A downhole axial expansion or telescoping tool includes radially expandable tubular members. The tubular members are relatively moveable before and after radial expansion, and include an intermediate layer therebetween of a non-metal or non-cladding material. The intermediate layer may provide any one or more of lubricity, load transfer, sealing, and shape retention during and after radial expansion.
DOWNHOLE TELESCOPING TOOL WITH RADIALLY EXPANDABLE MEMBERS

BACKGROUND

[0001] This disclosure relates generally to hydrocarbon exploration and production, and in particular to forming well bore tubular strings and connections to facilitate hydrocarbon production or downhole fluid injection.

[0002] During hydrocarbon exploration and production, a well bore typically traverses a number of zones within a subterranean formation. A tubular system may be established in the well bore to create flow paths from the multiple producing zones to the surface of the well bore. Efficient production is highly dependent on the inner diameter of the tubular production system, with greater inner diameters producing more hydrocarbons or allowing inserted equipment with appropriate pressure ratings to be used in well completions. Existing apparatus and methods for producing hydrocarbons include a complex set of tubulars, connections, liner hangers, sand control devices, packers and other equipment which tend to constrict the inner diameter of the production system available for production.

[0003] The tubular system implemented during the treatment, completion and production of subterranean oil and gas wells may also include a packer set at a preselected location above a production zone. In the case of wells of substantial depth, and particularly wells where the downhole temperatures are substantially in excess of or below the surface temperatures, problems have been encountered due to excessive expansion or contraction of the elongated tubing string. For example, in the treatment or stimulation of the well, it is common to introduce fluids at surface ambient temperature into the tubing string. In some cases, the fluid is introduced as steam at elevated temperatures. When the major portions of the tubing string are at a much higher temperature initially, this inherently results in a cooling, and hence a substantial contraction of the tubing string, resulting in the production of a substantial tensile stress in the tubing string between its surface connection and the set packer. Similarly, in the production phase of such wells, the production fluid is normally at a temperature substantially in excess of the temperature of the majority of the tubing string, resulting in a substantial expansion of the tubing string and the production of a substantial compressive force on the tubing string. Additionally, changes in fluid pressure inside and outside the tubing string play a major role in the development of substantial tension or compressive forces in the tubing string.

[0004] In other systems, a tubing hanger assembly is disposed at a relatively elevated downhole position within the well to suspend the production tubing extending to the production zones from such tubing hanger. Intermediate the tubing hanger and the top of the well there is commonly provided one or more production tubing strings commonly referred to as a “space-out section” which extends to a well surface hanger which is utilized to suspend the tubing string weight intermediate the downhole hanger and the surface hanger. The tubing strings coupled to the hangers undergo similar expansion or contraction forces as described.

[0005] To address the described expansion or contraction of the downhole tubulars, an expansion joint is disposed in the tubing string. The expansion joint may be located between the bottom of the tubing string and the packer. The expansion joint may be located between the surface hanger and the downhole hanger, or in the space-out section. The expansion joint is an axially moveable or telescoping device or component designed to enable relative movement between two fixed assemblies in the event of thermal expansion or contraction. Expansion joints within the completion assembly prevent any movement or forces being transmitted to fixed components such as packers or tubing hangers. Such expansion joints may, for example, comprise an elongated seal bore receptacle attached to the packer or hanger within which there is sealingly telescopically mounted a mandrel connected at its upper end to the tubing string and relatively moveable with respect to the seal bore of the receptacle in response to the changes in tension or compression in the tubing string. A telescoping joint disposed in a space-out section may be capable of expansion or contraction to absorb temperature produced variations in length of the space-out section or dimensional differences between the planned and actual location of the surface hanger with respect to the downhole hanger. Further, the telescoping joint may have rotational or torque transmitting capability so that rotation can be accomplished through the joint to the right or to the left in order to perform required operations on various pieces of apparatus carried by the tubing string.

[0006] The principles of the present disclosure are directed to overcoming one or more of the limitations of the existing apparatus and processes for increasing fluid injection or hydrocarbon production during treatment, completion and production of subterranean wells.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] For a more detailed description of the embodiments of the present disclosure, reference will now be made to the accompanying drawings, wherein:

[0008] FIG. 1 is a schematic view of an expandable tubular string disposed in a borehole, the string including expandable tubular members coupled together by connections or joints;

[0009] FIG. 2A is an enlarged, partial cross-section view of one of the tubular connections of FIG. 1, including the radial expansion and plastic deformation of a portion of the first tubular member;

[0010] FIG. 2B shows the radial expansion and plastic deformation of the tubular members and connection of FIG. 2A;

[0011] FIG. 3 is a schematic representation of an operating environment for a basic exemplary completion or production apparatus;

[0012] FIG. 4 is a partial, cross-section view of an expandable tubular telescoping tool in accordance with the principles herein, showing the various components of the tool assembly in an axially contracted position;

[0013] FIG. 5 is a full cross-section view of the upper guide member of FIG. 4;

[0014] FIG. 6 is the telescoping tool assembly of FIG. 4 shown in an axially expanded position;

[0015] FIG. 7 is a partial, cross-section view of another embodiment of an expandable tubular telescoping tool in accordance with the principles herein, showing the various components of the tool assembly in an axially contracted position;

[0016] FIG. 8 is the telescoping tool assembly of FIG. 7 shown in an axially expanded position;

[0017] FIG. 9 is a full cross-section view of the upper guide member of FIGS. 7 and 8;

[0018] FIG. 10 is a side perspective view of the upper guide member of FIGS. 7-9;
In the drawings and description that follow, like parts are typically marked throughout the specification and drawings with the same reference numerals. The drawing figures are not necessarily to scale. Certain features of the invention may be shown exaggerated in scale or in somewhat schematic form and some details of conventional elements may not be shown in the interest of clarity and conciseness. The present disclosure is susceptible to embodiments of different forms. Specific embodiments are described in detail and are shown in the drawings, with the understanding that the present disclosure is to be considered an exemplification of the principles of the invention, and is not intended to limit the invention to that illustrated and described herein. It is to be fully recognized that the different teachings of the embodiments discussed below may be employed separately or in any suitable combination to produce desired results.

Unless otherwise specified, any use of any form of the terms “connect,” “engage,” “couple,” “attach,” or any other term describing an interaction between elements is not meant to limit the interaction to direct interaction between the elements and may also include indirect interaction between the elements described. In the following discussion and in the claims, the terms “including” and “comprising” are used in an open-ended fashion, and thus should be interpreted to mean “including, but not limited to . . . .” The terms “pipe,” “tubular member,” “casing” and the like as used herein shall include tubing and other generally cylindrical objects. In addition, in the discussion and claims that follow, it may be sometimes stated that certain components or elements are in fluid communication. By this it is meant that the components are constructed and interrelated such that a fluid could be communicated between them, as via a passageway, tube, or conduit. The various characteristics mentioned above, as well as other features and characteristics described in more detail below, will be readily apparent to those skilled in the art upon reading the following detailed description of the embodiments, and by referring to the accompanying drawings.

Referring initially to FIG. 1, a string 14 of coupled tubular members is disposed in a well bore 10 drilled through the formation 12, creating an annulus 13. The string 14 comprises a series of connected tubular members, such as casing joints 15, 16, 17 and 18, having a centerline or axis 19. In some embodiments, the casing joints are secured by connections 15a, 16a and 17a as indicated to form an elongate string that extends to the well surface. The casing string 14 is illustrated as being made up of individual casing joints of approximately 40 feet in length, for example, with a joint connection between the adjoining casing joints. In accordance with the principles of the present disclosure, the casing string 14 is to be radically expanded and plastically deformed into engagement with the surrounding well bore 10 using a forging device or expansion mandrel that passes internally through the casing string 14 and the connections 15a, 16a, and 17a. In other embodiments, the well bore 10 is cased and the string 14 is expanded toward the casing.

Referring now to FIG. 2A, the connection 15a of FIG. 1 is shown enlarged and in partial cross-section about the axis 19. The first tubular member 16 includes an internal connection surface 22 at an end portion 24. In some embodiments, the internal surface 22 includes threads. An external connection surface 28 of an end portion 26 of the second tubular member 15 is coupled to the internal connection 12 of the end portion 14 of the first tubular member 10. In some embodiments, the external surface 28 includes threads such that the surfaces 22, 28 are threadedly engaged. The first and second tubulars 16, 15 abut at locations 30, 32. In an exemplary embodiment, the internally threaded connection 22 of the end portion 24 of the first tubular member 16 is a box connection, and the externally threaded connection 28 of the end portion 26 of the second tubular member 15 is a pin connection.

In an exemplary embodiment, as illustrated in FIGS. 2A and 2B, the first and second tubular members 16, 15 may then be positioned within another structure 10 such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by moving an expansion device or cone 34 through the interiors of the first and second tubular members. The movement of the expansion cone 34 through the interiors of the first and second tubular members 16, 15 may be from top to bottom or from bottom to top. As shown, the tubular members 15, 16 are radially expandable from a first unexpanded position to a final plastically deformed position.

In the embodiments just described, and throughout the disclosure herein, the wellbore or borehole described may be uncased or cased. The expandable tubulars may be radially expanded and plastically deformed toward the uncased borehole, or toward a casing already in place in the borehole.

Referring to FIG. 3, a schematic representation of an operating environment for a basic exemplary completion or production apparatus 100 is shown. The apparatus 100 is an exemplary embodiment, and various other embodiments of the apparatus 100 consistent with the teachings herein are included. As depicted, a drilling rig 110 is positioned on the earth’s surface 105 and extends over and around a well bore 120 that penetrates a subterranean formation 15 for the purpose of recovering hydrocarbons. The well bore 120 may be drilled into the subterranean formation 15 using conventional (or future) drilling techniques. The well bore 120 may extend substantially vertically away from the surface 105 over a vertical portion 122, or may deviate at any angle from the surface 105 over a lateral well bore portion 124. In some instances, all or portions of the well bore 120 may be vertical, deviated, horizontal, and/or curved.

At least a portion of the vertical well bore 122 may be lined with casing 125 that may be cemented 127 into position against the formation 15 in a conventional manner. A lower portion 128 of the well bore 122 may also be lined with cemented casing 125. In some instances, the operating environment for the apparatus 100 includes a substantially uncased, open hole well bore 120. The well bore may also include the uncased, open hole lateral well bore portion 124.
The lateral well 124 may include various hydrocarbon producing zones 80, 82, 84, 86, 88, 90. The drilling rig 110 includes a derrick 112 with a rig floor 114 through which a tubing or work string 118 extends downwardly from the drilling rig 110 into the well bore 120. The tubing string 118 suspends a representative downhole production apparatus 100 to a predetermined depth within the well bore 120 to perform a specific operation, such as perforating a casing, expanding a fluid path therethrough, fracturing the formation F, producing the formation F, or other completion or production operation. The tubing string 118 may also be known as the entire conveyance above and coupled to the apparatus 100. The drilling rig 110 is conventional and therefore includes a motor driven winch and other associated equipment for extending the tubing string 118 into the well bore 120 to position the apparatus 100 at the desired depth.

[0034] While the exemplary operating environment depicted in FIG. 3 refers to a stationary drilling rig 110 for lowering and setting the apparatus 100 within a land-based well bore 120, one of ordinary skill in the art will readily appreciate that mobile workover rigs, well servicing units, such as coiled tubing units, and the like, could also be used to lower the apparatus 100 into the well bore 120. It should be understood that the apparatus 100 may also be used in other operational environments, such as within an offshore well bore.

[0035] The production apparatus 100, disposed partially in a cased hole 122 and substantially in open hole 124, includes an upper end 128 having a liner hanger 132, a lower end 136, and a tubing section 134 extending therebetween. The lower end 136 may include devices 138, 140 such as a guide shoe, a float shoe or a float collar of a type known in the art, and other tubing conveyed devices 142, 144. The borehole 124 and the tubing section 134 define an annulus 146 therethrough. The tubing section 134 includes an interior 148 that defines a flow passage 150 therethrough. The tubing section 134 may include an inner string 152 with a lower end 154 that extends into a polished bore receptacle 144. The inner string 152 may be used to carry out preliminary operations, such as perforating or jetting. Alternatively, the tubing section 134 does not include the inner string 152 such that the flow passage 150 is the main flowbore through the apparatus 100. A plurality of devices 158 are connected in the tubing section 134 and provide operational interaction with the various hydrocarbon producing zones 180, 182, 184, 186, 188. The completion or production devices 158 may include seals, packers, subs, screens, blast joints and other devices used in completion or production strings.

[0036] Referring to FIG. 4, an assembly 200 for axial expansion and contraction of a tubular string is shown. As will be shown and described herein, tubular members of the assembly 200 are configured for relative axial movement while coupled to allow for expansion and contraction of the overall tubular string. Thus, the assembly 200 may also be referred to as an axial expansion tool or telescoping tool. In some embodiments, one or more of the tubular members in the telescoping tool is radially expandable, as will be described more fully herein. In certain embodiments, the tubular members are radially expandable to a plastically deformed position.

[0037] In FIG. 4, the telescoping tool assembly 200 is shown in an axially contracted position. An upper half of the telescoping tool assembly 200 is shown in cross-section, including an outer housing 220, an internal upper guide member 210 and a lower guide and seal assembly 230. The outer housing 220 is a tubular member including an upper end 222 and a lower end 224. The internal upper guide member 210 is a tubular member including an upper end 212 and a lower end 214. As shown in FIG. 5, an inner surface 215 of the upper guide 210 includes one or more slots 216 extending from an intermediate portion of the upper guide 210 to the end 214. In some embodiments, the slots 216 are milled. In some embodiments, an axial length 218 of the slots 216 is approximately 6 feet to 10 feet, though this range is exemplary only and other lengths are contemplated.

[0038] Still referring to FIG. 4, the lower guide 230 is a tubular member including an upper end 232 and a lower end 234. The upper end 232 includes outer slots 236 and ribs and splines 237 for slidably mating with the slots 216, creating the telescoping arrangement between the upper guide 210 and the lower guide 230 wherein these members reciprocate relative to each other. In some embodiments, the slots 236 are milled resulting in the splines 237. In some embodiments, the axial length of the slots 236 and splines 237 is similar to the length 218 such that a stroke 238 is created between the mating splines 237 and slots 216. The mating splines 237 and slots 216, 236 may also be referred to as anti-rotation splines. The splines and slots are an interlocking mechanism for axial movement and anti-rotation. In other embodiments, the positions of the splines 237 and the slots 216 are reversed, wherein the splines 237 are disposed on the upper guide 210 and instead extend into the slots 216 disposed on the lower guide 230. In some embodiments, other interlocking mechanisms are used between the telescoping and reciprocal upper guide 210 and lower guide 230 for axial movement and simultaneous prevention of relative rotation between these two members. While rotation between the two tubular members 210, 230 in the tool 200 is prevented, it should be understood that the overall tool 200 may be rotated as part of the larger tubular string into which the tool 200 is coupled. Thus, rotating or torquing through the tool 200 is possible via the anti-rotation mechanism that prevents relative rotation inside the tool 200.

[0039] The slidable, coupled and reciprocating guide members 210, 230 are disposed inside the outer housing 220. Disposed between the guide members 210, 230 and the outer housing 220 is a sleeve or layer 270. A portion of the sleeve 270 is disposed between the guide members 210, 230 and the length of the interlocked splines and slots. Another portion of the sleeve 270 is disposed between the lower guide 230 and the outer housing 220. One or more sealing members or bands 239 may be disposed between the lower guide 230 and the outer housing 220.

[0040] In some embodiments, the sleeve 270 is a layer of non-metallic material disposed between the metal tubulars 210, 230 and metal tubular 220 to prevent metal to metal contact between these tubulars. For example, the sleeve 270 comprises a layer of high strength, high modulus material. In exemplary embodiments, the sleeve 270 comprises a polyurethane material. In still other embodiments, the sleeve 270 is a layer of a spray on material, a bonded on (to one tubular or the other) material, a wrapped on material, or a combination thereof. In some embodiments, the sleeve 270 is a nano material. In some embodiments, the sleeve 270 is a composite material. The sleeve 270 is a lubricious, or becomes a lubricious, material that provides lubricity between the metal tubular members. The sleeve 270 is a non-cladding material, wherein bonding or other permanent attachment between the metal tubular members is prevented. As will be further
described herein, the lubricous material 270 allows relative axial movement of the guide members 210, 230 and the outer housing 220 of the telescoping tool assembly 200, both before and after radial expansion and plastic deformation of the tool assembly. In some embodiments, the sleeve 270 also radially expands to transfer radial expansion loads between the tubular member 210, 230, and between the tubular members 220, 230, and act as a seal. [0041] In some embodiments, the upper end 222 of the outer housing 220 is attached to the upper end 212 of the upper guide member 210, such as via a hanger connection, a threaded connection or a weld. In some embodiments, the connection between the outer housing 220 and the upper guide 210 is permanent. The upper end 222 of the outer housing 220 includes a connector coupled with a connector end 242 of a tubular member 240. The connectors may be threaded to form a threaded connection 225. In some embodiments, the tubular member 240 is a nonexpandable oilfield casing or tubing string with a premium connection. In some embodiments, the tubular member 240 is expandable. In some embodiments, the outer housing 220 is an expandable member with a premium connection to form the connection 225. [0042] The lower end 234 of the lower guide member 230 includes a connector coupled with a connector end 252 of a tubular member 250. The connectors may be threaded to form a threaded connection 235. In some embodiments, the tubular member 250 is a nonexpandable oilfield casing or tubing string with a premium connection. In some embodiments, the tubular member 250 is expandable. In some embodiments, the lower guide member 230 is expandable with a premium connection to form the connection 235. In some embodiments, the upper guide member is expandable. A shear connection 260, such as a shear ring or shear pin, extends through the outer housing end 224 and the lower guide end 234 to secure the assembly 200 in the contracted or closed position shown in FIG. 4. The contracted position may be maintained by the shear connection 260 while the assembly 200 is being lowered into its operating position such that the assembly 200 does not expand or open before it is in place. [0043] In FIG. 4, the expansion tool 200 is shown in the contracted or closed position. When tensile and/or compressive forces are created in one or both of the tubing strings 240, 250 due to thermal or pressure effects therein, the expansion tool is configured to axially expand or open as shown in FIG. 6. Upon application of the axial forces from the tubing strings 240, 250, the shear connection 260 is sheared to release the lower assembly, comprising the lower guide member 230 coupled to the tubular member 250, from the upper assembly, comprising the upper guide member 210 coupled to the outer housing 220 which is coupled to the tubular member 240. The lower assembly is then allowed to move axially relative to the upper assembly, as shown in FIG. 6 and represented by the strokes 238, 258. More particularly, the lower guide 230 moves axially relative to the upper guide 210, with the interlocking splines 237 and slots 216, 236 sliding axially against each other while preventing relative rotation. The non-metal sleeve or layer 270 prevents metal to metal contact between the interlocking and sliding splines and slots while also providing one or more of load transfer, sealing and lubricity. Axial forces applied in the opposite direction will force the assembly 200 back toward the contracted position of FIG. 4. Movement between the contracted and expanded positions of the assembly 200 will absorb the axial forces that may be detrimental to fixed components of the well completion system, such as packers, tubing hangers or tubing anchors. [0044] In some embodiments, the shear connection 260 is placed at variable axial positions from that shown. Further, in some embodiments, the original sheared run-in position of the assembly 200 can be any of various positions between the contracted position of FIG. 4 and the expanded position of FIG. 6. The pinned, run-in position may be closed, open, or partially open. [0045] Referring next to FIG. 7 another embodiment is shown including a telescoping tool assembly 300 with radially expandable members. An upper assembly includes an upper guide member 310 coupled to an outer housing 320 which is coupled to an upper tubular string 340. A lower assembly includes a lower guide member 330 coupled to a lower tubular string 350. The two assemblies are sheared connected at 360. In some embodiments, the shear connection 360 is located at other axial positions along the assembly 300, to provide various closed, open, or partially open run-in positions. Sealing members 339 are coupled between the lower guide 330 and the outer housing 320. A non-metal sleeve or layer 370 includes axial lengths disposed between the lower guide 330 and the outer housing 320, and between the lower guide 330 and the upper guide 310 at an interlocking and sliding anti-rotation mechanism 390. As shown in FIG. 8, axial forces in the tubing strings 340, 350 will cause the connection 360 to shear and the upper and lower assemblies to move axially relative to each other by sliding of the lower guide splines, as shown in FIG. 11, in the upper guide slots 316, as shown in FIG. 9. In some embodiments, the splines and slots are located on opposite members, and other interlocking arrangements are used to allow reciprocating translation of the upper and lower guides while preventing rotation. Such an arrangement allows rotation and torque to be transferred through the tool 300. [0046] Referring to FIGS. 10 and 11, an end 314 of the upper guide member 310 (FIG. 10) is configured to receive an end 332 of the lower guide member 330 (FIG. 11). The lower guide member 330 include alternating splines 337 and slots 336. The splines 337 mate with slots 316 milled into the inner surface 315 of the upper guide member 310. A sealing band 339 is provided on the lower guide 330 for sealing with the upper guide 310. A non-metal sleeve or layer 370 is provided on the lower guide 330 to each contact with and transfer loads between the lower guide 330 and the upper guide 310 and outer housing 320. [0047] Referring now to FIG. 12, a radial cross-section is shown of the assembly 300 of FIG. 7. The inner lower guide member 330 is surrounded by the upper guide member 310. Disposed between the interlocking splines and slots, as previously described, is the layer 370. The radial cross-section of the upper guide member 310 of FIGS. 9 and 10, as shown in FIG. 13, illustrates the slots 316 in the inner surface 315. The radial cross-section of the lower guide member 330 of FIG. 11, as shown in FIG. 14, illustrates the splines 337 separated by the reduced diameter outer surfaces 336. FIGS. 15-17 are additional radial cross-sections of the assembly 300 of FIG. 7. In FIG. 15, the lower guide member 330 is surrounded by the upper guide member 310, with the intervening layer 370 disposed therebetween at the spline/slot arrangements. The outer housing 320 surrounds and contains the upper guide member 310. In FIG. 16, a different portion of the layer 370 is shown disposed between the inner guide member 330 and the outer housing 320. In FIG. 17, the outer housing 320 is
shown surrounding and containing the upper part of the guide member 310. As previously noted, the upper end of the outer housing 320 may be attached to the upper end of the upper guide member 310 via a hanger connection, a threaded connection or a weld.

[0048] In the expansion tool assemblies 200, 300, an expansion device may be coupled thereto. An expansion device, such as the expansion cone 314, may be coupled to the assemblies 200, 300 or to the tubing strings 240, 250, 340, 350. Other expansion devices are known and contemplated herein. Before activation of the expansion device, the telescoping tools may be sheared from their run-in positions (any one of open, closed, or partially open) and the tubular guide members may be reciprocated relative to the other guide member and the outer housing to accommodate axial loads in the tubing strings. In further embodiments, upon application of a hydraulic or mechanical driving force, the expansion device is moved or displaced through the assemblies 200, 300 to radially expand and plastically deform portions thereof. As described herein, certain components and connections of the assemblies 200, 300 may be expandable while others are not. These components may be radially expandable to a plastically deformed position. The tubing strings 240, 250, 340, 350 may be expandable or non-expandable. In some embodiments, the assemblies 200, 300 include seals or other members bonded or attached to the outer surfaces such that the radially expanded assemblies 200, 300 engage the seals with an existing exterior structure and provide an anchor hanger. If all or some of the tubing strings 240, 250, 340, 350 are expanded, the assemblies 200, 300 may be expanded independently of the tubing strings or concurrently with the tubing strings. Different combinations of expandable and non-expandable components and connections may be used to produce desired results.

[0049] Thus, in the pre-expanded position, the assemblies 200, 300 can support axial tension and compression loads in the tubular strings. Further, when all or portions of the telescoping tool assemblies 200, 300 are radially expanded, the assemblies can continue to accommodate axial tension and compression loads in the tubing strings by allowing the moveable guide member to telescope or reciprocate relative to the other guide member and the outer housing. The radially expanded and plastically deformed tool assemblies 200, 300 retain their axial expansion or telescoping functionality. The layers 270, 370 are provided to facilitate the retained telescoping functionality. The layers 270, 370 provide lubricity between the moveable joint components, such as between the moveable guide member and the other guide member and outer housing. The layers 270, 370 comprise non-cladding materials such that the moveable guide members are not bonded upon radial expansion. The layers 270, 370 transfer loads between the assembly components, such as radial expansion loads from the inner tubular members to the outer tubular members. The layers 270, 370 provide sealing characteristics after radial expansion. The layers 270, 370 help maintain component and tool shape after radial expansion. The tools 200, 300 are re-shaped by radial expansion, and the layers 270, 370 provide a medium for retaining geometric shape after expansion while also maintaining functionality and operability of the relatively axially moveable members.

[0050] The assemblies 200, 300, whether radially expanded or not, by being axially moveable limit or remove axial load constraints within the tubular or casing string they are coupled to, such as the strings 240, 250, 340, 350. The assemblies 200, 300 also support pressures in both the pre- and post-expanded positions.

[0051] In all embodiments, radial expansion and plastic deformation of at least portions of the assemblies 200, 300 increases the effective flow area of the system to enable higher injection or production rates, and decreases restrictions, particularly at the inner hanger, for the passage of work strings and tools. Upon radial expansion, the assemblies 200, 300 are still capable of accommodating axial expansion or contraction loads in the tubing strings via the relatively moveable guide members. Further, the sleeves or layers 270, 370 transfer the radial expansion loads from the inner tubular members to the outer tubular members, in addition to providing sealing and lubricating characteristics.

[0052] While the disclosure is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and description. It should be understood, however, that the drawings and detailed description thereto are not intended to limit the disclosure to the particular form disclosed, but on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the present disclosure.

What is claimed is:

1. A downhole telescoping tool comprising:
   a. first metal tubular member;
   a second metal tubular member disposed in the first metal tubular member and reciprocal therein; and
   a non-metal layer disposed between the first and second tubular members;
   wherein the first and second tubular members are radially expandable to a plastically deformed position.

2. The telescoping tool of claim 1 wherein the first and second tubular members are radially expanded and plastically deformed.

3. The telescoping tool of claim 2 wherein the non-metal layer transfers the radial expansion load from the second tubular member to the first tubular member.

4. The telescoping tool of claim 2 wherein the second tubular member is reciprocal in the first tubular member before and after radial expansion.

5. The telescoping tool of claim 2 wherein the non-metal layer is lubrication between the reciprocal second tubular member and the first tubular member.

6. The telescoping tool of claim 2 wherein the non-metal layer seals between the second tubular member and the first tubular member.

7. The telescoping tool of claim 1 further comprising an outer tubular housing receiving the first and second tubular members.

8. The telescoping tool of claim 7 wherein the outer tubular housing is radially expandable.

9. The telescoping tool of claim 7 wherein the outer tubular housing engages a portion of the non-metal layer.

10. The telescoping tool of claim 7 wherein the outer tubular housing is coupled to at least one of the first tubular member and the second tubular member.

11. The telescoping tool of claim 7 wherein the outer tubular housing is coupled to an upper tubular string.

12. The telescoping tool of claim 11 wherein the upper tubular string is radially expandable.

13. The telescoping tool of claim 1 wherein the second tubular member is coupled to a lower tubular string.
14. The telescoping tool of claim 13 wherein the lower tubular string is radially expandable.

15. A downhole telescoping tool comprising:
a first tubular member slidably coupled with a second tubular member; and
an intermediate layer of non-cladding material disposed between the slidably coupled first and second tubular members,
wherein the first tubular member, the second tubular member, and the intermediate layer are radially expanded and plastically deformed;
wherein the first tubular member and the second tubular member are relatively slideable before and after radial expansion and plastic deformation.

16. The telescoping tool of claim 15 further comprising splines disposed between the first and second tubular members to prevent rotation while allowing axial translation of the first and second tubular members.

17. The telescoping tool of claim 15 wherein after radial expansion and plastic deformation the intermediate layer provides at least one of load transfer, lubrication and sealing.

18. A method of radially expanding a telescoping tool comprising:
disposing a layer of material between an inner tubular member slidably coupled to an outer tubular member;
radially expanding and plastically deforming the inner tubular member into the layer of material;
transferring the radial expansion load to the outer tubular member using the layer of material to radially expand and plastically deform the outer tubular member; and
after radial expansion and plastic deformation of the inner and outer tubular members, sliding the inner and outer tubular members relative to each other.

19. The method of claim 18 further comprising using the layer of material to prevent cladding of the inner and outer tubular members in response to the radial expansion and plastic deformation.

20. The method of claim 18 further comprising moving an expansion device through the inner and outer tubular members.