CLAIMS

WHAT IS CLAIMED IS:

1. A tubular assembly for connection between a platform (20) and a subsea wellhead assembly (30), the tubular assembly comprising:

an annular riser (34) for connection between the platform (20) and the subsea wellhead assembly (30); and

characterized in that the tubular assembly includes an axially expandable and contractable member (36) connected to the annular riser (34), the expandable and contractable member comprising (36) a uni-body tubular (37) having a wall (38) formed to axially expand and contract a greater amount per linear increment than the riser (34).

2. The tubular assembly (36) of claim 1, characterized in that wherein the expandable and contractable member wall (38) maintains an axial force therein when axially expanding and contracting.

3. The tubular assembly of any of claims 1-2, characterized in that wherein the wall (38) has a series of slots (40) along the wall length alternatingly formed about the wall (38) inner circumference and about the wall (38) outer circumference, each slot (40) lying in a plane substantially perpendicular to the member axis.

4. The tubular assembly of any of claims 1-2, characterized in that the expandable and contractable member wall (38) comprises annular foldable segments coaxially stacked along the member axis.

5. The tubular assembly of claim 4, characterized in that wherein the foldable segments have an "S" shaped cross section, wherein the segment outer and inner diameter can vary along the member axis length.

6. The tubular assembly of any of claims 1-5, characterized in that wherein the wall (38) has a bellows like shape.

7. The tubular assembly of any of claims 1-6, characterized in that wherein the expandable and contractable member wall (38) comprises a helix forming a corrugated pattern along the wall (38) surface.

8. The tubular assembly of any of claims 1-7, characterized in that the expandable and contractable member (36) is coaxially connected with the riser (34).

9. The tubular assembly of any of claims 1-8, characterized in that the tubular assembly further comprises an upper lead portion (39) on the upper end of the expandable and contractable member (36) and a lower lead portion (39) on the lower end of the expandable and contractable member (36), the lead portions (39) being cylindrical members connected to the riser (34).

10. The tubular assembly of claim 9, characterized in that wherein the expandable and contractable member (36) axially expands and contracts an amount greater per linear increment than the lead (39).

11. The tubular assembly of any of claims 1-10, characterized in that the tubular assembly further comprises a support sleeve (58) circumscribing at least a portion of the expandable and contractable member (36).

12. A compensating casing sub mechanically attachable between a platform (20) and a subsea wellhead assembly (30), the compensating casing sub comprising:

a tubular body (36) having an axis; and

characterized in that the body comprises a series of expandable and/or foldable segments integrally formed in the body (36) circumscribing the axis and sequentially arranged along a length of the body (36), so as to allow the body (36) to elastically elongate and contract.

13. The compensating casing sub of claim 12, characterized in that wherein the segments lie in a plane substantially perpendicular to the casing sub axis.

14. The compensating casing sub of any of claims 12 and 13, characterized in that wherein the foldable segments are defined by slots (40) alternatingly formed about an inner circumference and an outer circumference of the body (36).

15. The compensating casing sub of any of claims 12-14, characterized in that wherein the foldable segments form a bellows like configuration.

16. The compensating casing sub of any of claims 12-15, characterized in that wherein the foldable segments and the tubular body (36) are formed from a single piece of steel.

17. The compensating casing sub of any of claims 12-14, characterized in that wherein the foldable segments are defined by a series of slots (40) along the wall length alternatingly formed about the wall (38) inner circumference and about the wall (38) outer circumference, each slot (40) lying in a plane substantially perpendicular to the member axis.

18. The compensating casing sub of any of claims 12-14, characterized in that the casing sub further comprises a support sleeve (58) circumscribing at least a portion of the foldable segments.

19. A method of connecting a subsea wellhead assembly (30) and a surface platform (20), comprising:

assembling a tubular assembly (36) extending between the subsea wellhead assembly (30) and the surface platform (20); and

characterized in that an axially expandable and/or contractable tubular member (36) is installed in series with the tubular assembly.

20. The method of claim 19, characterized in that the method further comprises securing the riser (34) and tubular member (36) in tension or compression between the subsea wellhead (30) assembly and the platform (20).

21. The method of any of claims 19-20, characterized in that the method further comprises providing foldable segments on the tubular member (36), wherein the segments are defined by slots (40) alternatingly formed about an inner circumference and an outer circumference of the member (36).

22. The method of any of claims 19-21, characterized in that wherein the tubular member includes a wall along its length, the method further comprising providing a series of slots (40) along the wall (38) length alternatingly formed about the wall (38) inner circumference and about the wall (38) outer circumference, each slot (40) lying in a plane substantially perpendicular to the member axis.

CLAIMS

WHAT IS CLAIMED IS:

1. A subsea well production assembly, comprising:
a subsea wellhead;

a well production casing assembly having one end connected to the subsea wellhead and comprising:

an upper casing string;

a lower casing string; and

a tubular compensating member comprising an upper end connected to a lower end of the upper casing string, a lower end connected to an upper end of the lower casing string, and a steel body having a wall with undulation that are changeable between a compressed configuration and an elongate configuration; wherein

the undulations in the wall comprise a series of helical slots along a length of the wall alternatingly formed about an inner circumference and about an outer circumference of the wall, each helical slot lying in a plane substantially perpendicular to an axis of the compensating member, the helical slots defining a series of cantilevers along a length of the body that are bendable when the body is axially compressed and that are bendable when the body is axially elongated; and

the upper casing string is supported in tension, and the body transmits the tension to the lower casing string.

2. The assembly of claim 1, wherein the cantilevers in the wall comprise annular foldable segments coaxially stacked along an axis of the compensating member.

3. The assembly of claim 2, wherein the foldable segments have an “S” shaped cross section.

4. The assembly of claim 1, wherein said one end of the production casing assembly comprises a lower end, and wherein an upper end of the production casing assembly supported by a platform.

5. The assembly of claim 1, wherein the helical slots in the wall comprise helical grooves.

6. The assembly of claim 1 further comprising an upper lead portion on the upper end of the compensating member and a lower lead portion on the lower end of the compensating member the upper and lower portions being cylindrical members having threads that are connected to the upper casing string and the lower casing string.

7. The assembly of claim 6, wherein the compensating member axially expands and contracts an amount greater per linear increment than the lead portions.

8. The assembly of claim 1 further comprising a support sleeve circumscribing at least a portion of the compensating member, the support sleeve being free of any of the tension transmitted from the casing string to the lower casing string.

9. A compensating casing sub for attachment into a well casing string that connects to a subsea wellhead assembly, the compensating casing sub comprising:
a steel tubular body having an axis and a cylindrical wall concentric with the axis;

a plurality of circumferentially extending annular helical inner slots formed within an inner diameter surface of the wall, and a plurality of circumferentially extending annular helical outer slots formed within an outer diameter surface of the wall and alternating axially with the helical inner slots, the helical inner and helical outer slots defining a series of cantilevers along a length of the body that are bendable when the body is axially compressed and bendable when the body is axially elongated;

each of the helical inner and helical outer slots being rectangular when viewed in transverse cross-section and located in a plane substantially perpendicular to the axis; and

a set of threads on each end of the body for connecting to upper and lower sections of the well casing string.

10. The compensating casing sub of claim 9, wherein the wall has a greater thickness between the inner and outer diameter surface that portion of the sub containing the threads.

11. A method of making up a production casing for a subsea well, comprising:
providing an upper casing string and a lower casing string;

providing a compensating member having a steel body with a cylindrical wall having a series of helical slots along a length of the wall alternatingly formed about an inner circumference and an outer circumference of the wall, each helical slot lying in a plane substantially perpendicular to an axis of the compensating member, the helical slots defining a series of cantilevers along a length of the body that are bendable when the body is axially compressed and that are bendable when the body is axially elongated;

connecting upper and lower ends of the compensating member in the series between the upper and lower casing strings, defining a casing string assembly;

connecting one end of the casing string, assembly to a subsea wellhead; and

applying tension to the upper casing string and transmitting the tension through the body of the compensating member to the lower casing string.

12. The method of claim 11, wherein when one of the upper and lower casing strings elongates, the compensating member compresses and wherein when one of the upper and lower casing strings compresses, the compensating member elongates.

13. The method of claim 11 wherein the cantilevers in the tubular wall comprise foldable segments.

14. The method of claim 11, wherein:

connecting one of the ends of the casing string assembly to the subsea wellhead comprises connecting, a lower end of the casing string assembly to the subsea wellhead; and the method further comprises:

connecting an upper end of the casing string assembly to a platform.