating coating having a friction coefficient μ_i of at most 0.025. 10
7. The method of any one of claims 1-6, wherein the upper and lower well tubulars form part of a casing or liner assembly of a hydrocarbon fluid production well through which, after completion of the well, a larger flux of crude oil, natural gas and/or another hydrocarbon fluid is produced than via a conventional well in which no expandable casing or liner assembly is arranged. 15
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8. A well tubular for use in the method according to any one of claims 1-7, the tubular being configured to be radially expanded and comprising an outer surface having an upper section that is configured to be expanded against the lower end of the another well tubular and that has a larger roughness than an inner surface of the lower well tubular. 25
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9. The well tubular of claim 8, wherein the upper section of the outer surface is roughened and/or coated with a coating having a high friction coefficient and wherein the well tubular has an inner surface which is coated with a lubricating coating having a low friction coefficient thereby providing a well tubular which is configured to be radially expanded by moving an expansion cone therethrough. 35
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10. The well tubular of claim 9, wherein the upper section is coated with a high friction coating having a friction coefficient of at least 0.065.
11. The well tubular of claim 10, wherein the upper section is coated with a high friction coating having a friction coefficient μ_o of at least 0.1. 45
12. The well tubular of claim 9, wherein the inner surface of the tubular is coated with a lubricating coating having a friction coefficient μ_i of at most 0.045. 50
13. The well tubular claim 12, wherein the inner surface of the tubular is coated with a lubricating coating having a friction coefficient μ_i of at most 0.025. 55
14. The well tubular of any one of claims 8-13, wherein the upper section of the outer surface of the

tubular is expanded against an inner surface of another well tubular and forms part of a casing or liner assembly of a hydrocarbon fluid production well.

15. The well tubular of claim 14, wherein the casing or liner assembly comprises:
 - an expanded lower tubular having a length between 200 and 2000 meters and comprising a series of lower tubular sections that are interconnected by screw thread connections;
 - an expanded upper tubular having a length between 200 and 2000 meters and comprising a series of upper tubular sections that are interconnected by screw thread connections; and
 - an area of overlap between the upper section of the lower tubular and the lower section of the upper tubular wherein the outer surface of the lower tubular is expanded and in frictional engagement with the inner surface of the upper tubular, which area of overlap has a length between 10 and 100 meters, optionally between 30 and 70 meters.

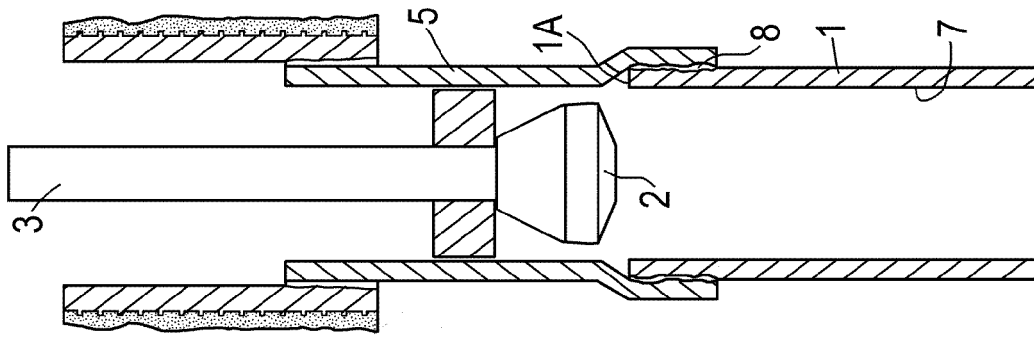


Fig. 2

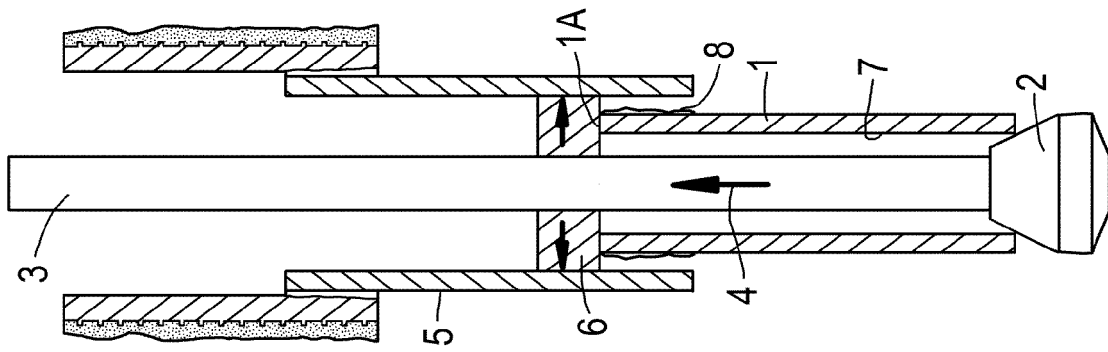


Fig. 1



EUROPEAN SEARCH REPORT

Application Number
EP 15 17 4835

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 2 December 2015	Examiner Georgescu, Mihnea
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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