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(54) **DOWNHOLE TUBULAR LENGTH COMPENSATING SYSTEM AND METHOD**

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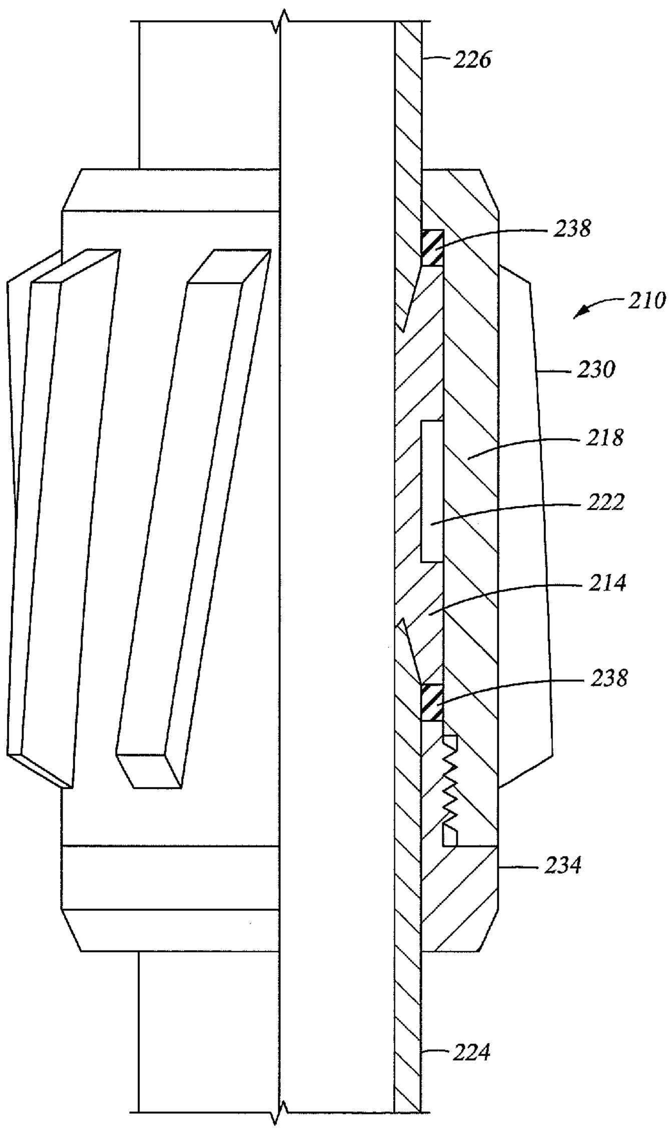
(57) **ABSTRACT**

Disclosed herein is a downhole tubular length compensating system. The system includes, a tubular having a plurality of length adjustable sections, and spacings between adjacent length adjustable sections are set to overcome frictional forces anticipated along the tubular.



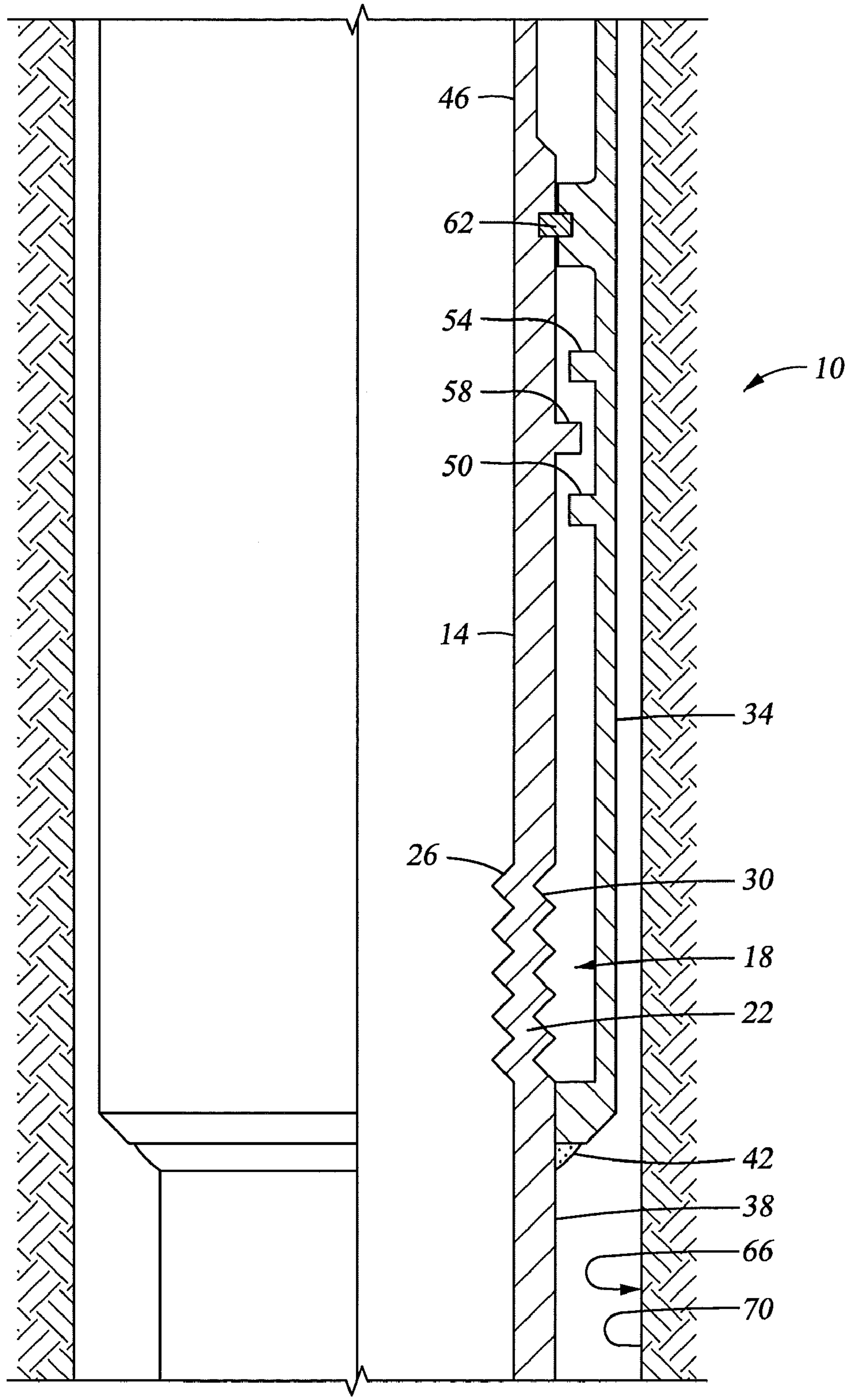


Fig. 1

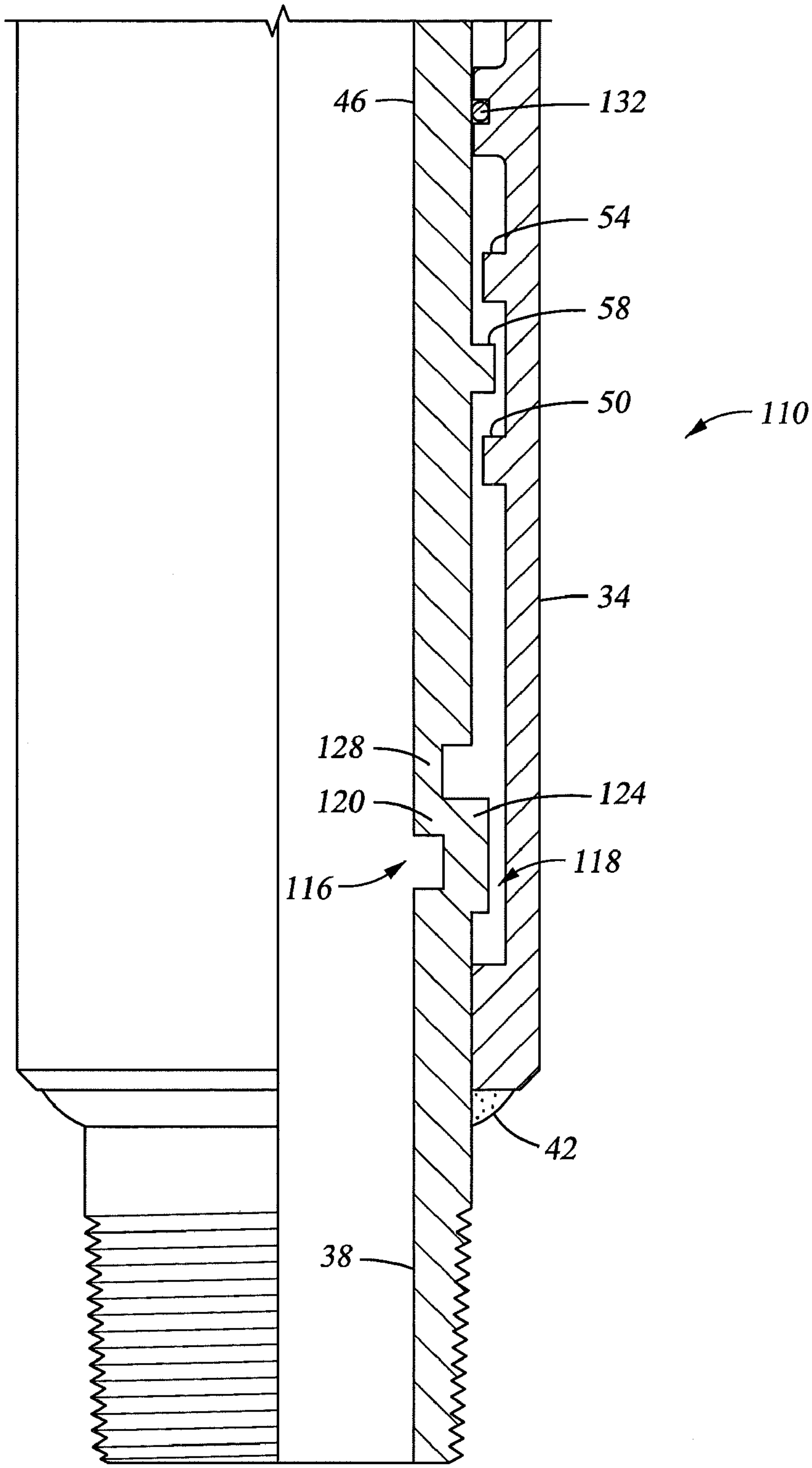


Fig. 2

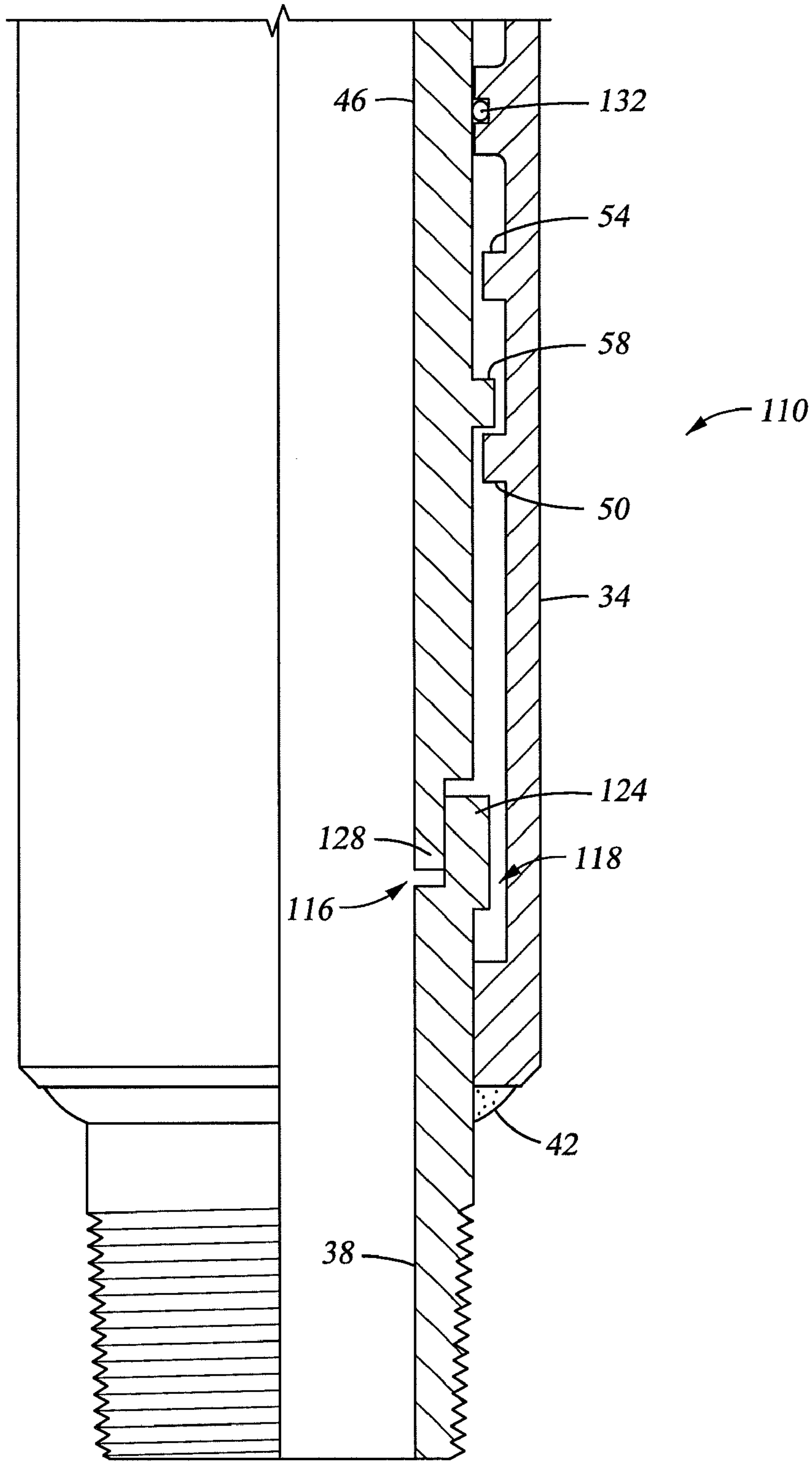


Fig. 3

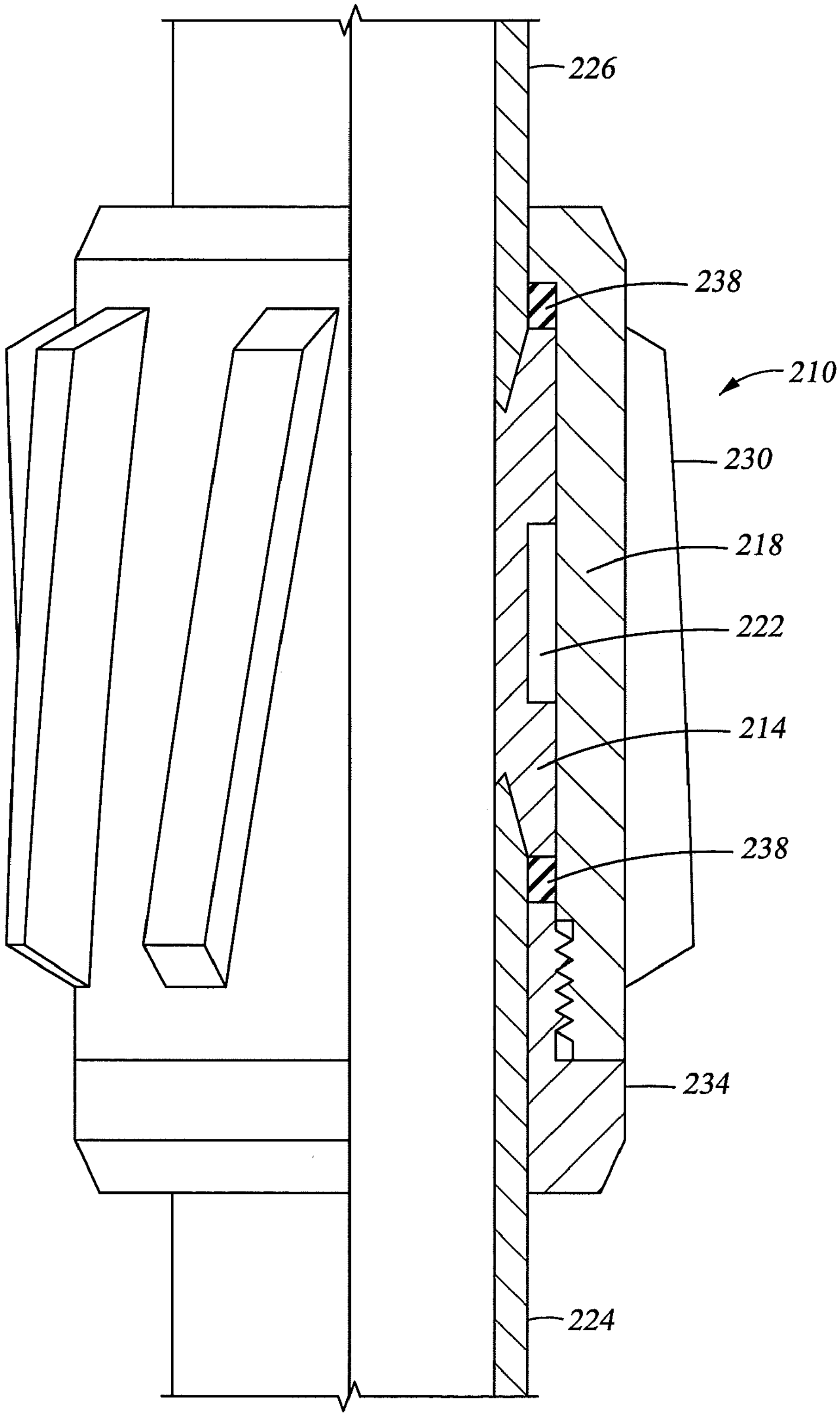


Fig. 4

DOWNHOLE TUBULAR LENGTH COMPENSATING SYSTEM AND METHOD

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application No. 61/052,919, filed on May 13, 2008, the entire contents of which are incorporated herein by reference. This application is a continuation-in-part of U.S. patent application Ser. No. 12/136,377, filed on Jun. 10, 2008, the entire contents of which are incorporated herein by reference.

BACKGROUND

[0002] In horizontal and highly deviated wells friction between a tubular and the walls of the well can be quite large due to factors, such as, the weight of the tubular, and fluid contained therein, and collapse of the formation against the tubular, for example. The longer a length of tubular encountering such conditions the greater the frictional forces become. In fact, frictional forces over a length of tubular can be high enough to result in damage to the tubular in response to forces urging the tubular to move longitudinally. Motive forces of such magnitude can be generated by longitudinal expansion and contraction of the tubular as temperatures of the tubular change. Systems to allow nondestructive longitudinal movement of tubulars under such conditions would be well received by the industry.

BRIEF DESCRIPTION

[0003] Disclosed herein is a downhole tubular length compensating system. The system includes, a tubular having a plurality of length adjustable sections, and spacings between adjacent length adjustable sections are set to overcome frictional forces anticipated along the tubular.

[0004] Further disclosed herein is a method of locally relieving longitudinal stress in a downhole tubular. The method includes, length adjusting a plurality of length adjustable sections of a downhole tubular in response to expansion and contraction of the downhole tubular between adjacent length adjustable sections.

[0005] Further disclosed herein is a downhole tubular length change compensating system. The system includes, a tubular having at least one length adjustable section between adjacent joints, and adjustability of the length adjustable sections is set to accommodate expansion and contraction of the tubular between adjacent length adjustable sections.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

[0007] FIG. **1** depicts a quarter cross sectional view of a tubular length compensating system disclosed herein;

[0008] FIG. **2** depicts a quarter cross sectional view of an alternate tubular length compensating system disclosed herein shown without an adjustment to the length thereof;

[0009] FIG. **3** depicts a quarter cross sectional view of the tubular length compensating system of FIG. **2** shown with a length adjustment to a length thereof; and

[0010] FIG. **4** depicts a quarter cross sectional view of an alternate embodiment of a tubular length compensating system.

DETAILED DESCRIPTION

[0011] 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.

[0012] Referring to FIG. **1**, an embodiment of the tubular length compensating system **10** is illustrated. The compensating system **10** includes, a tubular **14** having a plurality of length adjustable sections **18** (one being shown). One length adjustable section **18** illustrated in this embodiment includes a deformable portion **22** illustrated here as a convoluted portion, made of metal, having a series of alternating sections with reduced perimeters **26** and expanded perimeters **30**. The deformable portion **22** can alternately consist of deformable formations such as those disclosed in U.S. Pat. No. 6,896,049 to Moyes, for example, the contents of which are incorporated by reference herein in their entirety. The convoluted portion **22** can be longitudinally compressible, longitudinally expandable, or both in response to loads applied thereto. The loads needed to compress or expand the convoluted portion **22** being less than the loads needed to compress, expand or damage other portions of the tubular **14**. The ability of the convoluted portion **22** to longitudinally compress and expand provides length adjustability to the tubular **14**. The design of the convoluted portion **22**, in this embodiment, allows for such compression and expansion to take place within elastic limits of the material from which the convoluted portion **22** is fabricated, with metal being disclosed herein as the material of choice for the convoluted portion **22** while alternate materials such as polymers and elastomers are contemplated as also being usable. By maintaining deformation of the convoluted portion **22** within the elastic limits of the material the deformation and thus the compression and expansion are reversible an indefinite number of cycles.

[0013] In addition to the reversibility of the length adjustability, the convoluted portion **22** also allows compression and expansion to take place while maintaining a fluidic seal between the inside and the outside of the tubular **14**. This seal is maintained without a sliding seal which may be beneficial since sliding seal integrity can be questionable downhole due to high temperatures, high pressures, contamination and caustic fluids typically encountered in downhole environments.

[0014] An amount of length adjustability provided by the convoluted portion **22** can be controlled in different ways with one such way being disclosed in this embodiment. A pipe **34** is fixedly attached to a first portion **38** of the tubular **14** by a weld **42** while alternate methods of attachment, such as, by threadable engagement, for example, may be employed. A second portion **46** of the tubular **14**, on an opposing side of the length adjustable section **18** than the first portion **38**, is slidably engaged with the pipe **34**. A pair of standoffs **50**, **54** protruding radially inwardly from the pipe **34** straddle a standoff **58** protruding radially outwardly from the second portion **46**. The relative positioning of the standoffs **50**, **54**, **58** define the range of compression and expansion that the length adjustable section **18** is allowed to undergo. During compression and expansion the second portion **46** moves relative to the pipe **34** thereby causing the standoff **58** to move in relation to the standoffs **50**, **54**. Under compression the standoff **58** moves toward the standoff **50** until contact is made therebetween, limiting the compressive length of adjustment. Similarly, under expansion the standoff **58** moves toward the standoff **54** until contact is made therebetween, limiting the expansive length of adjustment. With the foregoing, a tool designer can set a total amount of travel allowed by a length adjustable section **18** through the spacing of the standoffs **50** and **54**. To control how much of the total travel is compressive versus expansive the designer sets an initial position of the standoff **58** relative to the standoffs **50**, **54**.

[0015] A release member **62**, ring engaged between the second portion **46** and the pipe **34**, sets the initial position of the standoff **58** relative to the standoffs **50** and **54**, in this embodiment. The release member **62** locks the second portion **46** in a position relative to the pipe **34** until a threshold load is achieved at which the release member **62** fails thereby allowing the load to be applied to the length adjustable section **18** directly. The release member **62** prevents inadvertent length adjustments from occurring, such as during running of the tubular into or out of a wellbore, for example.

[0016] As discussed above, high frictional forces between the tubular **14** and walls **66** of a wellbore **70** can make moving the tubular **14** within the wellbore **70** very difficult. This condition is exacerbated in horizontal or highly deviated wells. The longer the section of the tubular **14** within the wellbore **70** the greater the frictional forces therebetween. Embodiments disclosed herein position a plurality of the length adjustable sections **18** along the tubular **14** to prevent a build up of potentially damaging longitudinally compressive or longitudinally tensive forces due to expansion or contraction of the tubular **14** due to temperature changes therein. Embodiments can include at least one length adjustable section **18** between any two joints of tubing. Spacing between adjacent length adjustable sections **18** can be established based upon anticipated frictional forces along the tubular **14**. For example, a designer can determine longitudinal loads (both compressive and expansive) that if applied to the tubular **14** would cause damage thereto. The designer can also estimate a length of the tubular **14** under specific, anticipated, downhole conditions that may generate these destructive longitudinal loads based on parameters of the tubular **14** including, for example, material and coefficient of thermal expansion. With such information, the designer can space adjacent length adjustable sections **18** at distances apart so that the tubular **14** is able to overcome the frictional force (and the forces needed release the release member **62** and to adjust a length of the length adjustable sections **18**), and thereby slide relative to the walls **66**, without resulting in damage to the tubular **14**. Additionally, the designer can set an adjustable length of the length adjustable sections **18** to assure that the anticipated change in length of the tubulars **14** (due to thermal expansion and contraction of the tubular, for example), between adjacent length adjustable sections **18**, can be fully accommodated thereby. In summary, by positioning a plurality of the length adjustable sections **18** along a length of the tubular **14**, embodiments disclosed herein permit localized compressive and tensive loads in the tubular **14** to be relieved locally by a shortening or lengthening of a plurality of the length adjustable sections **18** of the tubular **14**.

[0017] Referring to FIGS. **2** and **3**, an alternate embodiment of a length compensating system **110** disclosed herein is illustrated. A primary difference between the two systems **10** and **110** is that the length adjustable section **18** of system **10** has been replaced with a length adjustable section **118** in system **110**. The length adjustable section **118** includes a release joint **116**, such as, a shear joint, for example, having a shear plane **120**. The shear plane **120** is shearable at a selected level of compressive or tensive load. Upon shearing of the shear plane **120** a first part **124** of the shear joint **116** is movable relative to a second part **128** of the shear joint **116**. During compressive movement the parts **124** and **128** overlap, similar to a lap joint arrangement, and may form a seal therebetween. During expansive movement the parts **124** and **128** move away from one another. An optional seal **132**, shown herein as an o-ring, may form a slidable seal between the second portion **46** and the pipe **34** to maintain a seal across the system **110** during longitudinal adjustment thereof.

[0018] Referring to FIG. **4**, an embodiment of an alternate length compensating system **210** disclosed herein is illustrated. The system **210** includes, a coupler **214** having a length adjustable section **218** positioned between two tubulars **222**, **226**. The length adjustable section **218** has a deformable portion **222** constructed herein as a reduced wall section. Axial loads applied to the deformable portion **222**, from the tubulars **224**, **226**, can cause the deformable portion **222** to plastically deform by buckling, in the case of compressive loading, and through elongation or rupture, in the case of tensive loading. A sleeve **230** and a lock nut **234** are engaged with the two tubulars **224**, **226** to provide structural stability across the length adjustable section **218** during length adjustment when the strength of the coupler **214** is compromised upon plastic deformation thereof. At least one of the sleeve **230** and lock nut **234** are slidably engaged with at least one of the tubulars **224**, **226** to permit the length adjustment thereacross without appreciably adding to a load required to cause the readjustment in length.

[0019] The slidable engagement between the sleeve **230**, or the lock nut **234**, and the tubulars **224**, **226**, may be packed with steel fiber **238**, or wire mesh, in a case where leakage therebetween is allowed as long as it is filtered such as in a sand screen application, as illustrated in herein. For applications requiring a fluidic seal, o-rings (not shown), or other slidably sealing members may be employed between the sleeve **230** or lock nut **234** and the tubulars **224**, **226**.

[0020] 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 downhole tubular length compensating system, comprising a tubular having a plurality of length adjustable sections, and spacings between adjacent length adjustable sections being set to overcome frictional forces anticipated along the tubular.

2. The downhole tubular length compensating system of claim **1**, wherein the plurality of length adjustable sections is adjustable in response to longitudinal forces applied thereto.

3. The downhole tubular length compensating system of claim **2**, wherein the plurality of length adjustable sections are adjusted by shortening thereof.

4. The downhole tubular length compensating system of claim **1**, further comprising a force failing member in operable communication with the plurality of length adjustable sections.

5. The downhole tubular length compensating system of claim **4**, wherein the force failing member is one of a shear joint and a lock ring.

6. The downhole tubular length compensating system of claim **1**, further comprising:

a first portion of the tubular being on a first side of each length adjustable portion; and

a second portion of the tubular on a second side of each length adjustable portion being movable relative to each length adjustable portion.

7. The downhole tubular length compensating system of claim **6**, wherein the first portion is fixedly attached to a pipe and the second portion is slidably engaged with the pipe.

8. The downhole tubular length compensating system of claim **7**, wherein the first portion is fixedly attached to the pipe by one of threadable engagement and welding.

9. The downhole tubular length compensating system of claim **7**, further comprising a seal slidably engaged between the second portion and the pipe.

10. The downhole tubular length compensating system of claim **1**, wherein at least one of the plurality of length adjustable sections include a deformable member.

11. The downhole tubular length compensating system of claim **10**, wherein the deformable member is metal.

12. The downhole tubular length compensating system of claim **10**, wherein deformation of the deformable member is reversible.

13. The downhole tubular length compensating system of claim **1**, wherein the plurality of length adjustable sections are configured to maintain a seal across a wall of the tubular during length adjustments without a sliding seal.

14. The downhole tubular length compensating system of claim **1**, wherein a length adjustability of the plurality of length adjustable sections is reversible.

15. The downhole tubular length compensating system of claim **1**, wherein a length adjustability of the plurality of length adjustable sections is in response to expansion and contraction of the tubular due to temperature changes therein.

16. The downhole tubular length compensating system of claim **1**, wherein a length adjustability of the plurality of length adjustable sections is selected based on parameters of the tubular between the adjacent length adjustable sections.

17. The downhole tubular length compensating system of claim **16**, wherein the parameters include at least one of material and coefficient of thermal expansion of the tubular.

18. The downhole tubular length compensating system of claim **16**, wherein the wherein adjustment of each of the plurality of length adjustable sections includes plastic deformation thereof.

19. A method of locally relieving longitudinal stress in a downhole tubular, comprising length adjusting a plurality of length adjustable sections of a downhole tubular in response to expansion and contraction of the downhole tubular between adjacent length adjustable sections.

20. A downhole tubular length change compensating system, comprising a tubular having at least one length adjustable section between adjacent joints, adjustability of the length adjustable sections being set to accommodate expansion and contraction of the tubular between adjacent length adjustable sections.

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