

Description

Length compensating joints or telescoping joints are well known in the field of pipeline repair. Typically these apparatuses have been used onshore and offshore to allow for length adjustment when a section of pipeline is being replaced to minimize the amount of cutting and welding which is required. Particularly in offshore installations where access to the pipeline is difficult and costly, it is desirable that the length compensating joint be remotely operable with a reliable sealing means, preferably metal-to-metal. The present invention provides an improved seal structure which has these features.

The present invention is an improvement of the structure covered by U. S. -A- 4,761,023. The US-A-4761023 telescoping joint discloses a metal-to-metal seal which can be energized or released by a pressure responsive means.

U. S. -A- 4,720,124 discloses a telescoping joint with metal-to-metal sealing and locking surfaces disposed on the exterior and interior surfaces, respectively, of the inner and outer tubular members. Hydraulic pressure is used to disengage the sealing surfaces and provide relative movement between the inner and outer tubular members.

U. S. -A- 4,696,494 discloses an adjustable flow-line joint which provides angular misalignment capability only and a hydraulically releasable locking means with metal-to-metal seals.

U. S. -A- 4,436,325 discloses an adjustable locking coupling with metal-to-metal sealing and hydraulically actuated locking means. No provision is made for unlocking the coupling after installation.

An object of the present invention is to provide an improved length compensating joint with a metal-to-metal seal which is mechanically energised upon installation and eliminates the need for additional activation means.

US-A-4761023 discloses a length compensating joint, comprising an inner tubular member; an outer tubular member receiving the inner member in close surrounding relationship; a sealing means disposed between the inner and outer tubular members defining joint extension and retraction chambers; a means for supplying fluid under pressure to the extension and retraction chambers to permit selective relative movement between the inner and outer members; a gripping means positioned on the outer tubular member; a pressure responsive camming means cooperating with the gripping means to lock and release the gripping means to the inner member; a metal-to-metal seal for sealing between the inner and outer tubular members; and means for applying pressure to the metal-to-metal seal to deenergise the seal during extension and retraction operations; and according to the present invention, such a joint is characterised in that the metal-to-metal seal is initially mechanically

energized by an interference fit between the inner and outer tubular members without additional activation means; and wherein the metal-to-metal seal is such that the pressure is removed to reenergise the seal.

In the accompanying drawings:

Figs. 1A and 1B are elevational views, partly in section, of the improved length compensating joint in a retracted and unlocked position with figure 1A being the left portion and figure 1B being the right portion thereof.

Figs. 2A and 2B are similar views of the improved length compensating joint in an extended and locked position with

FIGURE 2A being the left portion and FIGURE 2B being the right portion thereof.

FIGURE 3 is an enlarged sectional view of the metal-to-metal seal of the improved length compensating joint and its associated hydraulic porting.

FIGURES 4A and 4B are elevational views, partly in section, illustrating an alternate metal-to-metal seal embodiment for the improved length compensating joint shown in a retracted and unlocked position with FIGURE 4A being the left portion and FIGURE 4B being the right portion thereof.

FIGURE 5 is an enlarged sectional view of the alternate embodiment of the metal-to-metal seal for the improved length compensating joint and its associated hydraulic porting.

With reference to FIGURES 1A and 1B, the improved length compensating joint of the present invention, denoted generally by numeral 10, is composed of inner tubular member 12 and outer tubular assembly 14. Adjacent both ends of the length compensating joint 10 are the ends of the pipeline 16 which are shaped to facilitate connection to the ends of the length compensating joint 10 by suitable means, such as welded joints 18.

Inner tubular member 12 is generally cylindrically shaped with its bore 20 concentric with that of the outer assembly 14. The outer surface 22 of inner tubular member 12 has raised annular portion 24 with sealing means such as O ring 26 disposed therein. Inner tubular member 12 is of sufficient length to protrude from outer tubular assembly 14 when in the fully retracted position as shown in FIGURES 1A and 1B.

The outer tubular assembly 14 is composed of lock assembly 28, adapter spool 30 and end spool 32. Lock assembly 28 includes end flange 34, middle flange 36, lock ring 38 and piston 40. End flange 34 has O ring 44 disposed in a groove on its interior which seals against the exterior of inner member 12 and with annular portion 24 of inner member 12 defines annular retraction chamber 42 therebetween. Pressure integrity of chamber 42 is assured by O ring 46 located between stepped shoulders on the abutting faces of adapter spool 30 and end flange 34. Port 48 provides means for introducing pressurized fluid

into annular chamber 42 when it is desired to retract inner member 12. End flange 34 has a stepped lower shoulder with O ring 50 disposed therein which seals against the inside of middle flange 36. Annular recess 52 on the inside of end flange 34 has wear ring 54 disposed therein for maintaining flange 34 concentric with inner member 12. The lower portion of end flange 34 has collet fingers 56 extending therefrom with inner serrated surfaces 58 formed thereon for gripping inner member 12 in a manner to be described hereinafter.

Middle flange 36 abuts end flange 34 and is retained by suitable means such as studs 60 and nuts 62. Lower lip 64 of flange 36 extends radially inwardly toward end flange 34 and forms annular chamber 66 therebetween. Piston 40 is axially reciprocable therein. O ring 68 on the exterior of piston 40 and O ring 70 on the exterior of end flange 34 in combination with O ring 72 on the lower interior surface of middle flange 36 seal piston 40 within chamber 66 to allow for hydraulic reciprocation. Ports 74 and 76 provides means for introducing pressurized fluid into annular chamber 66 to cause such movement.

Piston 40 has tubular end portion 78 extending axially to lock ring 38 where bolts 80 provide suitable connection means. Interior camming surface 82 on end portion 78 is frustoconically shaped and cooperates with exterior frustoconical camming surface 84 of collet fingers 56 in a manner to be more fully described hereinafter to cause serrated surfaces 58 to grip inner member 12. Trash seals 86 and 88 are provided on the interior of lock ring 38. Studs 90 extend from the lower face of middle flange 36 through lock ring 38 and with nuts 92 provide a manual lock of collet fingers 56 when hydraulic pressure is removed from chamber 66.

Adapter spool 30 is a tubular member with flanges 94 and 96 at either end which allow attachment to end flange 34 by studs 60 and nuts 62 and connection to end spool 32 by studs 98 and nuts 100. The interior of flange 96 has reduced diameter annular portion 102 with O ring 104 thereon. Annular portion 102 and annular portion 24 of inner member 12 define extension chamber 106 therebetween with port 108 providing means for the introduction of pressurized fluid when it is desired to extend inner member 12. As best seen in FIGURE 3, the end face of flange 96 has annular recess 110 on its interior which receives improved seal member 112. Raised lip 114 is located radially outwardly of recess 110 with O ring 116 on its exterior in sealing engagement with complementary mating flange 118 of end spool 32. The interior of flange 118 is stepped with axially spaced counterbores 120, 122, and 124 therein. Port 126 in flange 96 provides means for the introduction of pressurized fluid to deenergize seal 112 in a manner to be discussed hereinafter. Port 128 in flange 118 allows pressure testing of seal 112 upon installation. Tubular

portion 130 extends axially from flange 118 and terminates in butt weld connection 18 of end spool 32. Seal groove 134 is located on the interior of tubular portion 130, spaced axially from bore 124, with elastomer lip seal 136 therein. Annular recess 138 is displaced axially from seal groove 134 with wear ring 140 disposed therein to maintain end spool 32 concentric with inner tubular member 12.

As best seen in FIGURE 3, improved seal member 112 is generally U shaped in cross section with a thick base portion 142 and outer leg 144 and elongated inner leg 146 extending therefrom. Outer leg 144 has enlarged annular portion 148 on its exterior which provides an initial metal-to-metal seal in counterbore 122. Inner leg 146 has greater radial thickness than inner leg 144 and extends axially beyond leg 144 with seal groove 150 disposed on its interior. Elastomeric lip seal 152 is oriented therein as shown. Enlarged annular portion 154 is displaced axially from groove 150 and provides an initial metal-to-metal seal between leg 146 and the exterior of inner member 12. Radially directed passage 156 is spaced axially from annular portion 154 and extends through base portion 142. Seal groove 158 is spaced axially below passage 156 with elastomeric lip seal 160 oriented therein as shown. The exterior of seal member 112 has seal grooves 162 and 164 on either side of radially directed passage 156 with O rings 166 and 168 disposed therein.

A typical sequence of operations for using the improved length compensating joint 10 in repairing a damaged section of pipeline begins with the damaged section of pipeline being cut free and removed from the pipeline 16. The improved length compensating joint of the present invention is lowered into a position adjacent the pipeline 16 and it is determined whether lengthening or shortening of the joint is required to allow the end connections to be made. If lengthening is required, pressurized fluid is injected in port 126 where it passes through port 156 to the interior of seal 112 and acts on seals 160 and annular seal 154. This pressurization causes inner seal leg 146 to move radially outward, lifting annular seal 154 from the exterior of inner member 12. Elastomeric lip seal 152 has sufficient resiliency to maintain sealing contact with the exterior of inner member 12 thus allowing annular metal-to-metal seal 154 to be maintained in a deenergized position. While metal-to-metal seal 154 is deenergized, pressurized fluid is supplied through port 108 to extension chamber 106, acting on the piston area between seals 26 and 104 to extend inner member 12, as seen in FIGURES 2A and 2B.

Similarly, if it is determined shortening of the length compensating joint is required, port 108 is vented while pressurized fluid is supplied through port 48 to retraction chamber 42, acting on the piston area between seals 26, 44 and 46 to retract inner member 12 to the desired position. The pressurized

fluid is vented from the interior of seal 112 through ports 156 and 126, thus allowing inner seal lip 146 to return to its initial position and metal-to-metal seal 154 to engage the exterior of inner member 12. At this point, the improved length compensating joint 10 can be connected to pipeline 16 by suitable means such as welded joint 18.

While maintaining pressurized fluid in retraction chamber 42 and extension chamber 106 will keep length compensating joint 10 in the desired position, it is preferable to have a mechanical lock to maintain the desired position. This is accomplished with lock assembly 28 as best seen in FIGURES 1A and 1B. When it is desired to activate lock assembly 28, pressurized fluid is supplied through port 74 causing piston 40 and lock ring 38 to move to the right as shown in the drawings. This movement causes camming surface 82 of piston 40 to engage mating camming surface 84 thereby causing collet fingers 56 to deflect inwardly and serrated surfaces 58 to grip inner member 12. Nuts 92 are threaded further onto studs 90 by a remote operated vehicle to lock lock ring 38 and serrated surfaces 58 in position as shown in FIGURES 2A and 2B. If it desired to release lock assembly 28, nuts 92 are unthreaded and pressurized fluid is supplied through port 76 while venting port 74 thereby moving piston 40 and lock ring 38 to the left as shown in FIGURES 1A and 1B and thereby allowing collet fingers 56 to move outwardly and release inner member 12. With lock assembly 28 released, seal member 112 can be deenergized as described previously and inner member 12 extended or retracted as required. This method of operation allows the metal-to-metal seals 148 and 154 to be deenergized during extension and retraction of inner member 12 thereby lessening the chance of damaging the seal.

An alternate embodiment with a second metal-to-metal seal configuration between the inner and outer tubular members is shown in FIGURES 4A and 4B. Those items which are unchanged from the preferred embodiment retain the same numeral designation. The length compensating joint is denoted generally by numeral 200 and is composed of inner tubular member 12 and outer tubular assembly 202. Outer tubular assembly 202 consists of lock assembly 28, adapter spool 204 and end spool 206. Lock assembly 28 is secured to adapter spool 204 by suitable means such as studs 60 and nuts 62.

Adapter spool 204 is identical with adapter spool 30 except for flange 208 which is configured to sealingly engage complementary mating flange 210 of end spool 206. Flange 208 has seal 104 disposed on its interior in sealing engagement with the exterior of inner member 12 and with seal 26 defines extension chamber 106 therebetween with port 108 providing means for the introduction of pressurized fluid when it is desired to extend inner member 12. Flange 208 has a raised annular portion 212 on its end face with

seal means 214 disposed on the exterior. Port 126 in flange 208 provides means for the introduction of pressurized fluid to deenergize metal-to-metal seal 216.

As best seen in FIGURE 5, the interior of flange 210 of end spool 206 is stepped with axially spaced counterbores 218 and 220 therein. Raised annular portion 212 of flange 208 is closely received within bore 218 with seal means 214 sealing therein. Seal 216 sits in the annular area defined by bore 220 and end face 222 of flange 208. Seal 216 is generally C shaped in cross section with a thicker triangularly shaped base portion 224. The apex 226 of seal 216 contacts flange 210 at seal face 228 to provide an initial metal-to-metal seal within end spool 206. Lower tip 230 of base portion 224 contacts inner member 12 to provide an initial metal-to-metal seal. Seal groove 232 is disposed on the lower face of base portion 224 with elastomeric seal 234 oriented therein as shown.

The sequence of operations for using the second embodiment of the improved length compensating joint 200 is the same as for the preferred embodiment. The metal-to-metal seal 216 is deenergized by supplying pressurized fluid through port 126, moving lower tip 230 out of sealing engagement with inner member 12. Elastomeric lip seal 136 and O ring 104 maintain sealing contact with inner member 12 and port 128 is blocked, thereby maintaining seal 216 in a deenergized position. Pressurized fluid can then be applied to port 48 or 108 to shorten or lengthen the length compensating joint 200 as required. Once the desired position is reached, pressure can be released from port 126 to reenergize seal 216. Lock assembly 28 can then be activated as described previously.

Claims

1. A length compensating joint, comprising an inner tubular member (12); an outer tubular member (14) receiving the inner member in close surrounding relationship; a sealing means (26,104,44,46) disposed between the inner and outer tubular members defining joint extension (106) and retraction (42) chambers; a means (108,48) for supplying fluid under pressure to the extension and retraction chambers to permit selective relative movement between the inner and outer members; a gripping means (58) positioned on the outer tubular member; a pressure responsive camming means (82,84) cooperating with the gripping means to lock and release the gripping means to the inner member; a metal-to-metal seal (112,216) for sealing between the inner and outer tubular members; and means (126,156) for applying pressure to the metal-to-metal seal to deenergise the seal during extension and retraction operations; characterised in



fluid is vented from the interior of seal 112 through ports 156 and 126, thus allowing inner seal lip 146 to return to its initial position and metal-to-metal seal 154 to engage the exterior of inner member 12. At this point, the improved length compensating joint 10 can be connected to pipeline 16 by suitable means such as welded joint 18.

While maintaining pressurized fluid in retraction chamber 42 and extension chamber 106 will keep length compensating joint 10 in the desired position, it is preferable to have a mechanical lock to maintain the desired position. This is accomplished with lock assembly 28 as best seen in FIGURES 1A and 1B. When it is desired to activate lock assembly 28, pressurized fluid is supplied through port 74 causing piston 40 and lock ring 38 to move to the right as shown in the drawings. This movement causes camming surface 82 of piston 40 to engage mating camming surface 84 thereby causing collet fingers 56 to deflect inwardly and serrated surfaces 58 to grip inner member 12. Nuts 92 are threaded further onto studs 90 by a remote operated vehicle to lock lock ring 38 and serrated surfaces 58 in position as shown in FIGURES 2A and 2B. If it desired to release lock assembly 28, nuts 92 are unthreaded and pressurized fluid is supplied through port 76 while venting port 74 thereby moving piston 40 and lock ring 38 to the left as shown in FIGURES 1A and 1B and thereby allowing collet fingers 56 to move outwardly and release inner member 12. With lock assembly 28 released, seal member 112 can be deenergized as described previously and inner member 12 extended or retracted as required. This method of operation allows the metal-to-metal seals 148 and 154 to be deenergized during extension and retraction of inner member 12 thereby lessening the chance of damaging the seal.

An alternate embodiment with a second metal-to-metal seal configuration between the inner and outer tubular members is shown in FIGURES 4A and 4B. Those items which are unchanged from the preferred embodiment retain the same numeral designation. The length compensating joint is denoted generally by numeral 200 and is composed of inner tubular member 12 and outer tubular assembly 202. Outer tubular assembly 202 consists of lock assembly 28, adapter spool 204 and end spool 206. Lock assembly 28 is secured to adapter spool 204 by suitable means such as studs 60 and nuts 62.

Adapter spool 204 is identical with adapter spool 30 except for flange 208 which is configured to sealingly engage complementary mating flange 210 of end spool 206. Flange 208 has seal 104 disposed on its interior in sealing engagement with the exterior of inner member 12 and with seal 26 defines extension chamber 106 therebetween with port 108 providing means for the introduction of pressurized fluid when it is desired to extend inner member 12. Flange 208 has a raised annular portion 212 on its end face with

seal means 214 disposed on the exterior. Port 126 in flange 208 provides means for the introduction of pressurized fluid to deenergize metal-to-metal seal 216.

As best seen in FIGURE 5, the interior of flange 210 of end spool 206 is stepped with axially spaced counterbores 218 and 220 therein. Raised annular portion 212 of flange 208 is closely received within bore 218 with seal means 214 sealing therein. Seal 216 sits in the annular area defined by bore 220 and end face 222 of flange 208. Seal 216 is generally C shaped in cross section with a thicker triangularly shaped base portion 224. The apex 226 of seal 216 contacts flange 210 at seal face 228 to provide an initial metal-to-metal seal within end spool 206. Lower tip 230 of base portion 224 contacts inner member 12 to provide an initial metal-to-metal seal. Seal groove 232 is disposed on the lower face of base portion 224 with elastomeric seal 234 oriented therein as shown.

The sequence of operations for using the second embodiment of the improved length compensating joint 200 is the same as for the preferred embodiment. The metal-to-metal seal 216 is deenergized by supplying pressurized fluid through port 126, moving lower tip 230 out of sealing engagement with inner member 12. Elastomeric lip seal 136 and O ring 104 maintain sealing contact with inner member 12 and port 128 is blocked, thereby maintaining seal 216 in a deenergized position. Pressurized fluid can then be applied to port 48 or 108 to shorten or lengthen the length compensating joint 200 as required. Once the desired position is reached, pressure can be released from port 126 to reenergize seal 216. Lock assembly 28 can then be activated as described previously.

Claims

1. A length compensating joint, comprising an inner tubular member (12); an outer tubular member (14) receiving the inner member in close surrounding relationship; a sealing means (26,104,44,46) disposed between the inner and outer tubular members defining joint extension (106) and retraction (42) chambers; a means (108,48) for supplying fluid under pressure to the extension and retraction chambers to permit selective relative movement between the inner and outer members; a gripping means (58) positioned on the outer tubular member; a pressure responsive camming means (82,84) cooperating with the gripping means to lock and release the gripping means to the inner member; a metal-to-metal seal (112,216) for sealing between the inner and outer tubular members; and means (126,156) for applying pressure to the metal-to-metal seal to deenergise the seal during extension and retraction operations; characterised in



that the metal-to-metal seal is initially mechanically energized by an interference fit between the inner and outer tubular members without additional activation means; and wherein the metal-to-metal seal is such that the pressure is removed to reenergise the seal.

2. A joint according to claim 1, wherein the pressure responsive camming means (82,84) includes an annular recess (86) within the outer tubular member (14) with an annular piston (40) sealing and reciprocable therein; the annular piston having a tubular lower extension (78) with a frustoconical inner surface (82); a plurality of collet fingers (56) with a frustoconical outer surface (84) extending axially from the outer tubular member and located radially inwardly of the tubular lower extension with the gripping means positioned on the inner surface of the collet fingers; the inner and outer frustoconical surfaces coacting to move the gripping means into engagement with the inner member (12); and porting means (74,76) for reciprocation of the annular piston.

3. A joint according to claim 1 or claim 2, wherein the sealing means (26,104,44,46) includes a plurality of annular seals spaced axially and radially to define piston areas for providing relative axial movement between the inner (12) and outer (14) tubular member.

4. A joint according to any one of the preceding claims, wherein the metal-to-metal seal (12) is a shaped annular ring (142) with a pair of unequal length legs (144,146) extending therefrom which face in the direction of internal pressure from the inner member (12) and provide an initial metal-to-metal seal between parallel surfaces on the inner and outer (12) tubular members.

5. A joint according to claim 4, wherein the deenergising means (126,156) includes a radially directed passage (156) providing fluid communication with the exterior and interior of the metal-to-metal seal (112,216); porting means (126) for supplying fluid under pressure to the passage; and elastomeric seal means (152,160) disposed on the exterior and interior of the metal-to-metal seal to allow pressurisation of an interior tip (154) of the metal-to-metal seal to disengage the tip from sealing engagement with the inner member (12) during relative axial movement between the inner and outer (14) members.

6. A joint according to any one of claims 1 to 3, wherein the metal-to-metal seal (216) is a shaped annular ring with a triangularly shaped base portion (224) with a pair of sealing legs which face in

the direction of pressure from the inner member (12) and includes an apex sealing (226) against an annular surface (228) on the outer member (14) which is perpendicular to its axis and a lower tip (230) on the base portion sealing against a cylindrical surface on the inner member portion which is parallel with its axis.

7. A joint according to claim 6, wherein the deenergising means (126) includes sealing means (136,104) disposed between the inner (12) and outer (14) members and axially spaced from the metal-to-metal seal (216); sealing means (230) disposed on the lower base portion of the metal-to-metal seal which in combination with the axially spaced sealing means defines an annular chamber for pressurisation of the interior of the metal-to-metal seal; porting means (126) for supplying fluid under pressure to the annular chamber to disengage the tip (230) from sealing engagement with the inner member during relative axial movement between the inner and outer members.

8. A joint according to any one of the preceding claims, wherein the metal-to-metal seal (112,216) includes a means (128) for pressure testing the metal-to-metal seal.

9. A joint according to claim 8, when dependent on any one of claims 5 to 7, wherein the pressure testing means (128) includes a sealing means (136) between the inner (12) and outer (14) members axially displaced from the sealing tips (154,230) in the direction of the internal pressure from the inner member; porting means (128) for supplying fluid under pressure between the metal-to-metal seal (112,216) and the sealing means; and porting means for detecting leakage past the seal tips.

Patentansprüche

1. Längenausgleichsverbindung, umfassend einen inneren rohrförmigen Körper (12); einen äußeren rohrförmigen Körper (14), der den inneren Körper in enger umfassender Verbindung aufnimmt; eine Dichtungseinrichtung (26, 104, 44, 46), die zwischen dem inneren und äußeren rohrförmigen Körper angeordnet ist und Kammern zum Ausdehnen (106) und Zusammenziehen (42) der Verbindung bildet; eine Einrichtung (108, 48) zur Zuführung von unter Druck stehendem Fluid zu den Kammern zum Ausdehnen und Zusammenziehen, um eine selektive Relativbewegung zwischen den inneren und äußeren Kammern zu ermöglichen; eine Greifeinrichtung (58), die an



dem äußeren rohrförmigen Körper angeordnet ist, eine druckbetätigte Nockeneinrichtung (82, 84), die mit der Greifeinrichtung zusammenwirkt, um die Greifeinrichtung mit dem inneren Körper zu verriegeln und zu lösen; eine Metall-Metall-Dichtung (112, 216) zur Abdichtung zwischen den inneren und äußeren rohrförmigen Körpern; und einer Einrichtung (126, 156) zur Ausübung von Druck auf die Metall-Metall-Dichtung, um die Dichtung während der Funktion des Ausdehnens und Zusammenziehens außer Funktion zu setzen; **dadurch gekennzeichnet, daß die Metall-Metall-Dichtung anfänglich durch einen überlagernden Sitz zwischen den inneren und äußeren rohrförmigen Körpern ohne zusätzliche Antriebsmittel mechanisch in Funktion gesetzt wird, und bei der die Metall-Metall-Dichtung so wirkt, daß der Druck beseitigt wird, um die Dichtung erneut in Funktion zu setzen.**

2. Verbindung nach Anspruch 1, **dadurch gekennzeichnet, daß die druckbetätigte Nockeneinrichtung (82, 84) eine ringförmige Ausnehmung (66) im äußeren rohrförmigen Körper (15) mit einem ringförmigen Kolben (40) aufweist, der darin abgedichtet und hin- und her bewegbar ist; daß der ringförmige Kolben eine rohrförmige untere Verlängerung (78) mit einer kegelstumpfförmigen inneren Fläche (82) aufweist, daß eine Vielzahl von Spannfingern (56) mit einer kegelstumpfförmigen Außenfläche (84) sich axial vom äußeren rohrförmigen Körper und radial in das Innere der rohrförmigen unteren Verlängerung erstrecken, wobei die Greifeinrichtung an der Innenfläche der Spannfinger angeordnet ist; daß die inneren und äußeren kegelstumpfförmigen Flächen zusammenwirken, um die Greifeinrichtung in Eingriff mit dem inneren Körper (12) zu bewegen; und daß eine Ein- und Auslaßöffnung (74, 76) zum hin- und herbewegen des ringförmigen Kolbens vorhanden ist.**

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß die Dichtungseinrichtung (26, 104, 44, 46) eine Vielzahl von ringförmigen Dichtungen umfaßt, die axial und radial beabstandet sind, um Kolbenbereiche zur Ermöglichung einer relativen axialen Bewegung zwischen dem inneren (12) und dem äußeren (14) rohrförmigen Körper zu bilden.**

4. Verbindung nach jedem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß die Metall-Metall-Dichtung (12) ein geformter Ring (142) mit einem Paar von Schenkeln (144, 146) ungleicher Länge ist, die von diesem ausgehen und in Richtung des Innendruckes des inneren Körpers (12) weisen und eine anfängliche Metall-Metall-**

Dichtung zwischen den parallelen Flächen an den inneren und äußeren (12) rohrförmigen Körpern bewirken.

5. Verbindung nach Anspruch 4, **dadurch gekennzeichnet, daß die Einrichtung zur Außerfunktionssetzung (126, 156) einen radial verlaufenden Durchgang (156) besitzt, der eine Fluidverbindung mit der Außen- und der Innenseite der Metall-Metall-Dichtung (112, 216) ermöglicht; sowie einer Ein- und Auslaßöffnung (126) zur Versorgung des Durchlasses mit unter Druck stehendem Fluid; einer elastomeren Dichtungseinrichtung (152, 160), die an der Außen- und Innenseite der Metall-Metall-Dichtung angeordnet ist, um die Unterdrucksetzung eines inneren Vorsprungs (154) der Metall-Metall-Dichtung zu ermöglichen, um den Vorsprung aus dem dichtenden Eingriff mit dem inneren Körper (12) während der relativen Axialbewegung zwischen dem inneren und äußeren (14) Körper zu bringen.**

6. Verbindung nach jedem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, daß die Metall-Metall-Dichtung (216) ein geformter Ring mit einem dreieckig profilierten Unterteil (224) mit einem Paar von Dichtungsschenkeln ist, welche in Richtung des Druckes vom inneren Körper (12) weisen und eine Abdichtung am Scheitelpunkt (226) gegen eine ringförmige Fläche (228) am äußeren Körper (14) vornehmen, welche senkrecht zu dessen Achse verläuft, und einem niedrigeren Vorsprung (230) am Unterteil, der gegen eine zylindrische Fläche am inneren Teil des Körpers abdichtet, welche parallel zu dessen Achse verläuft.**

7. Verbindung nach Anspruch 6, **dadurch gekennzeichnet, daß die Einrichtung zur Außerfunktionssetzung (126) eine Dichtungseinrichtung (136, 104) enthält, die zwischen dem inneren (12) und dem äußeren (14) Körper angeordnet ist und axial von der Metall-Metall-Dichtung (216) beabstandet ist; daß die Dichtungseinrichtung (230) an der Unterseite des Unterteiles der Metall-Metall-Dichtung angeordnet ist, welche in Kombination mit der axial beabstandeten Dichtungseinrichtung eine ringförmige Kammer zur Unterdrucksetzung des inneren der Metall-Metall-Dichtung bildet; und daß eine Ein- und Auslaßöffnung (126) zur Versorgung der ringförmigen Kammer mit unter Druck stehendem Fluid vorhanden ist, um den Vorsprung (230) aus dem dichtenden Eingriff mit dem inneren Körper während der relativen Axialbewegung zwischen dem inneren und dem äußeren Körper zu bringen.**

8. Verfahren nach jedem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß die Me-**



tall-Metall-Dichtung (112, 216) eine Einrichtung (128) zur Überprüfung des Druckes der Metall-Metall-Dichtung enthält.

9. Verbindung nach Anspruch 8, wenn dieser von einem der Ansprüche 5 bis 7 abhängig ist, dadurch gekennzeichnet, daß die Druckprüfungseinrichtung (128) eine Dichtungseinrichtung (136) zwischen dem inneren (12) und dem äußeren (14) Körper enthält, die axial versetzt von den Dichtungsvorsprüngen (154, 230) in Richtung des inneren Druckes vom inneren Körper angeordnet ist; daß eine Ein- und Auslaßöffnung (128) zur Zuführung von unter Druck stehendem Fluid zwischen die Metall-Metall-Dichtung (112, 216) und die Dichtungseinrichtung vorhanden ist; und daß Öffnungen zur Ermittlung von Undichtigkeiten nach den Dichtungsvorsprüngen vorhanden sind.

Revendications

1. Connexion de compensation pour des changements de longueur comportant un élément tubulaire intérieur (12); un élément tubulaire extérieur (14) dans lequel est logé l'élément intérieur qu'il entoure suivant un ajustage hermétique; un moyen d'étanchéité (26, 104, 44, 46) placé entre les éléments tubulaires intérieur et extérieur et qui définit des chambres d'allongement (106) et de rétraction (42); un moyen (108, 48) pour introduire un fluide sous pression dans les chambres d'allongement et de rétraction afin de permettre un déplacement relatif sélectif entre les éléments intérieur et extérieur; un moyen de serrage (58) placé sur l'élément tubulaire extérieur; un moyen faisant cames excentré sensible à la pression (82, 84) qui coopère avec le moyen de serrage pour bloquer et relâcher le moyen de serrage de l'élément intérieur; un joint d'étanchéité métal sur métal (112, 216) pour établir une étanchéité entre les éléments tubulaires intérieur et extérieur; et un moyen (126, 156) pour appliquer une pression au joint d'étanchéité métal sur métal afin de désactiver le joint d'étanchéité au cours des opérations d'allongement ou de rétraction; caractérisée en ce que le joint d'étanchéité métal sur métal est initialement activé mécaniquement par un ajustage d'interférence entre les éléments tubulaires intérieur et extérieur sans l'intervention d'un moyen d'activation supplémentaire; et où le joint d'étanchéité métal sur métal est tel que la pression est supprimée pour réactiver le joint d'étanchéité.
2. Connexion de compensation selon la revendication 1, dans laquelle le moyen faisant cames ex-
- centré sensible à la pression (82, 84) comporte un évidement annulaire (66) à l'intérieur de l'élément tubulaire extérieur (14), dans lequel un piston annulaire (40) est animé d'un mouvement alternatif tout en y assurant l'étanchéité, le piston annulaire comportant une extension inférieure tubulaire (78) ayant une surface intérieure tronconique (82); une pluralité de doigts de serrage (58) ayant une surface extérieure tronconique (84) s'étendent dans une direction axiale depuis l'élément tubulaire extérieur et sont positionnés dans une direction radiale vers l'intérieur de l'extension inférieure tubulaire, les moyens de serrage étant placés sur la surface intérieure des doigts de serrage; les surfaces tronconiques intérieure et extérieure agissant en association pour déplacer le moyen de serrage et le mettre en contact avec l'élément intérieur (12); et des moyens de lumière (74, 76) pour contribuer au mouvement alternatif du piston annulaire.
3. Connexion de compensation selon les revendications 1 ou 2, dans laquelle le moyen d'étanchéité (26, 104, 44, 46) comporte une pluralité de joints étanches annulaires espacés dans une direction axiale et radiale pour définir des surfaces faisant piston pour établir un mouvement axial relatif entre les éléments tubulaires intérieur (12) et extérieur (14).
4. Connexion de compensation selon l'une quelconque des revendications précédentes, dans laquelle le joint d'étanchéité métal sur métal (12) est une bague annulaire (142) comportant une paire de branches de longueur inégale (144, 146) s'étendant depuis la bague et faisant face à la direction de la pression interne exercée par l'élément intérieur (12) et constituant un joint d'étanchéité initial métal sur métal entre des surfaces parallèles sur les éléments tubulaires intérieur et extérieur (12).
5. Connexion de compensation selon la revendication 4, dans laquelle le moyen de désactivation (126, 156) comporte un passage (156) orienté dans une direction radiale pour établir une communication entre l'extérieur et l'intérieur du joint d'étanchéité métal sur métal (112, 216) en vue de la circulation d'un fluide; des moyens de lumière (126) pour introduire un fluide sous pression dans le passage; et des moyens d'étanchéité (152, 162) en un matériau élastomère placés sur la partie extérieure et sur la partie intérieure du joint d'étanchéité métal sur métal pour assurer la pressurisation d'un épaulement intérieur (154) du joint d'étanchéité métal sur métal afin de supprimer le contact étanche entre l'épaulement et l'élément intérieur (12) au cours du déplacement



axial relatif entre les éléments intérieur (12) et extérieur (14).

6. Connexion de compensation selon l'une quelconque des revendications 1 à 3, dans laquelle le joint d'étanchéité métal sur métal (216) est constitué par une bague annulaire comportant une portion de base triangulaire (224) et comprenant une paire de branches d'étanchéité qui font face à la direction de la pression exercée par l'élément intérieur (12) et comprenant un sommet d'étanchéité (226) opposé à une surface annulaire (228) sur l'élément extérieur (14) perpendiculaire à son axe et un épaulement inférieur (230) sur la portion de base assurant l'étanchéité contre une surface cylindrique de la portion d'élément intérieur parallèle à son axe.

5
10
15

7. Connexion de compensation selon la revendication 6, dans laquelle le moyen de désactivation (126) comporte un moyen d'étanchéité (136, 104) placé entre les éléments intérieur (12) et extérieur (14) et espacé dans une direction axiale du joint d'étanchéité métal sur métal (216), un moyen d'étanchéité (230) disposé sur la portion de base inférieure du joint métal sur métal qui, en combinaison avec le moyen d'étanchéité espacé dans une direction axiale, définit une chambre annulaire en vue de la pressurisation de la partie intérieure du joint d'étanchéité métal sur métal ; des moyens de lumière (126) pour l'introduction d'un fluide sous pression dans la chambre annulaire afin de supprimer le contact étanche entre l'épaulement (230) et l'élément intérieur au cours du mouvement axial relatif entre les éléments intérieur et extérieur.

20
25
30
35

8. Connexion de compensation selon l'une quelconque des revendications précédentes, dans laquelle le joint d'étanchéité métal sur métal (112, 216) comporte un moyen (128) d'essai en pression du joint d'étanchéité métal sur métal.

40

9. Connexion de compensation selon la revendication 8 lorsqu'elle dépend de l'une quelconque des revendications 5 à 7, dans laquelle le moyen d'essai en pression (128) comporte un moyen d'étanchéité (136) situé entre les éléments intérieur (12) et extérieur (14) qui se déplacent dans une direction axiale depuis les épaulements d'étanchéité (154, 230) dans la direction de la pression intérieure exercée par l'élément intérieur ; des moyens de lumières (128) pour introduire un fluide sous pression entre le joint d'étanchéité métal sur métal (112, 126) et le moyen d'étanchéité ; et des moyens de lumières pour détecter des fuites au niveau des épaulements d'étanchéité.

45
50
55