

Description

The present invention relates to an improved tubular joint with a metal seal ring positioned between interior tapered sealing surfaces on the ends of the tubular members. Prior to the present invention considerable problems have arisen when damage to either of the sealing surfaces on the tubular members has occurred. This can prevent the metal seal ring from providing the desired seal and the machining of the end of the tubular member may result in the tubular member being below tolerances for its pressure rating. This may require that the damaged tubular member be replaced or that the surface be reworked by welding and remachining.

The R. E. Latham et al Patent No. 3,404,902 discloses a joint for tubular members with a ring sealing against tapered sealing surfaces formed on the interior at the ends of both members. The sealing ring has an outer central alignment ring portion with outer end sealing surfaces and relieved surfaces between the central alignment ring portion and the sealing surfaces.

The R. L. Wilkins et al Patent No. 4,474,381 discloses a modified metal seal ring for a tubular joint with a port being provided through the seal ring from a point midway on at least one of its outer sealing surfaces to the interior of the ring to prevent damage to the tubular member sealing surface beyond that which could be sealed by a replacement seal ring.

An object of the present invention is to provide an improved tubular joint which, having had one of the tubular member's tapered sealing surface damaged, can be provided with a new sealing surface without the removal of both tubular members from their environment.

Another object is to provide an improved method of repairing the internal sealing surface at the end of a tubular member in location even when such location is underwater or otherwise remote from the operator.

According to a first aspect of the present invention there is provided a tubular joint having

a first tubular member having a central bore and a sealing surface tapering outwardly at one end of said member,

a second tubular member having a central bore and a sealing surface tapering outwardly at the end of said member facing said one end of said first tubular member,

a seal ring having a cylindrical bore and outer sealing surfaces being tapered for sealing between the sealing surfaces of the two tubular members, and

means for securing said first and second tubular members together with said seal ring in sealing

engagement with their respective sealing surfaces, and characterised by,

a recess on the interior of at least one of said tubular members extending axially inward from the inner end of the sealing surface of such tubular member,

an insert sleeve having a tubular portion which has been positioned within said recess in the tubular member following damage to one of said sealing surfaces, said sleeve having a frusto-conical portion extending outwardly both axially and radially into covering relationship to the sealing surface of said tubular member,

the insert sleeve having been cold forged into tight sealing engagement within said recess and with the sealing surface of said tubular member,

the inner surface of said frusto-conical portion of said insert sleeve having a taper mating with the taper of the seal ring whereby when said joint is held in tight engagement by said securing means said sealing ring sealingly engages the sealing surface of the tubular member which was not damaged and the sealing surface of said insert to provide a joint seal between said members.

According to a second aspect of the present invention there is provided

a method of repairing a damaged sealing surface on the interior of a subsea tubular wellhead housing at its joint end wherein the tubular housing includes an inner recess at the inner end of said sealing surface and a clamp for securing a connecting tubular member to the housing, the method being characterised by the steps of

positioning an insert sleeve having a tubular portion and a frusto-conical portion within said tubular member so that said tubular portion is within said recess and said frusto-conical portion is against the damaged sealing surface of said tubular housing, and

cold forging said insert sleeve into tight sealing engagement with said damaged sealing surface and with the interior of said recess to secure said insert sleeve to said tubular wellhead housing and to provide said housing with a sealing surface for subsequent use in making connection to said wellhead housing.

According to a third aspect of the present invention there is provided an insert sleeve repair part for location against the internal tapered end sealing surface of a tubular member, characterised by a frusto-conical portion and a tubular portion, said frusto-conical portion having an external taper to engage a damaged sealing surface of the tubular member and an internal taper to engage the tapered sealing surface of a sealing ring used to seal against said tubular member, the tubular portion being sized so that it can be cold forged into a recess on the interior of a tubular member to which

the repair part is secured.

According to a fourth aspect of the present invention there is provided a tubular joint having

a first tubular member having a central bore and a sealing surface tapering outwardly at one end of said member,

a second tubular member having a central bore and a sealing surface tapering outwardly at the end of said member facing said one of said first tubular member,

a seal ring having a cylindrical bore and outer sealing surfaces being tapered for sealing between the sealing surfaces of the two tubular members, and

means for securing said first and second tubular members together with said seal ring in sealing engagement with their respective sealing surfaces, and characterised by a recess on the interior of at least one of said tubular members extending axially inward from the inner end of the sealing surface of each tubular member,

said recess being sized and configured so that in the event that a sealing surface of one of the tubular members is damaged it can receive a insert sleeve repair part, the insert being cold forgable into tight sealing engagement within said recess and with the sealing surface of said tubular member.

The invention will be described now by way of example only, with particular reference to the accompanying drawings. In the drawings:

FIGURE 1 is a sectional view of a joint between tubular members in which the sealing surface of one of the tubular members has been damaged.

FIGURE 2 is a partial sectional view of the improved insert of the present invention being lowered into position on the damaged sealing surface of the tubular member.

FIGURE 3 is a partial sectional view of the improved insert of the present invention in position on the damaged sealing surface of the tubular member.

FIGURE 4 partial sectional view of the improved insert of the present invention having been forged in place within the tubular member with the damaged sealing surface and in covering relationship thereto.

FIGURE 5 is a sectional view of the completed joint with the improved sealing surface insert installed in sealing relationship between the two tubular members as shown in FIGURE 4.

FIGURE 6 is a partial sectional view of the damaged tubular member with the improved insert thereon and with the forging tool shown in position to forge the insert into tight sealing engagement within the tubular member.

FIGURE 7 is a partial sectional view of a modified form of insert of the present invention

forged into tight sealing and engaging position within the damaged tubular member, and

FIGURE 8 is a partial sectional view of another form of insert in accordance with the present invention.

In FIGURE 1, tubular wellhead housing 10 is shown connected to tubular connector 12 by a suitable external clamp 13 and having sealing ring 14 positioned between the inner tapered sealing surfaces 16 and 18 on the ends of housing 10 and connector 12. In this illustration, sealing surface 16 has been damaged and a new sealing surface needs to be provided for sealing of the joint between housing 10 and connector 12.

In order to repair the joint and ensure a good seal, it has been the practice to remove the wellhead housing from its location and correct the damaged portion of its sealing surface 16 by adding weld metal and remachining surface 16 to its desired smoothness and taper.

Sleeve 20 includes lower tubular portion 22 connected to upper tapered portion 24 which tapers outwardly and upwardly so that its outer surface 26 substantially mates with sealing surface 16 on housing 10. Lower tubular portion 22 of sleeve 20 is provided with reduced neck 28 connecting it to upper tapered portion 24. Lower portion 22 when sleeve 20 is in position is immediately within but spaced from recess 30 on the interior of housing 10 immediately below original sealing surface 16. Recess 30 includes a series of grooves 32 into which lower portion 22 of sleeve 20 is to be forged as hereinafter described. Test port 34 extends through housing 10 to detect any leakage past sleeve 20. A volume compensating material 21 may be bonded to the exterior of sleeve 20 (FIGURE 2) or in grooves 32 in housing 10 (FIGURE 4) so that during its forging, liquids trapped between sleeve 20 and housing 10 will not prevent the proper forging of sleeve 20 into tight engagement with sealing surface 16 and the interior of recess 30. Such volume compensating material is any suitable material which contains voids which will compress when exposed to forging pressures. Examples of such material is syntactic foam, microspheres in an epoxy matrix or a hollow metal O ring.

With sleeve 20 in position as shown in FIGURE 3, tool T is lowered so that it engages upper face 38 of housing 10 and the interior surface 40 of housing 10 below sleeve 20 as shown in FIGURE 6. With sleeve 20 on sealing surface 16 and remote actuated clamp retaining tool T in position, tool T is actuated so that its resilient sleeve 42 is exposed to pressure on its interior and exerts a very substantial forging pressure on the interior of sleeve 20 forcing it into tight sealing engagement with sealing surface 16 and recess 30.

When the cold forging is completed, forming pressure on tool T is released and test pressure is applied to the interior of insert sleeve 20 between a seal against surface 38 and another seal against the interior surface 40 of housing 10 below sleeve 20 and any leakage is conducted through port 34 and line 35 to be detected at the remote location (the surface) port. Upon completion of testing line 35 is disconnected from housing 10 and is retrieved together with the retrieval of tool T from within housing 10. Sleeve 20 has been forged into tight sealing engagement with surface 16 and within recess 30 on housing 10. This engagement is especially tight in view of the sharp inwardly facing corners 43 on the lands which are positioned between the grooves 32 within recess 30. As can be seen in FIGURE 4, such sharp corners 43 dig into the exterior of tubular portion 22 of sleeve 20 to ensure the tight sealing and gripping engagement of sleeve 20 with the interior of housing 10. Further, the effectiveness of this sealing engagement has been tested subsequent to the forging of sleeve 20.

Thereafter, seal ring 44 and connector 12 are lowered into position on housing 10. As shown in FIGURE 5, seal ring 44 includes upper sealing surface 46 which is tapered to mate with sealing surface 18 on connector 12 and lower sealing surface 48 which is tapered to mate with tapered sealing surface 50 on the interior of sleeve 20. As can be seen by a comparison of FIGURES 1 and 5, seal ring 44 rather than having symmetrical sealing surfaces, is shaped to mate with interior conical sealing surface 50 on sleeve 20 which is positioned on sealing surface 16 of housing 10. When connector 12 is secured to housing 10 by clamp 13 with seal ring 44 therebetween the joint is complete and will seal properly.

A modified form of the present invention is shown in FIGURE 7. Tubular wellhead housing 60 includes tapered inner sealing surface 62 on its end which is secured to connector 64 and sealing ring 66 is positioned between housing 60 and connector 64. Insert sleeve 68 of a modified form has been cold forged into tight gripping and sealing engagement with the damaged sealing surface 70 of housing 60 and with the interior surface 72 of recess 74 as shown. It should be noted that insert sleeve 68 includes tapered portion 76 which tapers to mate with the taper of sealing surface 62 on the interior of the end of housing 60 and tubular portion 78 which is adapted to be received within recess 74 which is positioned immediately within sealing surface 62 as shown and has a diameter sufficient to accommodate the thickness of tubular portion 78 therein so that when insert sleeve 68 is forged into recess 74 the inner diameter of insert sleeve 68 does not differ from the inner diameter of the remainder of housing 60. Tubular portion 78 of

insert sleeve 68 includes grooves 80 around its exterior surface to form a plurality of annular sharp teeth 82 which are moved into tight gripping and sealing engagement with the interior surface of recess 74 in housing 60. Suitable volume compensating material, such as previously described, is used in grooves 80 to ensure that fluids trapped between the exterior of insert sleeve 68 and interior surface 72 of recess 74 do not interfere with the forming of tubular portion 78 of sleeve 68.

The cold forging of modified insert sleeve 68 is performed as described previously herein with respect to insert sleeve 20. After cold forging, insert sleeve 68 provides inner sealing surface 84 against which sealing ring 66 may seal to provide a tight joint between subsea wellhead housing 60 and its tubular connector 64 without having to remove wellhead housing 60 from its subsea position to renew its sealing surface 62 after it has been damaged.

Another modified form of the present invention is shown in FIGURE 8. Tubular wellhead housing 90 includes tapered inner sealing surface 92 on its end which is secured to connector 94 and sealing ring 96 is positioned between housing 90 and connector 94. Insert sleeve 98 is substantially the same as insert sleeve 20, previously described, and includes tapered sealing portion 100 and tubular portion 102. The exterior of tapered sealing portion 100 is seated on tapered surface 104 of housing 90 and tubular portion 102 has been cold forged into tight, sealing and gripping engagement with lands 106 formed between grooves 108 in the surface of recess 110. Volume compensating material, such as that previously described, is preferred to be positioned in grooves 108 to ensure the cold forging of tubular portion 102 of insert sleeve 98 is not in any way affected by the presence of fluids within housing 90. Seal ring 112 is positioned within groove 114 in recess 110 and is sufficiently large that it comes into sealing engagement with the exterior of tubular portion 102 of insert sleeve 98 when it has been cold forged into position. Test port 116 communicates through housing 90 from within recess 110 immediately above seal ring 112 so that the sealing of tubular portion 102 and lands 106 can be checked as described above.

Claims

1. A tubular joint having

a first tubular member (10; 68; 90) having a central bore and a sealing surface (16; 62, 92) tapering outwardly at one end of said member,

a second tubular member (12; 64; 94) having a central bore and a sealing surface (18) tapering outwardly at the end of said member



When the cold forging is completed, forming pressure on tool T is released and test pressure is applied to the interior of insert sleeve 20 between a seal against surface 38 and another seal against the interior surface 40 of housing 10 below sleeve 20 and any leakage is conducted through port 34 and line 35 to be detected at the remote location (the surface) port. Upon completion of testing line 35 is disconnected from housing 10 and is retrieved together with the retrieval of tool T from within housing 10. Sleeve 20 has been forged into tight sealing engagement with surface 16 and within recess 30 on housing 10. This engagement is especially tight in view of the sharp inwardly facing corners 43 on the lands which are positioned between the grooves 32 within recess 30. As can be seen in FIGURE 4, such sharp corners 43 dig into the exterior of tubular portion 22 of sleeve 20 to ensure the tight sealing and gripping engagement of sleeve 20 with the interior of housing 10. Further, the effectiveness of this sealing engagement has been tested subsequent to the forging of sleeve 20.

Thereafter, seal ring 44 and connector 12 are lowered into position on housing 10. As shown in FIGURE 5, seal ring 44 includes upper sealing surface 46 which is tapered to mate with sealing surface 18 on connector 12 and lower sealing surface 48 which is tapered to mate with tapered sealing surface 50 on the interior of sleeve 20. As can be seen by a comparison of FIGURES 1 and 5, seal ring 44 rather than having symmetrical sealing surfaces, is shaped to mate with interior conical sealing surface 50 on sleeve 20 which is positioned on sealing surface 16 of housing 10. When connector 12 is secured to housing 10 by clamp 13 with seal ring 44 therebetween the joint is complete and will seal properly.

A modified form of the present invention is shown in FIGURE 7. Tubular wellhead housing 60 includes tapered inner sealing surface 62 on its end which is secured to connector 64 and sealing ring 66 is positioned between housing 60 and connector 64. Insert sleeve 68 of a modified form has been cold forged into tight gripping and sealing engagement with the damaged sealing surface 70 of housing 60 and with the interior surface 72 of recess 74 as shown. It should be noted that insert sleeve 68 includes tapered portion 76 which tapers to mate with the taper of sealing surface 62 on the interior of the end of housing 60 and tubular portion 78 which is adapted to be received within recess 74 which is positioned immediately within sealing surface 62 as shown and has a diameter sufficient to accommodate the thickness of tubular portion 78 therein so that when insert sleeve 68 is forged into recess 74 the inner diameter of insert sleeve 68 does not differ from the inner diameter of the remainder of housing 60. Tubular portion 78 of

insert sleeve 68 includes grooves 80 around its exterior surface to form a plurality of annular sharp teeth 82 which are moved into tight gripping and sealing engagement with the interior surface of recess 74 in housing 60. Suitable volume compensating material, such as previously described, is used in grooves 80 to ensure that fluids trapped between the exterior of insert sleeve 68 and interior surface 72 of recess 74 do not interfere with the forming of tubular portion 78 of sleeve 68.

The cold forging of modified insert sleeve 68 is performed as described previously herein with respect to insert sleeve 20. After cold forging, insert sleeve 68 provides inner sealing surface 84 against which sealing ring 66 may seal to provide a tight joint between subsea wellhead housing 60 and its tubular connector 64 without having to remove wellhead housing 60 from its subsea position to renew its sealing surface 62 after it has been damaged.

Another modified form of the present invention is shown in FIGURE 8. Tubular wellhead housing 90 includes tapered inner sealing surface 92 on its end which is secured to connector 94 and sealing ring 96 is positioned between housing 90 and connector 94. Insert sleeve 98 is substantially the same as insert sleeve 20, previously described, and includes tapered sealing portion 100 and tubular portion 102. The exterior of tapered sealing portion 100 is seated on tapered surface 104 of housing 90 and tubular portion 102 has been cold forged into tight, sealing and gripping engagement with lands 106 formed between grooves 108 in the surface of recess 110. Volume compensating material, such as that previously described, is preferred to be positioned in grooves 108 to ensure the the cold forging of tubular portion 102 of insert sleeve 98 is not in any way affected by the presence of fluids within housing 90. Seal ring 112 is positioned within groove 114 in recess 110 and is sufficiently large that it comes into sealing engagement with the exterior of tubular portion 102 of insert sleeve 98 when it has been cold forged into position. Test port 116 communicates through housing 90 from within recess 110 immediately above seal ring 112 so that the sealing of tubular portion 102 and lands 106 can be checked as described above.

Claims

1. A tubular joint having
 - a first tubular member (10; 68; 90) having a central bore and a sealing surface (16; 62, 92) tapering outwardly at one end of said member,
 - a second tubular member (12; 64; 94) having a central bore and a sealing surface (18) tapering outwardly at the end of said member



facing said one end of said first tubular member,

a seal ring (44; 66; 96) having a cylindrical bore and outer sealing surfaces (46, 48) being tapered for sealing between the sealing surfaces of the two tubular members, and

means (13) for securing said first and second tubular members together with said seal ring in sealing engagement with their respective sealing surfaces, and characterised by,

a recess on the interior of at least one of said tubular members (30; 74; 110) extending axially inward from the inner end of the sealing surface of such tubular member,

an insert sleeve (20; 68; 98) having a tubular portion (22; 78; 102) which has been positioned within said recess (30; 74; 110) in the tubular member following damage to one of said sealing surfaces, said sleeve having a frusto-conical portion (24; 76; 100) extending outwardly both axially and radially into covering relationship to the sealing surface of said tubular member,

the insert sleeve (20; 68; 95) having been cold forged into tight sealing engagement within said recess and with the sealing surface of said tubular member,

the inner surface of said frusto-conical portion (24; 76; 100) of said insert sleeve having a taper mating with the taper of the seal ring (44; 66; 96) whereby when said joint is held in tight engagement by said securing means (13) said sealing ring (44; 66; 90) sealingly engages the sealing surface of the tubular member which was not damaged and the sealing surface of said insert (20; 68; 98) to provide a joint seal between said members (10, 12).

2. A tubular joint according to claim 1 including at least one groove (32; 108) on the interior of said recess (30; 110) against which the exterior of said tubular portion of said insert sleeve (20; 98) is cold forged.
3. A tubular joint according to claim 2 including a plurality of grooves (108) on the interior of said recess and
the lands (106) between said grooves having inwardly facing sharp corners for gripping engagement with the exterior surface of the tubular portion (102) of said insert sleeve when said insert sleeve is cold forged into said recess.
4. A tubular joint according to claim 1 including a volume compensating material (21) positioned between the tubular portion (22; 78; 102) of said sleeve and the interior surface of said

recess of said one of said tubular members.

5. A tubular joint according to claim 4, wherein said volume compensating material (21) is positioned against the exterior of the tubular portion (22) of said sleeve.
6. A tubular joint according to claim 4 wherein said volume compensating material (21) is positioned within said recess (30; 74; 110).
7. A tubular joint according to claim 1 including a plurality of annular sharp teeth (82) on the exterior of the tubular portion (78) of said insert sleeve (68) whereby when said insert sleeve is cold forged into said recess (74) said annular sharp teeth are moved into tight gripping and sealing engagement with the interior surface of said recess.
8. A tubular joint according to claim 1 including a test portion (34; 116) through the tubular member having the internal recess, said test port communicating with the interior of said tubular member (10; 60; 90) at the exterior junction between the frusto-conical portion and the tubular portion of said insert sleeve (20; 68; 98).
9. A tubular joint according to claim 1 including a test port (116) through the tubular member (90) having the internal recess (110), and
a seal ring (112) positioned for sealing between the lower end of said tubular portion (102) of said sleeve and said recess,
said test portion (116) communication with said recess immediately above said seal ring (112).
10. A method of repairing a damaged sealing surface on the interior of a subsea tubular wellhead housing at its joint end wherein the tubular housing (10, 60, 90) includes an inner recess (30; 74; 110) at the inner end of said sealing surface and a clamp (13) for securing a connecting tubular member to the housing, the method being characterised by the steps of
positioning an insert sleeve (20; 68; 98) having a tubular portion (22; 78; 102) and a frusto-conical portion (24; 76; 100) within said tubular member so that said tubular portion is within said recess (30; 74; 100) and said frusto-conical portion is against the damaged sealing surface of said tubular housing, and
cold forging said insert sleeve (20; 68; 98) into tight sealing engagement with said damaged sealing surface and with the interior of said recess to secure said insert sleeve to said tubular wellhead housing and to provide said



housing with a sealing surface for subsequent use in making connection to said wellhead housing.

11. A method according to claim 10 including the step of
initially removing the connecting tubular member (12, 64, 94),
a seal ring (44; 66; 96) and the clamp (13) from the tubular housing. 10
12. A method according to claim 10 including the steps of
pressure testing the sealing of said insert sleeve (20; 68; 98) against said recess in said tubular member. 15
13. An insert sleeve repair part (20; 68; 98) for location against the internal tapered end sealing surface of a tubular member, characterised by a frusto-conical portion (24; 76; 100) and a tubular portion (22; 78; 102), said frusto-conical portion having an external taper to engage a damaged sealing surface of the tubular member and an internal taper to engage the tapered sealing surface of a sealing ring (44; 66; 96) used to seal against said tubular member, the tubular portion (22; 78; 102) being sized so that it can be cold forged into a recess (30; 74; 110) on the interior of a tubular member to which the repair part is secured. 20 25 30
14. An insert sleeve repair part according to claim 13, including a plurality of sharp teeth (82) on the exterior of said tubular portion. 35
15. An insert sleeve repair part according to claim 13, including a volume compensating material (21) positioned on the exterior of the tubular portion (22; 78; 102) of the sleeve. 40
16. A tubular joint having
a first tubular member (10; 68; 90) having a central bore and a sealing surface (16; 62; 92) tapering outwardly at one end of said member, 45
a second tubular member (12; 64; 94) having a central bore and a sealing surface (18) tapering outwardly at the end of said member facing said one of said first tubular member, 50
a seal ring (44; 66; 96) having a cylindrical bore and outer sealing surfaces (46, 48) being tapered for sealing between the sealing surfaces of the two tubular members, and
means (13) for securing said first and second tubular members together with said seal ring in sealing engagement with their respective sealing surfaces, and characterised by a 55

recess on the interior of at least one of said tubular members (30; 74; 110) extending axially inward from the inner end of the sealing surface of each tubular member,

said recess (30; 74; 110) being sized and configured so that in the event that a sealing surface of one of the tubular members is damaged it can receive a insert sleeve repair part according to any one of claims 13 to 15, the insert being cold forgable into tight sealing engagement within said recess and with the sealing surface of said tubular member.

Patentansprüche

1. Rohrverbindung mit einem ersten Rohrteil (10; 68, 90) mit einer zentralen Bohrung und einer Dichtungsfläche (16; 62, 92), die an einem Ende des Teils schräg nach außen verläuft, einem zweiten Rohrteil (12; 64; 94) mit einer zentralen Bohrung und einer Dichtungsfläche (18), die an dem Ende des Bauteils schräg nach außen verläuft und dem einen Ende des ersten Rohrteils gegenüberliegt, einem Dichtungsring (44; 66; 96) mit einer zylindrischen Bohrung und äußeren Dichtungsflächen (46, 48), die zur Abdichtung zwischen den Dichtungsflächen der zwei Rohrteile schräg verlaufen, und einer Einrichtung (13) zum Befestigen des ersten und des zweiten Rohrteils aneinander mit dem Dichtungsring in abdichtendem Eingriff mit den jeweiligen Dichtungsflächen, gekennzeichnet durch
eine Aussparung im Inneren von wenigstens einem Rohrteil (30, 74; 110), die sich axial einwärts von dem inneren Ende der Dichtungsfläche des Rohrteils erstreckt,
eine Einsatzhülse (20; 68; 98) mit einem rohrförmigen Abschnitt (22; 78; 102), der innerhalb der Aussparung (30; 74; 110) in dem Rohrteil nach Beschädigung einer der Dichtungsflächen positioniert wird, wobei die Hülse einen kegelstumpfförmigen Abschnitt (24; 76; 100) hat, der sich axial und radial nach außen in eine überdeckende Beziehung zu der Dichtungsfläche des Rohrteils erstreckt,
wobei die Einsatzhülse (20; 68; 95) in festen Dichtungseingriff in der Aussparung und mit der Dichtungsfläche des Rohrteils kaltverformt ist und die Innenfläche des kegelstumpfförmigen Abschnitts (24; 76; 100) der Einsatzhülse eine Neigung hat, die mit der Neigung des Dichtungsring (44; 66; 96) übereinstimmt, wodurch dann, wenn die Verbindung von der Befestigungseinrichtung (13) in festem Eingriff gehalten ist, der Dichtungsring (44; 66; 90) abdichtend an der Dichtungsfläche des Rohrteils anliegt, die nicht beschädigt war, und an



der Dichtungsfläche des Einsatzes (20; 68; 98) um eine Verbindungsdichtung zwischen den Teilen (10, 12) hervorzurufen.

2. Rohrverbindung nach Anspruch 1, mit wenigstens einer Nut (32; 108) an dem Inneren der Aussparung (30; 110), gegen die das Äußere des rohrförmigen Abschnitts der Einsatzhülse (20, 98) kaltverformt wird.
3. Rohrverbindung nach Anspruch 2, mit mehreren Nuten (108) an dem Inneren der Aussparung und vorstehenden Abschnitten (106) zwischen den Nuten mit einwärts gerichteten scharfen Ecken zum Klemmeingriff mit der Außenfläche des rohrförmigen Abschnitts (102) der Einsatzhülse, wenn diese in die Aussparung kaltverformt wird.
4. Rohrverbindung nach Anspruch 1, mit einem Volumenkompensationsmaterial (21), das zwischen dem rohrförmigen Abschnitt (22; 78; 102) der Hülse und der Innenfläche der Aussparung des einen Rohrteiles angeordnet wird.
5. Rohrverbindung nach Anspruch 4, wobei das Volumenkompensationsmaterial (21) gegen das Äußere des rohrförmigen Abschnitts (229 der Hülse positioniert ist.
6. Rohrverbindung nach Anspruch 4, wobei das Volumenkompensationsmaterial (21) innerhalb der Aussparung (30; 74; 110) positioniert ist.
7. Rohrverbindung nach Anspruch 1, mit mehreren ringförmigen scharfen zähnen (82) an dem Äußeren des rohrförmigen Abschnitts (78) der Einsatzhülse (68), wobei nach Kaltverformung der Einsatzhülse in die Aussparung (74) die ringförmigen scharfen Zähne in festen Greif- und Dichtungseingriff mit der Innenfläche der Aussparung bewegt werden.
8. Rohrverbindung nach Anspruch 1, mit einer Testöffnung (34; 116) durch das Rohrteil mit der inneren Aussparung, wobei die Testöffnung mit dem Inneren des Rohrteils (10; 60; 90) an der äußeren Verbindung zwischen dem kegelstumpfförmigen Abschnitt und dem rohrförmigen Abschnitt der Einsatzhülse (20, 68; 98) in Verbindung steht.
9. Rohrverbindung nach Anspruch 1, mit einer Testöffnung (116) durch das Rohrteil (90) mit der inneren Aussparung (110), und einem Dichtungsring (112), der zur Abdichtung zwischen dem unteren Ende des rohrförmigen Abschnitts (102) der Hülse und der Ausspa-

rung angeordnet ist, wobei die Testöffnung (116) mit der Aussparung unmittelbar oberhalb des Dichtungsring (112) in Verbindung steht.

- 5 10. Verfahren zum Reparieren einer beschädigten Dichtungsfläche an dem Inneren eines rohrförmigen Unterwasser-Bohrkopfgehäuses an dessen Verbindungsende, wobei das rohrförmige Gehäuse (10, 60, 90) eine innere Aussparung (30; 74; 110) an dem inneren Ende der Dichtungsfläche und eine Klemmeinrichtung (13) zur Befestigung eines rohrförmigen Verbindungsteils an dem Gehäuse aufweist, wobei das Verfahren durch folgende Schritte gekennzeichnet ist: Positionieren einer Einsatzhülse (20; 68; 98) mit einem rohrförmigen Abschnitt (22; 78; 102) und einem kegelstumpfförmigen Abschnitt (24; 76; 100) innerhalb des Rohrteils, so daß der rohrförmige Abschnitt sich innerhalb der Aussparung (30; 74; 100) befindet und der kegelstumpfförmige Abschnitt an der beschädigten Dichtungsfläche des rohrförmigen Gehäuses anliegt, und Kaltverformen der Einsatzhülse (20; 68; 98) in festen Dichtungseingriff mit der beschädigten Dichtungsfläche und mit dem Inneren der Aussparung, um die Einsatzhülse an dem rohrförmigen Bohrkopfgehäuse zu befestigen und um das Gehäuse mit einer Dichtungsfläche zur Herstellung einer nachfolgenden Verbindung mit dem Bohrkopfgehäuse zu versehen.
- 10 11. Verfahren nach Anspruch 10, mit dem Schritt des anfänglichen Entferns des rohrförmigen Verbindungsteils (12, 64, 94), eines Dichtungsring (44; 66; 96) und der Klemmeinrichtung (13) von dem rohrförmigen Gehäuse.
- 15 12. Verfahren nach Anspruch 10, mit dem Schritt des Drucktestens der Dichtung der Einsatzhülse (20; 68; 98) gegen die Aussparung des Rohrteils.
- 20 13. Einsatzhülsenreparatur (20; 68; 98) zur Anordnung gegen die innere konische Enddichtungsfläche eines Rohrteils, gekennzeichnet durch einen kegelstumpfförmigen Abschnitt (24; 76; 100) und einen rohrförmigen Abschnitt (22; 78; 102), wobei der kegelstumpfförmige Abschnitt eine äußere Neigung hat, um an einer beschädigten Dichtungsfläche des Rohrteils anzuliegen, und eine innere Neigung, um an der schrägen Dichtungsfläche eines Dichtungsring (44; 66; 96) anzuliegen, der verwendet wird, um gegen das Rohrteil abzudichten, wobei ferner der rohrförmige Abschnitt (22; 78; 102) so bemessen ist, daß er in eine Aussparung (30, 74; 110) an
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dem Inneren eines Rohrteils, an dem das Reparaturteil befestigt wird, kaltverformt wird.

14. Einsatzhülse-Reparaturteil nach Anspruch 13, mit mehreren scharfen Zähnen (82) an dem Äußeren des rohrförmigen Abschnitts. 5
15. Einsatzhülse-Reparaturteil nach Anspruch 13, mit einem Volumenkompensationsmaterial (21), das auf der Außenseite des rohrförmigen Abschnitts (22, 78, 102) der Hülse positioniert wird. 10
16. Rohrverbindung mit einem ersten Rohrteil (10; 68; 90) mit einer zentralen Bohrung und einer Dichtungsfläche (16; 62; 92), die an einem Ende des Teils konisch nach außen verläuft, einem zweiten Rohrteil (12; 64; 94) mit einer zentralen Bohrung und einer Dichtungsfläche (18), die an dem Ende des Teils konisch nach außen verläuft und dem ersten Rohrteil gegenüberliegt, einem Dichtungsring (44; 66; 96) mit einer zylindrischen Bohrung und äußeren Dichtungsflächen (46, 48) die zur Abdichtung zwischen den Dichtungsflächen der zwei Rohrteile konisch verlaufen, und einer Einrichtung (13) zum Befestigen des ersten und des zweiten Rohrteils aneinander mit dem Dichtungsring in Dichtungseingriff mit den jeweiligen Dichtungsflächen, 20
gekennzeichnet durch eine Aussparung an dem Inneren wenigstens eines der Rohrteile (30; 74; 110), die sich axial einwärts von dem inneren Ende der Dichtungsfläche jedes Rohrteils erstreckt, wobei die Aussparung (30; 74; 110) so bemessen und gestaltet ist, daß im Falle der Beschädigung einer Dichtungsfläche eines der Rohrteile die Aussparung ein Einsatzhülse-Reparaturteil nach jedem der Ansprüche 13 bis 15 aufnehmen kann, wobei der Einsatz in festen Dichtungseingriff mit der Aussparung und mit der Dichtungsfläche des Rohrteils kaltverformbar ist. 25
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Revendications

1. Joint tubulaire comprenant :

un premier élément tubulaire (18 ; 68 ; 90) qui comporte un alésage central et une surface d'étanchéité (16 ; 62 ; 92) inclinée vers l'extérieur au niveau d'une extrémité dudit élément ; 50

un second élément tubulaire (12 ; 64 ; 94) qui comporte un alésage central et une surface d'étanchéité (18) inclinée vers l'extérieur au niveau de l'extrémité dudit élément qui fait face à ladite extrémité dudit premier élément 55

tubulaire ;

une bague d'étanchéité (44 ; 66 ; 96) qui comporte un alésage cylindrique et des surfaces externes d'étanchéité (46,48) qui sont inclinées en vue d'assurer l'étanchéité entre les surfaces d'étanchéité des deux éléments tubulaires ; et

un moyen (13) pour fixer lesdits premier et second éléments tubulaires à ladite bague d'étanchéité selon un contact d'étanchéité avec leurs surfaces d'étanchéité respectives, et caractérisé en ce que :

un évidement ménagé sur l'intérieur d'au moins l'un desdits éléments tubulaires (30 ; 74 ; 110) s'étend axialement vers l'intérieur depuis l'extrémité interne de la surface d'étanchéité de cet élément tubulaire ;

un manchon d'insertion (20 ; 68 ; 98) qui comporte une partie tubulaire (22 ; 78 ; 102) est positionné dans ledit évidement (30 ; 74 ; 110) ménagé dans l'élément tubulaire suite à un endommagement de l'une desdites surfaces d'étanchéité, ledit manchon comportant une partie tronconique (24 ; 76 ; 100) qui s'étend vers l'extérieur à la fois axialement et radialement de façon à recouvrir la surface d'étanchéité dudit élément tubulaire ;

le manchon d'insertion (20 ; 68 ; 98) est forgé à froid de façon à être amené en contact d'étanchéité intime avec l'intérieur dudit évidement et avec la surface d'étanchéité dudit élément tubulaire ;

la surface interne de ladite partie tronconique (24 ; 76 ; 100) dudit manchon d'insertion présente une inclinaison qui correspond à l'inclinaison de la bague d'étanchéité (44 ; 66 ; 96) et ainsi, lorsque ledit joint est maintenu selon un contact intime par ledit moyen de fixation (14), ladite bague d'étanchéité (44 ; 66 ; 96) entre en contact de façon étanche avec la surface d'étanchéité de l'élément tubulaire qui n'est pas endommagée et avec la surface d'étanchéité dudit manchon d'insertion (20 ; 68 ; 98) afin de constituer un joint d'étanchéité entre lesdits éléments (10, 12). 45
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2. Joint tubulaire selon la revendication 1, incluant au moins une gorge (32 ; 108) ménagée sur l'intérieur dudit évidement (30, 110) et contre laquelle l'extérieur de ladite partie tubulaire dudit manchon d'insertion (20 ; 98) est forgée à froid. 55



3. Joint tubulaire selon la revendication 2, incluant une pluralité de gorges (108) ménagées sur l'intérieur dudit évidement ; et

des zones d'appui (106) situées entre lesdites gorges comportant des arêtes vives qui sont tournées vers l'intérieur pour entrer en contact d'accrochage avec la surface extérieure de la partie tubulaire (102) dudit manchon d'insertion lorsque ledit manchon d'insertion est forgé à froid dans ledit évidement.

4. Joint tubulaire selon la revendication 1, incluant un matériau de compensation de volume (21) positionné entre la partie tubulaire (22 ; 78 ; 102) dudit manchon et la surface intérieure dudit évidement dudit un desdits éléments tubulaires.

5. Joint tubulaire selon la revendication 4, dans lequel ledit matériau de compensation de volume (21) est positionné contre l'extérieur de la partie tubulaire (22) dudit manchon.

6. Joint tubulaire selon la revendication 4, dans lequel ledit matériau de compensation de volume (21) est positionné à l'intérieur dudit évidement (30 ; 74 ; 110).

7. Joint tubulaire selon la revendication 1, incluant une pluralité de dents pointues annulaires (82) prévues sur l'extérieur de la partie tubulaire (78) dudit manchon d'insertion (68) si bien que, lorsque ledit manchon d'insertion est forgé à froid dans ledit évidement (74), lesdites dents pointues annulaires sont déplacées de manière à venir en contact d'accrochage intime et d'étanchéité intime avec la surface intérieure dudit évidement.

8. Joint tubulaire selon la revendication 1, incluant un orifice d'essai (34 ; 116) ménagé à travers l'élément tubulaire qui comporte l'évidement interne, ledit orifice d'essai communiquant avec l'intérieur dudit élément tubulaire (10 ; 60 ; 90) au niveau de la jonction externe de la partie tronconique avec la partie tubulaire dudit manchon d'insertion (20 ; 68 ; 98).

9. Joint tubulaire selon la revendication 1, incluant un orifice d'essai (116) ménagé à travers l'élément tubulaire (90) qui comporte l'évidement interne (110) ; et

une bague d'étanchéité (112) positionnée pour assurer l'étanchéité entre l'extrémité inférieure de ladite partie tubulaire (102) dudit manchon et dudit évidement ;

ladite partie d'essai (116) communiquant avec ledit évidement immédiatement au-dessus de ladite bague d'étanchéité (112).

10. Procédé de réparation d'une surface d'étanchéité endommagée située sur l'intérieur d'un boîtier tubulaire, sous-marin, de tête de puits, au niveau de son extrémité de jonction, dans lequel le boîtier tubulaire (10 ; 60 ; 90) inclut un évidement interne (30 ; 74 ; 110) au niveau de l'extrémité interne de ladite surface d'étanchéité et une bride (13) pour fixer un élément tubulaire de connexion au boîtier, le procédé étant caractérisé par les étapes de :

positionnement d'un manchon d'insertion (20 ; 68 ; 98) qui comporte une partie tubulaire (22 ; 78 ; 102) et une partie tronconique (24 ; 76 ; 100) à l'intérieur dudit élément tubulaire de telle sorte que ladite partie tubulaire soit située à l'intérieur dudit évidement (30 ; 74 ; 110) et que ladite partie tronconique soit placée contre la surface d'étanchéité endommagée dudit boîtier tubulaire ; et

forgeage à froid dudit manchon d'insertion (20 ; 68 ; 98) pour l'amener en contact intime d'étanchéité avec ladite surface d'étanchéité endommagée et avec l'intérieur dudit évidement afin de fixer ledit manchon d'insertion audit boîtier tubulaire de tête de puits et d'assurer audit boîtier une surface d'étanchéité en vue d'une utilisation ultérieure en effectuant une connexion audit boîtier de tête de puits.

11. Procédé selon la revendication 10, incluant l'étape de :

enlèvement initial de l'élément tubulaire de connexion (12 ; 64 ; 94), d'une bague d'étanchéité (44 ; 66 ; 96) et de la bride (13) hors du boîtier tubulaire.

12. Procédé selon la revendication 10, incluant les étapes de :

essai en pression, de l'étanchéité dudit manchon d'insertion (20 ; 68 ; 98) positionné contre ledit évidement dans ledit élément tubulaire.

13. Pièce de réparation en forme de manchon d'insertion (20 ; 68 ; 98) destinée à être positionnée contre la surface inclinée, interne, d'étanchéité d'extrémité d'un élément tubulaire, caractérisée par une partie tronconique (24 ; 76 ; 100) et par une partie tubulaire (22 ; 78 ; 102), ladite partie tronconique présentant une



inclinaison externe pour venir en contact avec une surface d'étanchéité endommagée de l'élément tubulaire et une inclinaison interne pour venir en contact avec la surface inclinée d'étanchéité d'une bague d'étanchéité (44 ; 66 ; 96) utilisée pour assurer à nouveau l'étanchéité dudit élément tubulaire, la partie tubulaire (22 ; 78 ; 102) étant dimensionnée de telle sorte qu'elle puisse être forgée à froid à l'intérieur d'un évidement (30 ; 74 ; 110) ménagé sur l'intérieur d'un élément tubulaire auquel la pièce de réparation est fixée.

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14. Pièce de réparation en forme de manchon d'insertion selon la revendication 13, incluant une pluralité de dents pointues (82) prévues sur l'extérieur de ladite partie tubulaire.

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15. Pièce de réparation en forme de manchon selon la revendication 13, incluant un matériau de compensation de volume (21) positionné sur l'extérieur de la partie tubulaire (22 ; 78 ; 102) du manchon.

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16. Joint tubulaire comprenant :

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un premier élément tubulaire (10 ; 68 ; 90) qui comporte un alésage central et une surface d'étanchéité (16 ; 62 ; 92) inclinée vers l'extérieur au niveau d'une extrémité dudit élément ;

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un second élément tubulaire (12 ; 64 ; 94) qui comporte un alésage central et une surface d'étanchéité (18) inclinée vers l'extérieur au niveau de l'extrémité dudit élément qui fait face à ladite extrémité dudit premier élément tubulaire ;

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une bague d'étanchéité (44 ; 66 ; 96) qui comporte un alésage cylindrique et des surfaces externes d'étanchéité (46, 48) qui sont inclinées en vue d'assurer l'étanchéité entre les surfaces d'étanchéité des deux éléments tubulaires ; et

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un moyen (13) pour fixer lesdits premier et second éléments tubulaires à ladite bague d'étanchéité selon un contact d'étanchéité avec leurs surfaces d'étanchéité respectives, et caractérisé en ce que :

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un évidement ménagé sur l'intérieur d'au moins un desdits éléments tubulaires (30 ; 74 ; 110) s'étend axialement vers l'intérieur depuis l'extrémité interne de la surface d'étanchéité de chaque élément tubulaire,

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ledit évidement (30 ; 74 ; 110) est dimensionné

et configuré de telle sorte que dans l'éventualité où une surface d'étanchéité d'un des éléments tubulaires serait endommagée, il pourrait recevoir une pièce de réparation en forme de manchon d'insertion selon l'une quelconque des revendications 13 à 15, le manchon d'insertion pouvant être forgé à froid pour venir en contact intime d'étanchéité avec l'intérieur dudit évidement et avec la surface d'étanchéité dudit élément tubulaire.