Abstract: An apparatus and method according to which a tubular liner is positioned in a preexisting structure such as, for example, a wellbore, a wellbore casing, a pipeline or a structural support, and the tubular liner is anchored to the preexisting structure during radial expansion.
before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments
TUBULAR LINER

BACKGROUND

Field of the Invention

[0001] The invention relates generally to tubular liners. More particularly, the invention relates to tubular liners positioned in preexisting structures such as, for example, wellbores, wellbore casings, pipelines and structural supports, to facilitate, for example, oil and gas exploration.

Background of the Invention

[0002] Conventionally, when a wellbore is created, a number of casings or tubular liners are installed in the borehole to prevent collapse of the borehole wall and to prevent undesired outflow of drilling fluid into the formation or inflow of fluid from the formation into the borehole. The borehole is drilled in intervals whereby a tubular liner which is to be installed in a lower borehole interval is lowered through a previously installed tubular liner of an upper borehole interval. As a consequence of this procedure the tubular liner of the lower interval is of smaller diameter than the tubular liner of the upper interval. Thus, the tubular liners are in a nested arrangement with diameters decreasing in downward direction. Cement annuli are provided between the outer surfaces of the liners and the borehole wall to seal the tubular liners from the borehole wall. As a consequence of this nested arrangement a relatively large borehole diameter is required at the upper part of the wellbore. Such a large borehole diameter involves increased costs due to heavy casing handling equipment, large drill bits and increased volumes of drilling fluid and drill cuttings. Moreover, increased drilling rig time is involved due to required cement pumping, cement hardening, required equipment changes due to large variations in hole diameters drilled in the course of the well, and the large volume of cuttings drilled and removed.

[0003] Conventionally, a wellbore tubular liner cannot be formed during the drilling of a wellbore. Typically, the wellbore is drilled and then a wellbore tubular liner is formed in the newly drilled section of the wellbore. This delays the completion of a well.

[0004] Embodiments of described herein are directed to overcoming one or more of the limitations of the existing procedures for forming wellbores and wellheads.
BRIEF SUMMARY OF SOME OF THE PREFERRED EMBODIMENTS

[0005] These and other needs in the art are addressed in one embodiment by a method. In an embodiment, the method comprises positioning a radially expandable tubular liner in a preexisting structure. The tubular liner comprising a first portion defining a first outside diameter and a second portion defining a second outside diameter that is greater than the first outside diameter. In addition, the method comprises radially expanding the tubular liner. Moreover, the method comprises a response to radially expanding and plastically deforming the tubular liner. Further, the method comprises a preexisting member positioned outside the tubular liner; the method comprises defining a second portion in response to radially expanding the tubular liner.

[0006] These and other needs in the art are addressed in another embodiment by a method. In an embodiment, the apparatus comprises a an expandable tubular liner adapted to be positioned in a preexisting structure and radially expanded to line at least a portion of the preexisting structure. The tubular liner comprises a first portion defining a first outside diameter. In addition, the tubular liner comprises a second portion defining a second outside diameter that is greater than the first outside diameter. The second portion anchors the tubular liner to the preexisting structure in response to the radial expansion of the expandable tubular liner.

[0007] These and other needs in the art are addressed in another embodiment by a method. In an embodiment, the method comprises positioning a radially expandable tubular liner in a preexisting structure. The tubular liner comprises a first portion defining a first outside diameter and a second portion defining a second outside diameter that is greater than the first outside diameter. In addition, the method comprises radially expanding and plastically deforming the tubular liner. Further, the method comprises anchoring the expandable tubular member to the preexisting structure in response to radially expanding and plastically deforming the tubular liner. Still further, the method comprises sealing the interface between the tubular liner and the preexisting structure in response to radially expanding and plastically deforming the tubular liner. Anchoring the expandable tubular member to the preexisting structure in response to radially expanding and plastically deforming the tubular liner comprises at least one of the following: penetratingly engaging the preexisting structure with the second portion of the tubular liner in response to radially expanding and plastically deforming the tubular liner, compressing the second portion between the preexisting structure and the tubular liner in response to radially expanding and plastically deforming the tubular liner; and compressing the first portion around at least a portion of the second portion in response to radially expanding and plastically deforming the tubular liner. Moreover, the
preexisting structure comprises one or more of the following: a wellbore, a wellbore casing, a pipeline, and a structural support.

[0008] Thus, embodiments described herein comprise a combination of features and advantages intended to address various shortcomings associated with certain prior devices. The various characteristics described above, as well as other features, will be readily apparent to those skilled in the art upon reading the following detailed description of the preferred embodiments, and by referring to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] For a detailed description of the preferred embodiments of the invention, reference will now be made to the accompanying drawings in which:

[0010] Figure 1 is a fragmentary cross-sectional view of an exemplary embodiment of a tubular liner including an expandable tubular member and a sleeve coupled thereto positioned within a wellbore that traverses a subterranean formation.

[0011] Figure 2 is a fragmentary cross-sectional view of the tubular liner of Figure 1 after positioning an expansion device within the expandable tubular member.

[0012] Figure 3 is a fragmentary cross-sectional view of the tubular liner of Figure 2 after operating the expansion device within the expandable tubular member to radially expand and plastically deform at least a portion of the expandable tubular member.

[0013] Figure 4 is a fragmentary cross-sectional view of the tubular liner of Figure 3 after further operating the expansion device within the expandable tubular member to radially expand and plastically deform another portion of the expandable tubular member so that the sleeve penetratively engages the wall of the wellbore.

[0014] Figure 5 is a fragmentary cross-sectional view, not necessarily to scale, of the tubular liner of Figure 1 positioned within a wellbore that traverses a subterranean formation.

[0015] Figure 6 is a fragmentary cross-sectional view of the tubular liner of Figure 5 after positioning an expansion device within the expandable tubular member.

[0016] Figure 7 is a fragmentary cross-sectional view of the tubular liner of Figure 6 after operating the expansion device within the expandable tubular member to radially expand and plastically deform at least a portion of the expandable tubular member.

[0017] Figure 8A is a fragmentary cross-sectional view of the tubular liner of Figure 7 after further operating the expansion device within the expandable tubular member to radially...
expand and plastically deform another portion of the expandable tubular member so that the sleeve is compressed between the expandable tubular member and the wall of the wellbore.  

[0018] Figure 8B is a fragmentary cross sectional view of the tubular liner of Figure 7 after further operating the expansion device within the expandable tubular member to radially expand and plastically deform another portion of the expandable tubular member so that the expandable tubular member is compressed around at least a portion of the sleeve.  

[0019] Figure 9 is a perspective view, not necessarily to scale, of a tubular liner according to another exemplary embodiment.  

[0020] Figure 10 is a sectional view of the tubular liner of Figure 9.  

[0021] Figure 11 is an enlarged portion of the view depicted in Figure 10.  

[0022] Figure 12 is a perspective view, not necessarily to scale, of a tubular liner according to yet another exemplary embodiment.  

[0023] Figure 13 is a sectional view of the tubular liner of Figure 12.  

[0024] Figure 14 is an enlarged portion of the view depicted in Figure 13.  

[0025] Figure 15 is a perspective view, not necessarily to scale, of a tubular liner according to yet another exemplary embodiment.  

[0026] Figure 16 is a sectional view of the tubular liner of Figure 15.  

[0027] Figure 17 is an enlarged portion of the view depicted in Figure 16.  

DETAILED DESCRIPTION OF SOME OF THE PREFERRED EMBODIMENTS  

[0028] The following discussion is directed to various embodiments of the invention. Although one or more of these embodiments may be preferred, the embodiments disclosed should not be interpreted, or otherwise used, as limiting the scope of the disclosure, including the claims. In addition, one skilled in the art will understand that the following description has broad application, and the discussion of any embodiment is meant only to be exemplary of that embodiment, and not intended to intimate that the scope of the disclosure, including the claims, is limited to that embodiment.  

[0029] Certain terms are used throughout the following description and claims to refer to particular features or components. As one skilled in the art will appreciate, different persons may refer to the same feature or component by different names. This document does not intend to distinguish between components or features that differ in name but not function. The drawing figures are not necessarily to scale. Certain features and components herein
may be shown exaggerated in scale or in somewhat schematic form and some details of conventional elements may not be shown in interest of clarity and conciseness.

[0030] 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..." Also, the term "couple" or "couples" is intended to mean either an indirect or direct connection. Thus, if a first device couples to a second device, that connection may be through a direct connection, or through an indirect connection via other devices and connections.

[0031] In an exemplary embodiment, as illustrated in Figure 1, a tubular liner is generally referred to by the reference numeral 10 and includes an expandable tubular member 12 and a sleeve 14 coupled thereto so that the expandable tubular member 12 extends through the sleeve 14. The sleeve 14 defines an outside diameter that is greater than the outside diameter defined by the expandable tubular member 12.

[0032] During operation, in an exemplary embodiment and as illustrated in Figure 1, the tubular liner 10 is positioned within a preexisting structure such as, for example, a wellbore 16 that traverses a subterraneean formation 18.

[0033] In an exemplary embodiment, as illustrated in Figure 2, an expansion device 20 is then positioned within the expandable tubular member 12. In several exemplary embodiments, the expansion device 20 may be positioned within the expandable tubular member 12 before, during, or after the placement of the expandable tubular member 12 within the wellbore 16.

[0034] In an exemplary embodiment, as illustrated in Figure 3, the expansion device 20 is then operated to radially expand and plastically deform at least a portion of the expandable tubular member 12 of the tubular liner 10.

[0035] In an exemplary embodiment, as illustrated in Figure 4, the expansion device 20 is then further operated to radially expand the remaining portion of the expandable tubular member 12. In response to the radial expansion of the expandable tubular member 12, the sleeve 14 also radially expands and penetratingly engages the wall of the wellbore 16. As a result of the penetration of the sleeve 14 into the wall of the wellbore 16, the tubular liner 10 is anchored to the wellbore 16, thereby generally preventing relative movement therebetween.

[0036] In an exemplary embodiment, as illustrated in Figure 4, in addition to anchoring the tubular liner 10 to the wellbore 16 in response to the radial expansion of the expandable
tubular member 12, the sleeve 14 sealingly engages the interface between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 16, thereby fluidically isolating the portion of the wellbore 16 below the sleeve 14 from the portion of the wellbore 16 above the sleeve 14, and vice versa, in response to the radial expansion of the expandable tubular member 12.

[0037] In several exemplary embodiments, as a result of the anchoring of the tubular liner 10 to the wellbore 16, embodiments described herein offer the potential to reduce the risk of the tubular liner 10 being pulled upward or downward, in response to the operation and axial movement of the expansion device 20 during the radial expansion of the portion of the expandable tubular member 12 above or below the sleeve 14 and/or one or more other expandable tubular members coupled to the expandable tubular member 12 above or below the sleeve 14.

[0038] In several exemplary embodiments, the ability of the tubular liner 10 to be anchored to a wellbore in response to the radial expansion of the expandable tubular member 12 facilitates, for example, the formation of wellbore casings in, for example, soft formations.

[0039] In several exemplary embodiments, as a result of the anchoring of the tubular liner 10 to the wellbore 16 and the sealing of the interface between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 16 in response to the radial expansion of the expandable tubular member 12, there is no need, or at least there is less of a need, to inject a hardenable fluidic material such as, for example, cement, into the annular region defined between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 16 before, during or after the radial expansion of the expandable tubular member 12.

[0040] In several exemplary embodiments, before, during or after the operation of the expansion device 20, a hardenable fluidic material such as, for example, cement, is injected into the annular region defined between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 16. As a result, an annular body of the hardenable fluidic sealing material is formed within the annular region defined between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 16. Before, during or after the curing of the annular body of the hardenable fluidic sealing material, the expansion device 20 may be operated to radially expand and plastically deform the expandable tubular member 12.
During operation, in an exemplary embodiment and as illustrated in Figure 5, the tubular liner 10 is positioned within a preexisting structure such as, for example, a wellbore 22 that traverses a subterranean formation 24.

In an exemplary embodiment, as illustrated in Figure 6, the expansion device 20 is then positioned within the expandable tubular member 12. In several exemplary embodiments, the expansion device 20 may be positioned within the expandable tubular member 12 before, during, or after the placement of the tubular member 12 within the wellbore 22.

In an exemplary embodiment, as illustrated in Figure 7, the expansion device 20 is then operated to radially expand and plastically deform at least a portion of the expandable tubular member 12 of the tubular liner 10.

In an exemplary embodiment, as illustrated in Figure 8A, the expansion device 20 is then further operated to radially expand the remaining portion of the expandable tubular member 12. In response to the radial expansion of the expandable tubular member 12, the sleeve 14 also radially expands until the sleeve 14 engages the wall of the wellbore 22, at which point the sleeve 14 is compressed between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 22. As a result of the compression of the sleeve 14 between the expandable tubular member 12 and the wall of the wellbore 22, and the resulting stresses and/or frictional forces generated therebetween, the tubular liner 10 is anchored to the wellbore 22, thereby generally preventing relative movement therebetween.

Alternatively, in an exemplary embodiment, after operating the expansion device 20 as illustrated in Figure 7, the expansion device 20 is then further operated to radially expand the remaining portion of the expandable tubular member 12, as illustrated in Figure 8B. In response to the radial expansion of the expandable tubular member 12, the sleeve 14 also radially expands until the sleeve 14 engages the wall of the wellbore 22, at which point the sleeve 14 is sandwiched between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 22. However, after engaging the wall of the wellbore 22, the sleeve 14 remains substantially intact and the expandable tubular member 12 is instead compressed around the portions of the sleeve 14 not engaging the wall of the wellbore 22, as shown in Figure 8B. As a result of the sandwiching of the sleeve 14 between the expandable tubular member 12 and the wall of the wellbore 22, the compression of the expandable tubular member 12 around the portions of the sleeve 14 not engaging the wall of the wellbore 12, and the resulting stresses and/or frictional forces generated among the wall of the
wellbore 12, the sleeve 14 and the expandable tubular member 12, the tubular liner 10 is anchored to the wellbore 22, thereby generally preventing relative movement therebetweem.

[0046] In an exemplary embodiment, as illustrated in both Figure 8A and 8B, in addition to anchoring the tubular liner 10 to the wellbore 22 in response to the radial expansion of the expandable tubular member 12, the sleeve 14 sealingly engages the interface between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 22, thereby fluidically isolating the portion of the wellbore 22 below the sleeve 14 from the portion of the wellbore 22 above the sleeve 14, and vice versa, in response to the radial expansion of the expandable tubular member 12.

[0047] In several exemplary embodiments, as a result of the anchoring of the tubular liner 10 to the wellbore 22, embodiments described herein offer the potential to reduce the risk of the tubular liner 10 being pulled upward or downward, in response to the operation and axial movement of the expansion device 20 during the radial expansion of the portion of the expandable tubular member 12 above or below the sleeve 14 and/or one or more other expandable tubular members coupled to the expandable tubular member 12 above or below the sleeve 14.

[0048] In several exemplary embodiments, the ability of the tubular liner 10 to be anchored to a wellbore in response to the radial expansion of the expandable tubular member 12 facilitates, for example, the formation of wellbore casings in, for example, soft formations.

[0049] In several exemplary embodiments, as a result of the anchoring of the tubular liner 10 to the wellbore 22 and the sealing of the interface between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 22 in response to the radial expansion of the expandable tubular member 12, there is no need, or at least there is less of a need, to inject a hardenable fluidic material such as, for example, cement, into the annular region defined between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 22 before, during or after the radial expansion of the expandable tubular member 12.

[0050] In several exemplary embodiments, before, during or after the operation of the expansion device 20, a hardenable fluidic material such as, for example, cement, is injected into the annular region defined between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 22. As a result, an annular body of the hardenable fluidic sealing material is formed within the annular region defined between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 22. Before, during
or after the curing of the annular body of the hardenable fluidic sealing material, the expansion device 20 may be operated to radially expand and plastically deform the expandable tubular member 12.

[0051] During operation, in several exemplary embodiments, the sleeve 14 of the tubular liner 10 penetratingly engages the wall of the wellbore 16 and/or 22 as described above with reference to Figures 1, 2, 3 and 4, is compressed between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 16 and/or 22 as described above with reference to Figures 5, 6, 7 and 8A, and/or is sandwiched between the exterior surface of the expandable tubular member 12 and the wall of the wellbore 16 and/or 22 as described above with reference to Figures 5, 6, 7 and 8B, thereby anchoring the tubular liner 10 to the wellbore 16 and/or 22 and sealing the interface between the exterior of the expandable tubular member 12 and the wall of the wellbore 16 and/or 22.

[0052] In an exemplary embodiment, the sleeve 14 is composed of one or more metallic materials. In an exemplary embodiment, the sleeve 14 is composed of one or more non-metallic materials. In an exemplary embodiment, the sleeve 14 is composed of a combination of one or more metallic materials and one or more non-metallic materials.

[0053] In an exemplary embodiment, the sleeve 14 is composed of one or more elastomeric materials. In an exemplary embodiment, the sleeve 14 is composed of a Viton® elastomer, a nitrile elastomer, a swellable elastomer, a non-swellable elastomer, and/or any combination thereof.

[0054] In an exemplary embodiment, the sleeve 14 is composed of one or more composite materials. In an exemplary embodiment, the sleeve 14 is composed of one or more composite materials that are sprayed onto the exterior surface of the expandable tubular member 12. In an exemplary embodiment, the sleeve 14 is composed of a material that is impregnated with carbide, wire filament and/or any combination thereof. In several exemplary embodiments, the sleeve 14 is composed of a material such as polyetheretherketone/PEEK or polytetrafluoro-ethylene/PTFE (Teflon®).

[0055] In several exemplary embodiments, the sleeve 14 is composed of one or more combinations of any of the above-identified types of materials.

[0056] In an exemplary embodiment, the sleeve 14 is integral with the expandable tubular member 12.
In several exemplary embodiments, the tubular liner 10 further includes one or more standoffs coupled to the exterior surface of the expandable tubular member 12. In several exemplary embodiments, the standoffs are composed of one or more resilient materials.

In an exemplary embodiment, the sleeve 14 includes a plurality of circumferentially-spaced fins that extend radially outward away from the exterior surface of the expandable tubular member 12. In an exemplary embodiment, the sleeve 14 includes one or more spikes and/or other types of protrusions that extend radially outward away from the exterior surface of the expandable tubular member 12.

In several exemplary embodiments, in addition to the sleeve 14, the tubular liner 10 includes one or more other sleeves, which are substantially similar to the sleeve 14 and are coupled to the expandable tubular member 12.

In several exemplary embodiments, in addition to the expandable tubular member 12, the tubular liner 10 includes one or more other expandable tubular members, which are substantially similar to the expandable tubular member 12 and are coupled together to form a tubular string, of which the expandable tubular member 12 is a part; in several exemplary embodiments, one or more sleeves 14 that are substantially similar to the sleeve 14 may be coupled to each of the expandable tubular members in the tubular string. In several exemplary embodiments, instead of, or in addition to being coupled to the expandable tubular member 12 at an axial position between the ends of the expandable tubular member 12, the sleeve 14 is coupled at a coupling between the expandable tubular member 12 and another expandable tubular member. In several exemplary embodiments, the sleeve 14 also functions as, or is a part of, a connection sleeve that couples the expandable tubular member 12 to another expandable tubular member.

In several exemplary embodiments, during the operation of the tubular liner 10, one or more discrete portions of the expandable tubular member 12, and thus one or more discrete portions of the tubular liner 10, may be radially expanded and plastically deformed.

In several exemplary embodiments, instead of, or in addition to the wellbore 16 and/or 22, the tubular liner 10 may be coupled to one or more other types of preexisting structures such as, for example, one or more wellbore casings, one or more pipelines, one or more structural supports, and/or any combination thereof.

In an exemplary embodiment, the expansion device 20 includes a vibration mechanism. In an exemplary embodiment, the expansion device 20 includes a vibration mechanism that travels upwards (bottom-up), as viewed in any of Figures 1-8. In an
exemplary embodiment, the expansion device 20 includes a vibration mechanism that travels downwards (top-down), as viewed in any of Figures 1-8. In an exemplary embodiment, the expansion device 20 employs mechanical force to effect its displacement relative to the expandable tubular member 12. In an exemplary embodiment, the expansion device 20 includes a fluid-powered expansion device. In an exemplary embodiment, the expansion device 20 employs hydraulic pressure to effect its displacement relative to the expandable tubular member 12. In an exemplary embodiment, to effect the displacement of the expansion device 20 relative to the expandable tubular member 12, the expansion device 20 employs mechanical force, hydraulic pressure and/or any combination thereof.

[0064] In several exemplary embodiments, the radial expansion and plastic deformation of the expandable tubular member 12 using the expansion device 20 is provided using one or more of the disclosures in whole or in part of one or more of the following: (1) U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, which claims priority from provisional application 60/121,702, filed on 2/25/99, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/19,611, filed on 2/1/99, (4) U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (5) U.S. patent application serial no. 10/169,434, attorney docket no. 25791.10.04, filed on 7/1/02, which claims priority from provisional application 60/183,546, filed on 2/18/00, (6) U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (7) U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (8) U.S. patent number 6,575,240, which was filed as patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, which claims priority from provisional application 60/121,907, filed on 2/26/99, (9) U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (10) U.S. patent application serial no.
09/981,916, attorney docket no. 25791.18, filed on 10/18/01 as a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (11) U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (12) U.S. patent application serial no. 10/030,593, attorney docket no. 25791.25.08, filed on 1/8/02, which claims priority from provisional application 60/146,203, filed on 7/29/99, (13) U.S. provisional patent application serial no. 60/143,039, attorney docket no. 25791.26, filed on 7/9/99, (14) U.S. patent application serial no. 10/111,982, attorney docket no. 25791.27.08, filed on 4/30/02, which claims priority from provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (15) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (16) U.S. provisional patent application serial no. 60/438,828, attorney docket no. 25791.31, filed on 1/9/03, (17) U.S. patent number 6,564,875, which was filed as application serial no. 09/679,907, attorney docket no. 25791.34.02, on 10/5/00, which claims priority from provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (18) U.S. patent application serial no. 10/089,419, filed on 3/27/02, attorney docket no. 25791.36.03, which claims priority from provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (19) U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (20) U.S. patent application serial no. 10/303,992, filed on 11/22/02, attorney docket no. 25791.38.07, which claims priority from provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (21) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (22) U.S. provisional patent application serial no. 60/455,051, attorney docket no. 25791.40, filed on 3/14/03, (23) PCT application US02/2477, filed on 6/26/02, attorney docket no. 25791.44.02, which claims priority from U.S. provisional patent application serial no. 60/303,711, attorney docket no. 25791.44, filed on 7/6/01, (24) U.S. patent application serial no. 10/311,412, filed on 12/12/02, attorney docket no. 25791.45.07, which claims priority from provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (25) U.S. patent application serial no. 10/
12/18/02, attorney docket no. 25791.46.07, which claims priority from provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (26) U.S. patent application serial no. 10/322,947, filed on 1/22/03, attorney docket no. 25791.47.03, which claims priority from provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (27) U.S. patent application serial no. 10/406,648, filed on 3/31/03, attorney docket no. 25791.48.06, which claims priority from provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (28) PCT application US02/04353, filed on 2/14/02, attorney docket no. 25791.50.02, which claims priority from U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001, (29) U.S. patent application serial no. 10/465,835, filed on 6/13/03, attorney docket no. 25791.51.06, which claims priority from provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001, (30) U.S. patent application serial no. 10/465,831, filed on 6/13/03, attorney docket no. 25791.52.06, which claims priority from U.S. provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001, (31) U.S. provisional patent application serial no. 60/452,303, filed on 3/5/03, attorney docket no. 25791.53, (32) U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (33) U.S. patent number 6,561,227, which was filed as patent application serial number 09/852,026, filed on 5/9/01, attorney docket no. 25791.56, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (34) U.S. patent application serial number 09/852,027, filed on 5/9/01, attorney docket no. 25791.57, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (35) PCT Application US02/25608, attorney docket no. 25791.58.02, filed on 8/13/02, which claims priority from provisional application 60/318,021, filed on 9/7/01, attorney docket no. 25791.58, (36) PCT Application US02/24399, attorney docket no. 25791.59.02, filed on 8/1/02, which claims priority from U.S. provisional patent application serial no. 60/313,453,
attorney docket no. 25791.59, filed on 8/20/2001, (37) PCT Application US02/29856, attorney docket no. 25791.60.02, filed on 9/19/02, which claims priority from U.S. provisional patent application serial no. 60/326,886, attorney docket no. 25791.60, filed on 10/3/2001, (38) PCT Application US02/20256, attorney docket no. 25791.61.02, filed on 6/26/02, which claims priority from U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001, (39) U.S. patent application serial no. 09/962,469, filed on 9/25/01, attorney docket no. 25791.62, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.1 1.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (40) U.S. patent application serial no. 09/962,470, filed on 9/25/01, attorney docket no. 25791.63, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.1 1.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (41) U.S. patent application serial no. 09/962,471, filed on 9/25/01, attorney docket no. 25791.64, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.1 1.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (42) U.S. patent application serial no. 09/962,467, filed on 9/25/01, attorney docket no. 25791.65, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.1 1.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (43) U.S. patent application serial no. 09/962,468, filed on 9/25/01, attorney docket no. 25791.66, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.1 1.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (44) PCT application US 02/25727, filed on 8/14/02, attorney docket no. 25791.67.03, which claims priority from U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001, and U.S. provisional patent application serial no. 60/318,386, attorney docket no. 25791.67.02, filed on 9/10/2001, (45) PCT application US 02/39425, filed on 12/10/02, attorney docket no. 25791.68.02, which claims priority from U.S. provisional patent application serial no. 60/343,674 , attorney docket no. 25791.68, filed on 12/27/2001, (46) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (47) U.S. utility patent
application serial no. 10/516,467, attorney docket no. 25791.70, filed on 12/10/01, which is a continuation application of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (48) PCT application US 03/00609, filed on 1/9/03, attorney docket no. 25791.71.02, which claims priority from U.S. provisional patent application serial no. 60/357,372, attorney docket no. 25791.71, filed on 2/15/02, (49) U.S. patent application serial no. 10/074,703, attorney docket no. 25791.74, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (50) U.S. patent application serial no. 10/074,244, attorney docket no. 25791.75, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, U.S. patent application serial no. 10/076,660, attorney docket no. 25791.76, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, U.S. patent application serial no. 10/076,661, attorney docket no. 25791.77, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, U.S. patent application serial no. 10/076,659, attorney docket no. 25791.78, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, U.S. patent application serial no. 10/078,928, attorney docket no. 25791.79, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, U.S. patent application serial no. 10/078,922, attorney docket no. 25791.80, filed on 2/20/02, which is a divisional of U.S. patent number
6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (56) U.S. patent application serial no. 10/078,921, attorney docket no. 25791.81, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (57) U.S. patent application serial no. 10/261,928, attorney docket no. 25791.82, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (58) U.S. patent application serial no. 10/079,276, attorney docket no. 25791.83, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (59) U.S. patent application serial no. 10/262,009, attorney docket no. 25791.84, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (60) U.S. patent application serial no. 10/092,481, attorney docket no. 25791.85, filed on 3/7/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (61) U.S. patent application serial no. 10/261,926, attorney docket no. 25791.86, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (62) PCT application US 02/36157, filed on 11/12/02, attorney docket no. 25791.87.02, which claims priority from U.S. provisional patent application serial no. 60/338,996, attorney docket no. 25791.87, filed on 11/12/01, (63) PCT application US 02/36267, filed on 11/12/02, attorney docket no. 25791.88.02, which claims priority from U.S. provisional patent application serial no. 60/339,013, attorney docket no. 25791.88, filed on 11/12/01, (64) PCT application US 03/1765, filed on 4/16/03, attorney docket no. 25791.89.02, which claims priority from U.S. provisional patent application serial no. 60/383,917, attorney docket no. 25791.89, filed
on 5/29/02, (65) PCT application US 03/15020, filed on 5/12/03, attorney docket no. 25791.90.02, which claims priority from U.S. provisional patent application serial no. 60/391,703, attorney docket no. 25791.90, filed on 6/26/02, (66) PCT application US 02/39418, filed on 12/10/02, attorney docket no. 25791.92.02, which claims priority from U.S. provisional patent application serial no. 60/346,309, attorney docket no. 25791.92, filed on 1/7/02, (67) PCT application US 03/06544, filed on 3/4/03, attorney docket no. 25791.93.02, which claims priority from U.S. provisional patent application serial no. 60/372,048, attorney docket no. 25791.93, filed on 4/12/02, (68) U.S. patent application serial no. 10/331,718, attorney docket no. 25791.94, filed on 12/30/02, which is a divisional U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (69) PCT application US 03/04837, filed on 2/29/03, attorney docket no. 25791.95.02, which claims priority from U.S. provisional patent application serial no. 60/363,829, attorney docket no. 25791.95, filed on 3/13/02, (70) U.S. patent application serial no. 10/261,297, attorney docket no. 25791.97, filed on 10/1/02, which is a division of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (71) U.S. patent application serial no. 10/262,008, attorney docket no. 25791.98, filed on 10/1/02, which is a division of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (72) U.S. patent application serial no. 10/261,925, attorney docket no. 25791.99, filed on 10/1/02, which is a division of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (73) U.S. patent application serial no. 10/199,524, attorney docket no. 25791.100, filed on 7/19/02, which is a continuation of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/11,293, filed on 12/7/98, (74) PCT application US 03/10144, filed on 3/28/03, attorney docket no. 25791.101.02, which claims priority from U.S. provisional patent application serial no. 60/372,632, attorney docket no. 25791.101, filed on 4/15/02, (75) U.S. provisional patent application serial no. 60/412,542, attorney docket no. 25791.102, filed on 9/20/02,
(76) PCT application US 03/14153, filed on 5/6/03, attorney docket no. 25791.104.02, which claims priority from U.S. provisional patent application serial no. 60/380,147, attorney docket no. 25791.104, filed on 5/6/02, (77) PCT application US 03/19993, filed on 6/24/03, attorney docket no. 25791.106.02, which claims priority from U.S. provisional patent application serial no. 60/397,284, attorney docket no. 25791.106, filed on 7/19/02, (78) PCT application US 03/13787, filed on 5/5/03, attorney docket no. 25791.107.02, which claims priority from U.S. provisional patent application serial no. 60/387,486, attorney docket no. 25791.107, filed on 6/10/02, (79) PCT application US 03/18530, filed on 6/11/03, attorney docket no. 25791.108.02, which claims priority from U.S. provisional patent application serial no. 60/387,961, attorney docket no. 25791.108, filed on 6/12/02, (80) PCT application US 03/20694, filed on 7/1/03, attorney docket no. 25791.110.02, which claims priority from U.S. provisional patent application serial no. 60/398,061, attorney docket no. 25791.110, filed on 7/24/02, (81) PCT application US 03/20870, filed on 7/2/03, attorney docket no. 25791.111.02, which claims priority from U.S. provisional patent application serial no. 60/399,240, attorney docket no. 25791.111, filed on 7/29/02, (82) U.S. provisional patent application serial no. 60/412,487, attorney docket no. 25791.112, filed on 9/20/02, (83) U.S. provisional patent application serial no. 60/412,488, attorney docket no. 25791.114, filed on 9/20/02, (84) U.S. patent application serial no. 10/280,356, attorney docket no. 25791.115, filed on 10/25/02, which is a continuation of U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (85) U.S. provisional patent application serial no. 60/412,177, attorney docket no. 25791.117, filed on 9/20/02, (86) U.S. provisional patent application serial no. 60/412,653, attorney docket no. 25791.118, filed on 9/20/02, (87) U.S. provisional patent application serial no. 60/405,610, attorney docket no. 25791.119, filed on 8/23/02, (88) U.S. provisional patent application serial no. 60/405,394, attorney docket no. 25791.120, filed on 8/23/02, (89) U.S. provisional patent application serial no. 60/412,544, attorney docket no. 25791.121, filed on 9/20/02, (90) PCT application US 03/24779, filed on 8/8/03, attorney docket no. 25791.125.02, which claims priority from U.S. provisional patent application serial no. 60/407,442, attorney docket no. 25791.125, filed on 8/30/02, (91) U.S. provisional patent application serial no. 60/423,363, attorney docket no. 25791.126, filed on 12/10/02, (92) U.S.
provisional patent application serial no. 60/412,196, attorney docket no. 25791.127, filed on 9/20/02, (93) U.S. provisional patent application serial no. 60/412,187, attorney docket no. 25791.128, filed on 9/20/02, (94) U.S. provisional patent application serial no. 60/412,371, attorney docket no. 25791.129, filed on 9/20/02, (95) U.S. patent application serial no. 10/382,325, attorney docket no. 25791.145, filed on 3/5/03, which is a continuation of U.S. patent number 6,557,640, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (96) U.S. patent application serial no. 10/624,842, attorney docket no. 25791.151, filed on 7/22/03, which is a division of U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (97) U.S. provisional patent application serial no. 60/431,184, attorney docket no. 25791.157, filed on 12/5/02, (98) U.S. provisional patent application serial no. 60/448,526, attorney docket no. 25791.185, filed on 2/18/03, (99) U.S. provisional patent application serial no. 60/461,539, attorney docket no. 25791.186, filed on 4/9/03, (100) U.S. provisional patent application serial no. 60/462,750, attorney docket no. 25791.193, filed on 4/14/03, (101) U.S. provisional patent application serial no. 60/436,106, attorney docket no. 25791.200, filed on 12/23/02, (102) U.S. provisional patent application serial no. 60/442,942, attorney docket no. 25791.213, filed on 1/27/03, (103) U.S. provisional patent application serial no. 60/442,938, attorney docket no. 25791.225, filed on 1/27/03, (104) U.S. provisional patent application serial no. 60/418,687, attorney docket no. 25791.228, filed on 4/18/03, (105) U.S. provisional patent application serial no. 60/454,896, attorney docket no. 25791.236, filed on 3/14/03, (106) U.S. provisional patent application serial no. 60/450,504, attorney docket no. 25791.238, filed on 2/26/03, (107) U.S. provisional patent application serial no. 60/451,152, attorney docket no. 25791.239, filed on 3/9/03, (108) U.S. provisional patent application serial no. 60/455,124, attorney docket no. 25791.241, filed on 3/17/03, (109) U.S. provisional patent application serial no. 60/453,678, attorney docket no. 25791.253, filed on 3/1/03, (110) U.S. patent application serial no. 10/421,682, attorney docket no. 25791.256, filed on 4/23/03, which is a continuation of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/1/99, (111) U.S. provisional patent application serial no. 60/457,965, attorney docket no. 25791.260, filed on 3/27/03, (112) U.S. provisional patent application serial no. 60/455,718, attorney docket no. 25791.262, filed on 3/18/03, (113) U.S.
patent number 6,550,821, which was filed as patent application serial no. 09/811,734, filed on 3/19/01, (114) U.S. patent application serial no. 10/436,467, attorney docket no. 25791.268, filed on 5/12/03, which is a continuation of U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (115) U.S. provisional patent application serial no. 60/459,776, attorney docket no. 25791.270, filed on 4/2/03, (116) U.S. provisional patent application serial no. 60/461,094, attorney docket no. 25791.272, filed on 4/8/03, (117) U.S. provisional patent application serial no. 60/461,038, attorney docket no. 25791.273, filed on 4/7/03, (118) U.S. provisional patent application serial no. 60/463,586, attorney docket no. 25791.277, filed on 4/17/03, (119) U.S. provisional patent application serial no. 60/472,240, attorney docket no. 25791.286, filed on 5/20/03, (120) U.S. patent application serial no. 10/619,285, attorney docket no. 25791.292, filed on 7/14/03, which is a continuation-in-part of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (121) U.S. utility patent application serial no. 10/418,688, attorney docket no. 25791.257, which was filed on 4/18/03, as a division of U.S. utility patent application serial no. 09/523,468, attorney docket no. 25791.1.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/1/99, (122) PCT patent application serial no. PCT/US04/06246, attorney docket no. 25791.238.02, filed on 2/26/2004, (123) PCT patent application serial number PCT/US04/08170, attorney docket number 25791.40.02, filed on 3/15/04, (124) PCT patent application serial number PCT/US04/08171, attorney docket number 25791.236.02, filed on 3/15/04, (125) PCT patent application serial number PCT/US04/08073, attorney docket number 25791.262.02, filed on 3/18/04, (126) PCT patent application serial number PCT/US04/07711, attorney docket number 25791.253.02, filed on 3/11/2004, (127) PCT patent application serial number PCT/US2004/009434, attorney docket number 25791.260.02, filed on 3/26/2004, (128) PCT patent application serial number PCT/US2004/010317, attorney docket number 25791.270.02, filed on 4/2/2004, (129) PCT patent application serial number PCT/US2004/010712, attorney docket number 25791.272.02, filed on 4/6/2004, (130) PCT patent application serial number PCT/US2004/010762, attorney docket number 25791.273.02, filed on 4/6/2004, (131) PCT
patent application serial number PCT/2004/0 11973, attorney docket number 25791.277.02, filed on 4/15/2004, (132) U.S. provisional patent application serial number 60/495,056, attorney docket number 25791.301, filed on 8/14/2003, (133) U.S. provisional patent application serial number 60/585,370, attorney docket number 25791.299, filed on 7/2/2004, (134) U.S. provisional patent application serial number 60/598,020, attorney docket number 25791.329, filed on 8/2/2004, (135) U.S. provisional patent application serial number 60/600,679, attorney docket number 25791.194, filed on 8/11/2004, and (136) U.S. provisional patent application serial number 60/601,502, attorney docket number 25791.338 filed on 8/13/2004, the disclosures of which are incorporated herein by reference, and/or any combination thereof.

[0065] In an exemplary embodiment, as illustrated in Figures 9, 10 and 11, a tubular liner is generally referred to by the reference numeral 26 and includes an expandable tubular member 28 defining an internal passage 28a, an outside diameter 28b and an inside diameter 28c, and including an external threaded connection 28d at one end and an internal threaded connection 28e at the other end. In an exemplary embodiment, the outside diameter 28b is about 6.010 inches and the inside diameter 28c is about 5.390 inches. In an exemplary embodiment, the external threaded connection 28d is a pin connection and the internal threaded connection 28e is a box connection.

[0066] Sleeves 30a, 30b, and 30c are coupled to the expandable tubular member 28 so that the expandable tubular member 28 extends through the sleeves 30a, 30b and 30c. The sleeves 30a, 30b, and 30c include opposing tapered end portions, 30aa and 30ab, 30ba and 30bb, and 30ca and 30cb, respectively, and the sleeves 30a, 30b, and 30c are axially spaced from one another along the axial or longitudinal length of the expandable tubular member 28. In an exemplary embodiment, the axial gap between the sleeves 30a and 30b is about 2.0 inches, and the axial gap between the sleeves 30b and 30c is also about 2.0 inches. Each of the sleeves 30a, 30b, and 30c defines an outside diameter 32 that is greater than the outside diameter 28b of the expandable tubular member 28. In an exemplary embodiment, the outside diameter 32 is about 6.337 inches. Each of the sleeves 30a, 30b and 30c defines a wall thickness 34. In an exemplary embodiment, the wall thickness 34 is about 0.160 inches before any radial expansion of any of the sleeves 30a, 30b and 30c. Each of the sleeves 30a, 30b, and 30c defines an axial length 36. In an exemplary embodiment, the axial length 36 is about 6.0 inches.
In an exemplary embodiment, the tubular liner 26 operates in a manner substantially similar to the manner in which the tubular liner 10 operates, as described above with reference to Figures 1, 2, 3 and 4, with the sleeves 30a, 30b, and 30c penetratingly engaging the wall of a wellbore in response to the radial expansion of the expandable tubular member 28, thereby anchoring the tubular liner 26 to the wellbore and sealing the interface between the exterior surface of the expandable tubular member 28 and the wall of the wellbore.

In an exemplary embodiment, the tubular liner 26 operates in a manner substantially similar to the manner in which the tubular liner 10 operates, as described above with reference to Figures 5, 6, 7, 8A and 8B, with the sleeves 30a, 30b, and 30c being compressed between the expandable tubular member 28 and the wall of a wellbore in response to the radial expansion of the expandable tubular member 28, thereby anchoring the tubular liner 26 to the wellbore and sealing the interface between the exterior surface of the expandable tubular member 28 and the wall of the wellbore.

In an exemplary embodiment, the tubular liner 26 operates in a manner substantially similar to the manner in which the tubular liner 10 operates as described above with reference to Figures 1, 2, 3 and 4, with the sleeves 30a, 30b, and 30c penetratingly engaging the wall of a wellbore in response to the radial expansion of the expandable tubular member 28, and also in a manner substantially similar to the manner in which the tubular liner 10 operates, as described above with reference to Figures 5, 6, 7, 8A and 8B, with the sleeves 30a, 30b and 30c also being compressed between the expandable tubular member 28 and the wall of the wellbore in response to the radial expansion of the expandable tubular member 28.

In an exemplary embodiment, as illustrated in Figures 12, 13 and 14, a tubular liner is generally referred to by the reference numeral 38 and includes an expandable tubular member 40 defining an internal passage 40a, an outside diameter 40b and an inside diameter 40c, and including an external threaded connection 40d at one end and an internal threaded connection 40e at the other end. In an exemplary embodiment, the outside diameter 40b is about 6.010 inches and the inside diameter 40c is about 5.390 inches. In an exemplary embodiment, the external threaded connection 40d is a pin connection and the internal threaded connection 40e is a box connection.

Sleeves 42a and 42b are coupled to the expandable tubular member 40 so that the expandable tubular member 40 extends through the sleeves 42a and 42b. The sleeves 42a and 42b include opposing tapered end portions, 42aa and 42ab, and 42ba and 42bb, respectively, and the sleeves 42a and 42b are axially spaced from one another along the axial
or longitudinal length of the expandable tubular member 40. In an exemplary embodiment, the axial gap between the sleeves 42a and 42b is about 2.0 inches. Each of the sleeves 42a and 42b defines an outside diameter 44 that is greater than the outside diameter 40b of the expandable tubular member 28. In an exemplary embodiment, the outside diameter 44 is about 6.337 inches. Each of the sleeves 42a and 42b defines a wall thickness 46. In an exemplary embodiment, the wall thickness 46 is about 0.160 inches before any radial expansion of any of the sleeves 42a and 42b. Each of the sleeves 42a and 42b defines an axial length 48. In an exemplary embodiment, the axial length 48 is about 12.0 inches.

[0072] In an exemplary embodiment, the tubular liner 38 operates in a manner substantially similar to the manner in which the tubular liner 10 operates, as described above with reference to Figures 1, 2, 3 and 4, with the sleeves 42a and 42b penetratingly engaging the wall of a wellbore in response to the radial expansion of the expandable tubular member 40, thereby anchoring the tubular liner 38 to the wellbore and sealing the interface between the exterior surface of the expandable tubular member 40 and the wall of the wellbore.

[0073] In an exemplary embodiment, the tubular liner 38 operates in a manner substantially similar to the manner in which the tubular liner 10 operates, as described above with reference to Figures 5, 6, 7, 8A and 8B, with the sleeves 42a and 42b being compressed between the expandable tubular member 40 and the wall of a wellbore in response to the radial expansion of the expandable tubular member 40, thereby anchoring the tubular liner 38 to the wellbore and sealing the interface between the exterior surface of the expandable tubular member 40 and the wall of the wellbore.

[0074] In an exemplary embodiment, the tubular liner 38 operates in a manner substantially similar to the manner in which the tubular liner 10 operates as described above with reference to Figures 1, 2, 3 and 4, with the sleeves 42a and 42b penetratingly engaging the wall of a wellbore in response to the radial expansion of the expandable tubular member 40, and also in a manner substantially similar to the manner in which the tubular liner 10 operates, as described above with reference to Figures 5, 6, 7, 8A and 8B, with the sleeves 42a and 42b also being compressed between the expandable tubular member 40 and the wall of the wellbore in response to the radial expansion of the expandable tubular member 28.

[0075] In an exemplary embodiment, as illustrated in Figures 15, 16 and 17, a tubular liner is generally referred to by the reference numeral 50 and includes an expandable tubular member 52 defining an internal passage 52a and including an external threaded connection 52b at one end, an internal threaded connection 52c at the other end, tubular portions 52d, 52e, 52f, and
52g, and enlarged-diameter tubular portions 52h, 52i and 52j. The portion 52h is located between the portions 52d and 52e, the portion 52i is located between the portions 52e and 52f, and the portion 52j is located between the portions 52f and 52g. Each of the portions 52d, 52e, 52f, and 52g defines an outside diameter 52k. Each of the portions 52h, 52i and 52j defines an outside diameter 52l that is greater than the outside diameter 52k. Each of the portions 52d, 52e, 52f, 52g, 52h, 52i, and 52j are integral with each other, defining an inside diameter 52m.

[0076] In an exemplary embodiment, each of the portions 52h, 52i and 52j is a machined pad. In an exemplary embodiment, each of the portions 52d, 52e, 52f and 52g is an external annular recess.

[0077] In an exemplary embodiment, the outside diameter 52k is about 6.00 inches and the outside diameter 52l is about 6.30 inches. In an exemplary embodiment, the axial or longitudinal length of each of the portions 52h, 52i, and 52j is about 4.0 inches. In an exemplary embodiment, the axial or longitudinal length of each of the portions 52e and 52f is about 14.0 inches. In an exemplary embodiment, the external threaded connection 52b is a pin connection and the internal threaded connection 52c is a box connection.

[0078] In an exemplary embodiment, the tubular liner 50 operates in a manner substantially similar to the manner in which the tubular liner 10 operates, as described above with reference to Figures 1, 2, 3 and 4, with the enlarged-diameter portions 52h, 52i and 52j penetratingly engaging the wall of a wellbore in response to the radial expansion of the expandable tubular member 52, thereby anchoring the tubular liner 50 to the wellbore and sealing the interface between the expandable tubular member 52 and the wall of the wellbore.

[0079] In an exemplary embodiment, the tubular liner 50 operates in a manner substantially similar to the manner in which the tubular liner 10 operates, as described above with reference to Figures 5, 6, 7, 8A and 8B, with the enlarged-diameter portions 52h, 52i and 52j being compressed between the expandable tubular member 52 and the wall of a wellbore in response to the radial expansion of the expandable tubular member 52, thereby anchoring the tubular liner 50 to the wellbore and sealing the interface between the expandable tubular member 52 and the wall of the wellbore.

[0080] In an exemplary embodiment, the tubular liner 50 operates in a manner substantially similar to the manner in which the tubular liner 10 operates as described above with reference to Figures 1, 2, 3 and 4, with the enlarged-diameter portions 52h, 52i and 52j penetratingly engaging the wall of a wellbore in response to the radial expansion of the expandable tubular
member 52, and also in a manner substantially similar to the manner in which the tubular liner 10 operates, as described above with reference to Figures 5, 6, 7, 8A and 8B, with the enlarged-diameter portions 52h, 52i and 52j also being compressed between the expandable tubular member 52 and the wall of the wellbore in response to the radial expansion of the expandable tubular member 52.

[0081] In an exemplary experimental model, a set of calculation results are provided in Table 1 below. These calculation results are at least partially based on a tubular liner that is similar to the embodiments of tubular liners 26, 38, 50 described above. These calculation results indicate that the embodiments described herein offer the potential to be anchored to at least a wellbore and/or a wellbore casing in response to the radial expansion of the tubular liner 26, 38 and/or 50. These calculation results, and/or the conclusions derived therefrom, are unexpected results.

### TABLE 1

<table>
<thead>
<tr>
<th>DrtemaL Base Casing</th>
<th>7.625 in.</th>
<th>SEiU iieLELe::&amp;J3,aQsiQ.Q</th>
<th>Ex-80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>39.00 lb/ft</td>
<td>Nominal Yield Strength</td>
<td>80,000 psi</td>
</tr>
<tr>
<td>Nominal ID</td>
<td>6.625 in.</td>
<td>Minimum Ultimate Strength</td>
<td>95,000 psi</td>
</tr>
<tr>
<td>API Drift ID</td>
<td>6.500 in.</td>
<td>Nominal OD</td>
<td>6 000 in.</td>
</tr>
<tr>
<td>Connection Type</td>
<td>VAM ACE</td>
<td>Nominal ID</td>
<td>5 390 in.</td>
</tr>
<tr>
<td>Connection ID</td>
<td>6.625 in.</td>
<td>API Drift ID</td>
<td>5 265 in.</td>
</tr>
<tr>
<td>Other ID Restriction</td>
<td>N/A</td>
<td>Nominal Wall Thickness</td>
<td>0.305 in.</td>
</tr>
<tr>
<td>Launcher</td>
<td>6.250 in.</td>
<td>Weight</td>
<td>18.60 lb/ft</td>
</tr>
<tr>
<td>Anchor Hanger</td>
<td></td>
<td>Internal Yield</td>
<td>7,120 psi</td>
</tr>
</tbody>
</table>

| Set in Base Casing - Elastomer Thickness | 0.230 in. | SET Liner Post-Expansion |
| Set in Base Casing - OD | 6.460 in. | Nominal OD                | 6 297 in.  |
| Set in Open Hole - Machined Pad Thickness | 0.150 in. | Nominal ID                | 5 700 in.  |
| Set in Open Hole - OD | 6.300 in. | Drift ID                  | 5 641 in.  |
| Connection SSseves          |           | Nominal Wall Thickness    | 0.299 in.   |
| Set in Base Casing - Thickness | 0.100 in. | Nominal Weight            | 19.14 lb/ft |
| Set in Base Casing - Expanded OD | 6.493 in. | Internal Yield            | 6,640 psi   |
| Set in Open Hole - Thickness | 0.100 in. | Collapse [4]              | 4,180 psi   |
| Set in Open Hole - Expanded OD | 6.493 in. | Expansion Ratio          | 5.8%       |

| Base Expansion Specification | 254,800 lb | Post-Expansion Connection Specifications |
| Tension Load Rating [2] | 262,400 lb |
| Compressive Load Rating [2] | 203,800 lb |
| Minimum Parting Load [3] | 302,500 lb |
| Pure Bend Load [2,5] | 17 1 00 f |
| Pure Bend Load [0,5] | 17 1 00 f |

TABLE 1
Any spatial references such as, for example, "upper," "lower," "above," "below," "between," "vertical," "horizontal," "angular," "upwards," "downwards," "side-to-side," "left-to-right," "right-to-left," "top-to-bottom," "bottom-to-top," "top," "bottom," "bottom-up," "top-down," etc., are for the purpose of illustration only and do not limit the specific orientation or location of the structure described above.

In several exemplary embodiments, one or more of the operational steps in each embodiment may be omitted. Moreover, in some instances, some features of the present disclosure may be employed without a corresponding use of the other features. Moreover, one or more of the above-described embodiments and/or variations may be combined in whole or in part with any one or more of the other above-described embodiments and/or variations.

While preferred embodiments have been shown and described, modifications thereof can be made by one skilled in the art without departing from the scope or teachings herein. The embodiments described herein are exemplary only and are not limiting. Many variations and modifications of the system and apparatus are possible and are within the scope of the invention. For example, the relative dimensions of various parts, the materials from which the various parts are made, and other parameters can be varied. Accordingly, the scope of protection is not limited to the embodiments described herein, but is only limited by the claims that follow, the scope of which shall include all equivalents of the subject matter of the claims.
Claims

What is claimed is:

1. A method comprising:
   - positioning a radially expandable tubular liner in a preexisting structure, the tubular liner comprising a first portion defining a first outside diameter and a second portion defining a second outside diameter that is greater than the first outside diameter;
   - radially expanding the tubular liner; and
   - anchoring the expandable tubular member to the preexisting structure in response to radially expanding the tubular liner.

2. The method of claim 1 further comprising:
   - sealing the interface between the tubular liner and the preexisting structure in response to radially expanding the tubular liner.

3. The method of claim 1 wherein anchoring the expandable tubular member to the preexisting structure in response to radially expanding the tubular liner comprises:
   - penetratingly engaging the preexisting structure with the second portion of the tubular liner in response to radially expanding the tubular liner.

4. The method of claim 3 wherein the preexisting structure comprises a wellbore formed in a subterranean formation, the wellbore comprising a wall; and
   - wherein penetratingly engaging the preexisting structure with the second portion of the tubular liner in response to radially expanding the tubular liner comprises:
   - penetratingly engaging the wall of the wellbore with the second portion of the tubular liner in response to radially expanding the tubular liner.

5. The method of claim 1 wherein anchoring the expandable tubular member to the preexisting structure in response to radially expanding the tubular liner comprises:
   - compressing the second portion between the preexisting structure and the tubular liner in response to radially expanding the tubular liner.

6. The method of claim 5 wherein the preexisting structure comprises a wellbore formed in a subterranean formation, the wellbore comprising a wall; and
   - wherein compressing the second portion between the preexisting structure and the tubular liner in response to radially expanding the tubular liner comprises:
compressing the second portion between the wall of the wellbore and the
tubular liner in response to radially expanding the tubular liner.

7. The method of claim 1 wherein anchoring the expandable tubular member to the
preexisting structure in response to radially expanding the tubular liner comprises:
penetratingly engaging the preexisting structure with the second portion of the
tubular liner in response to radially expanding the tubular liner; and
compressing the second portion between the preexisting structure and the
tubular liner in response to radially expanding the tubular liner.

8. The method of claim 1 wherein the first and second portions of the tubular liner are
integral.

9. The method of claim 8 wherein the first portion comprises an external annular recess.

10. The method of claim 8 wherein the second portion comprises a machined pad.

11. The method of claim 1 wherein the first portion comprises an expandable tubular
member and the second portion comprises at least one sleeve, the at least one sleeve coupled
to the expandable tubular member so that the expandable tubular member extends through the
at least one sleeve.

12. The method of claim 11 wherein the at least one sleeve is composed of an elastomeric
material.

13. The method of claim 11 wherein the at least one sleeve is composed of one or more of
the following:
   a metallic material;
   a non-metallic material;
   a composite material;
   polyetheretherketone;
   polytetrafluoroethylene; and
   a material impregnated with one or more of the following:
      carbide, and
      wire filament.

14. An apparatus comprising:
an expandable tubular liner adapted to be positioned in a preexisting structure
and radially expanded to line at least a portion of the preexisting structure, the tubular
liner comprising:
a first portion defining a first outside diameter; and
a second portion defining a second outside diameter that is greater than the first outside diameter;

wherein the second portion anchors the tubular liner to the preexisting structure in response to the radial expansion of the expandable tubular liner.

15. The apparatus of claim 14 wherein the first portion comprises at least one expandable tubular member and the second portion comprises at least one sleeve coupled to the expandable tubular member so that the expandable tubular member extends through the at least one sleeve.

16. The apparatus of claim 15 wherein the at least one sleeve is composed of an elastomeric material.

17. The apparatus of claim 15 wherein the at least one sleeve is composed of one or more of the following:

   a metallic material;
   a non-metallic material;
   a composite material;
   polyetheretherketone;
   polytetrafluoroethylene; and
   a material impregnated with one or more of the following:
      carbide, and
      wire filament.

18. The apparatus of claim 14 wherein the first and second portions of the tubular liner are integral.

19. The apparatus of claim 18 wherein the first portion comprises an external annular recess.

20. The apparatus of claim 18 wherein the second portion comprises a machined pad.

21. The apparatus of claim 14 wherein the second portion is adapted to penetratingly engage the preexisting structure in response to the radial expansion of the tubular liner to thereby anchor the tubular liner to the preexisting structure.

22. The apparatus of claim 14 wherein the second portion is adapted to be compressed between the preexisting structure and the tubular liner in response to the radial expansion of the tubular liner to thereby anchor the tubular liner to the preexisting structure.
23. The apparatus of claim 14 wherein the second portion is adapted to penetratingly engage the preexisting structure in response to the radial expansion of the tubular liner; and wherein the second portion is adapted to be compressed between the preexisting structure and the tubular liner in response to the radial expansion of the tubular liner.

24. The apparatus of claim 14 wherein the second portion seals the interface between the tubular liner and the preexisting structure in response to the radial expansion of the expandable tubular liner.

25. A method comprising:
   - positioning a radially expandable tubular liner in a preexisting structure, the tubular liner comprising a first portion defining a first outside diameter and a second portion defining a second outside diameter that is greater than the first outside diameter;
   - radially expanding and plasticly deforming the tubular liner;
   - anchoring the expandable tubular member to the preexisting structure in response to radially expanding and plasticly deforming the tubular liner; and
   - sealing the interface between the tubular liner and the preexisting structure in response to radially expanding and plasticly deforming the tubular liner;
   wherein anchoring the expandable tubular member to the preexisting structure in response to radially expanding and plasticly deforming the tubular liner comprises at least one of the following:
   - penetratingly engaging the preexisting structure with the second portion of the tubular liner in response to radially expanding and plasticly deforming the tubular liner;
   - compressing the second portion between the preexisting structure and the tubular liner in response to radially expanding and plasticly deforming the tubular liner; and
   - compressing the first portion around at least a portion of the second portion in response to radially expanding and plasticly deforming the tubular liner; and
   wherein the preexisting structure comprises one or more of the following: a wellbore; a wellbore casing; a pipeline; and a structural support.
## A. CLASSIFICATION OF SUBJECT MATTER

**E21B 43/00(2006.01)**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

- **IPC** 8 E21B 17/00, E21B 19/16, E21B 23/00, E21B 43/00 and E21B 43/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

- Korean Utility models and applications for utility models since 1975
- Japanese utility models and applications for utility models since 1975

Electronic database consulted during the international search (name of database and, where practical, search terms used)

- eKIPASS (KIPO internal) & Keywords: tubular, liner, wellbore, wellborecasing and similar terms

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
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<td>See paragraphs 25-46, claims 1-48, and Figures 1a-1f</td>
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<td>US 2006/0048948 A1 (GREG NOEL) 9 March 2006</td>
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Further documents are listed in the continuation of Box C

See patent family annex

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**Date of the actual completion of the international search**

19 AUGUST 2008 (19 08 2008)

**Date of mailing of the international search report**

20 AUGUST 2008 (20.08.2008)

**Name and mailing address of the ISA/KR**

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seogu, Daejeon 302-701, Republic of Korea

Facsimile No 82-42-472-7140

**Authorized officer**

KIM, Seong Kon

**Telephone No** 82-42-481-5526

Form PCT/ISA/210 (second sheet) (July 2008)
**INTERNATIONAL SEARCH REPORT**

### Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. **Claims Nos**
   - because they relate to subject matter not required to be searched by this Authority, namely

2. **Claims Nos**
   - because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically

3. **Claims Nos**
   - because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 64(a)

### Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Independent claim 1 is directed to a method comprising positioning a radially expandable tubular liner in a preexisting structure, the tubular liner comprising a first portion defining a first outside diameter and a second portion defining a second outside diameter that is greater than the first outside diameter, radially expanding the tubular liner, and anchoring the expandable tubular member to the preexisting structure in response to radially expanding the tubular liner.

(Continued in the Supplemental Box)

1. **As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims**

2. **As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee**

3. **As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos**

4. **No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims, it is covered by claims Nos**

**Remark on Protest**
- □ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee
- ■ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation
- □ No protest accompanied the payment of additional search fees
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Continuation of Box III.

Independent claim 14 is directed to an apparatus comprising: an expandable tubular liner adapted to be positioned in a preexisting structure and radially expanded to line at least a portion of the preexisting structure, the tubular liner comprising: a first portion defining a first outside diameter! and a second portion defining a second outside diameter that is greater than the first diameter, wherein the second portion anchors the tubular liner to the preexisting structure in response to the radial expansion of the expandable tubular liner.

Independent claim 25 is directed to a method comprising: positioning a radially expandable tubular liner in a preexisting structure, the tubular liner comprising a first portion defining a first outside diameter and a second portion defining a second outside diameter that is greater than the first diameter! radially expanding and plastically deforming the tubular liner! anchoring the expandable tubular member to the preexisting structure in response to radially expanding and plastically deforming the tubular liner! and sealing the interface between the tubular liner and the preexisting structure in response to radially expanding and plastically deforming the tubular liner, wherein anchoring the expandable tubular member to the preexisting structure in response to radially expanding and plastically deforming the tubular liner comprises at least one of the following: penetrating engaging the preexisting structure with the second portion of the tubular liner in response to radially expanding and plastically deforming the tubular liner! compressing the second portion between the preexisting structure and the tubular liner in response to radially expanding and plastically deforming the tubular liner! and compressing the first portion around at least a portion of the second portion in response to radially expanding and plastically deforming the tubular liner, and wherein the preexisting structure comprises one or more of the following: a wellbore! a wellbore casing! a pipeline! and a structural support.

The common technical feature between claims 1, 14 and 25 is the expandable tubular liner, which is defined in claim 14. However, this feature lacks novelty and/or an inventive step with respect to the documents US 2004/0231858 A1, US 6997266 B2, US 2006/0048948 A1 and US 7100684 B2 cited in the ISR. Thus, there is no technical relationship left over the prior art among the claimed inventions, leaving the claims without a single general inventive concept.

Hence, there is a lack of unity of invention "a posteriori" (PCT Rules 13.1 and 13.2).