Description

As oil and gas exploration has required the drilling of wells to greater and greater depths, the use of metal-to-, metal seals has become more desirable and in some cases essential. Previous designs for metal-to-metal seals have typically required an activation means of one form or another, resulting in increased complexity and increased difficulty in deploying the seals. Those designs which did not require additional activation means usually depended upon an initial interference between the seal element and the surfaces to be sealed against. These interference type seals could be damaged during the initial installation procedure which required the seal element to be "stabbed" into position. Also, these interference type metal-to-metal seals were made of a relatively soft metal to allow the seal element to "flow" and fill in scratched or damaged surfaces. Since the seal element was constructed from relatively soft metal, it would quickly lose its initial interference with the surfaces sealed against and commence leaking.

The present invention relates to an interference type metal-to-metal seal which uses low interference between the seal element and the surfaces sealed against in conjunction with various support elements to maintain this initial sealed condition. In U. S. -A-3,378,269, a metal-to-metal seal of a generally U shape is disclosed which establishes an initial seal by interference between the seal element and the surfaces sealed against.

U. S. -A- 4,665,979 discloses a metal-to-metal seal for use in the annulus between a casing hanger and wellhead housing. The seal is U shaped and has no initial sealing interference when installed. An energizer ring is forced between the legs of the U shaped member to urge the legs into sealing engagement with the hanger and housing. The energiser ring has ports which prevent excessive fluid pressure during energisation of the seal. US-A-4,742,874 discloses a similar type of seal in a U shaped seal of unequal length legs is urged into sealing engagement by wedge rings.

US-A-4,749,047 discloses an annular wellhead seal which is activated by inserting the seal into the annulus to be sealed and forging the upper rim of the hanger outward with pressure into sealing engagement with the seal.

US-A-4,766,956 discloses another annular wellhead seal' which uses upper and lower U shaped seal legs with a curved tip. The curved tips are moved into engagement with the seal bores by mechanical activation means.

An object of the present invention is to provide an improved interference type metal-to-metal seal which allows use of a relatively soft metal seal material which enhances seal performance.

Another object of the present invention is to provide a metal-to-metal seal with means for maintaining the initial sealing interference to enhance the performance of the seal.

A further object of the present invention is to provide a metal-to-metal seal which requires only low interference for its initial sealing, thereby minimising the force required for stabbing the seal into position.

A still further object of the present invention is to provide a reliable metal-to-metal seal which eliminates the need for additional activation means.

US-A-4469172 discloses an annular seal assembly for sealing the annulus between a seal bore and a seal member disposed therein, the seal assembly comprising an annular base; an inner and an outer seal leg extending from the base to define a seal annulus therebetween and having, in use, an initial sealing interference with the seal member and the seal bore; the inner and the outer seal legs each terminating in a tip; means for retaining the seal assembly on the seal member; and an annular support ring disposed between the inner and the outer seal legs supporting the inner and outer seal legs, in use, in sealing engagement with the seal bore; and according to the present invention such an assembly is characterised in that the seal assembly is a metal to metal seal assembly and further comprises an enlarged diameter seal surface on the outer seal leg and a reduced diameter seal surface on the inner seal leg, the reduced diameter seal surface having, in use, an initial sealing interference with the seal member, and the enlarged diameter seal surface having, in use, an initial sealing interference with the seal bore upon insertion of the seal member into the seal annulus; and the support ring maintains the reduced diameter seal surface in sealing engagement with the seal member, wherein the annular support ring has an enlarged portion, radially disposed and supporting the inner and outer seal legs, the annular support ring including a plurality of radially disposed circumferentially spaced holes preventing fluid block during assembly and installation and balancing pressure distribution within the seal.

These and other objects and advantages of the present invention are set fourth below and further made clear by reference to the drawings wherein:

In the accompanying drawings:-

Fig. 1 is a sectional elevational view of a typical wellhead tieback installation where the improved seal of the present invention is used.

Fig. 2 is an enlarged partial sectional view of the preferred embodiment of the seal in its bidirectional sealing configuration.

Fig. 3 is an enlarged partial section view of the seal in it unidirectional sealing configuration.

FIGURE 4 is an enlarged partial sectional view of an alternate embodiment of the seal in a unidirectional sealing configuration with another form of support ring.

With reference to FIGURE 1, the present invention is shown in a typical subsea tieback application wherein the improved metal seal, denoted generally by numeral 10 is used as an annulus seal and as a tieback or stab seal. The 30" housing 12 is vertically disposed on the ocean floor and has structural pipe 14, typically 30" in diameter, attached thereto by suitable means, such as circumferential weld joint 16. An 18-3/4" housing 18 is disposed therein in a manner well known to those skilled in the art with conductor pipe 20, typically 20" in diameter, attached by suitable means as circumferential weld joint 22.

Inner casing 24 is suspended within wellhead housing 18 by casing hanger 26 with annulus seal means 28 disposed therein. In a similar manner, production casing 30 is suspended within annulus seal means 28 by casing hanger 32. An annulus seal means 34 is disposed therein to seal the annulus between inner casing 24 and production casing 30. The upper portion of wellhead housing 18 has tieback connector 36 structurally connected thereto by latching means 38. Outer tieback casing 40, typically of the same diameter as conductor casing 20, is connected to tieback connector 36 by suitable means as circumferential weld 41 and extends to the surface with suitable pressure control equipment (not shown) mounted thereon. Suitable sealing means, such as O ring 42, is disposed between tieback connector 36 and wellhead housing 18 to ensure pressure integrity of the annulus between the conductor pipe 20 and inner casing 24.

Intermediate tieback casing 44 is threaded into intermediate tieback connector 46 which in turn is structurally connected to tieback connector 36 by expansible latch means 48. Intermediate tieback connector 46 extends axially below latch means 48 and terminates with seal nose 50 sealing within annulus sealing means 34. Improved sealing apparatus 10 of the present invention provides the sealing means between seal nose 50 and annulus sealing means 34.

Production tieback casing 52 is threaded into production tieback connector 54 which is structurally connected to intermediate tieback connector 46 by expansible latch means 56. In a manner similar to intermediate tieback connector 46, production tieback connector 54 extends axially below latch means 56 and terminates with seal nose 58. Sealing between seal nose 58 and casing hanger 32 is provided by improved sealing apparatus 10 of the present invention.

Referring to FIGURE 2, improved sealing apparatus 10 is shown disposed on the exterior of seal nose 58 at the lowermost portion of production tieback connector 54, sealing within seal bore 60 of casing hanger 32. Reduced diameter portion 62 of seal nose 58 ends at radial shoulder 64 with seal 10 sealingly disposed thereon. An external thread 66 is positioned axially below seal surface 62 for purposes to be explained hereinafter. Seal apparatus 10 includes annular base portion 68 with upper outer seal leg 70 and upper inner seal leg 72 extending axially and upwardly therefrom. Lower outer seal leg 74 and lower inner seal leg 76 extend axially and downwardly from base portion 68 in a similar manner. Outer seal legs 70 and 74 have enlarged diameter sealing surfaces 78 and 80 disposed intermediately thereon, respectively, which provide an initial sealing interference with seal bore 60 of casing hanger 32. Inner seal legs 72 and 76 have reduced diameter sealing surfaces 82 and 84 disposed intermediately thereon, respectively, which provide an initial sealing interference with seal surface 62 of seal nose 58.

A support ring 86 is positioned between seal legs 70 and 72 and an identical ring 86 is also positioned between seal legs 74 and 76. Rings 86 are annularly shaped with enlarged portion 88 positioned on one end thereof. When rings 86 are positioned between seal legs 70, 72 and 74, 76, the enlarged portions 88 contact the insides of the seal legs and maintain the initial interference of sealing surfaces 78, 80, 82 and 84. This support is at the tips of the seal legs to minimize the deflection of the seal legs and maintain the sealing contact of sealing surfaces 78, 80, 82 and 84 with seal bores 60 and 62. Support rings 86 have axially directed holes 90 intersected by radially directed holes 92 disposed therein which serve to equalize any pressure within seal legs 70, 72 and 74, 76. Support rings 86 are slightly longer than seal legs 70, 72 and 74, 76, thereby providing a controlled length to the seal assembly 10. This controlled length permits retainer ring 94 to maintain seal assembly 10 in its proper position, without axial movement if required, against radial shoulder 64 and protects seal legs 70, 72 and 74, 76. Retainer ring 94 has internal thread 96 which engages the external thread 66 of seal nose 58 to secure seal assembly 10 in position. A snap ring 98 engages groove 100 in thread 66 to lock retainer ring 94 in position.

In some applications, such as a seal on a tubing hanger mandrel, it is desirable for the improved metal seal to hold pressure from only one direction. This alternate embodiment is shown in FIGURE 3, on a greatly enlarged scale where the improved seal apparatus is denoted generally by numeral 110. The seal apparatus 110 is shown positioned on the exterior of seal nose 112 at the lowermost portion of seal stinger 114, sealing within seal bore 116 of tubing hanger 118. Reduced diameter portion 120 of seal nose 112 ends at radial shoulder 122 with seal 110 sealingly disposed thereon. An external thread 124 is positioned axially below seal surface 120 for purposes to be explained hereinafter.

The alternate seal apparatus 110 is essentially identical to the preferred embodiment seal apparatus 10 with the exception of having only one pair of seal legs. Seal apparatus 110 includes annular base portion 126 with outer seal leg 128 and inner seal leg 130

extending axially and downwardly therefrom. Outer seal leg 128 has enlarged diameter sealing surface 132 disposed intermediately thereon which provides an initial sealing interference with seal bore 116 of tubing hanger 118. Inner seal leg 130 has reduced diameter sealing surface 134 disposed intermediately thereon which provides an initial sealing interference with seal surface 120 of seal nose 112.

A support ring 136 is positioned between seal legs 128 and 130. Support ring 136 is annularly shaped with enlarged portion 138 positioned on one end thereof. When support ring 136 is positioned between seal legs 128 and 130 the enlarged portion 138 contacts the inside of seal legs 128 and 130 and maintains the initial interference of sealing surface 132 with seal bore 116 and the initial interference of sealing surface 134 with seal diameter 120. This support is at the tips of the seal legs to minimize the deflection of the seal legs and maintain the sealing contact of sealing surfaces 132 and 134 with seal bores 116 and 120, respectively.

As in the preferred embodiment, support ring 136 has axially directed holes 139 intersected by radially directed holes 140 disposed therein which serve to equalize any pressure within seal legs 128 and 130 at any time. Support ring 136 is slightly longer than seal legs 128 and 130 thereby providing a preset length to the seal assembly 110. This preset length permits retainer ring 142 to maintain seal assembly 110 in its proper position, without axial movement, against radial shoulder 122. Retainer ring 142 has internal thread 144 which engages the external thread 124 of seal nose 112 to secure seal assembly 110 in position. A snap ring 146 engages groove 148 in thread 124 to lock retainer ring 142 in position.

A second alternate embodiment showing another form of the improved metal-to-metal seal is shown in FIGURE 4. Those items which are unchanged from the previous embodiment of FIGURE 3 retain the same numeral designation. The improved metal seal 210 is disposed on reduced diameter portion 120 of seal nose 112, in sealing engagement with seal bore 116 of tubing hanger 118. Seal apparatus 210 includes annular base portion 212 which abuts radial shoulder 122. Outer seal leg 214 and inner seal leg 216 extend axially from annular base 212. Outer seal leg 214 has enlarged diameter sealing surface 218 disposed intermediately thereon which provides an initial sealing interference with seal bore 116 of tubing hanger 118. Inner seal leg 216 has reduced diameter sealing surface 220 disposed intermediately thereon which provides an initial sealing interference with seal surface 120 of seal nose 112.

A support ring 222 is positioned between seal legs 214 and 216. Support ring 222 is an annular ring with a generally U shaped cross section. Support ring 222 has an enlarged outer diameter portion 224 and a reduced diameter inner portion 226 disposed near the tips of the legs of ring 222. When support ring 222 is positioned between seal legs 214 and 216, an enlarged base portion 228 contacts the inside of seal legs 214 and 216 at their juncture with base portion 212. This contact positions the enlarged annular portion 224 and reduced annular portion 226 of support ring 222 opposite the seal surfaces 218 and 220, respectively, of seal apparatus 210. As in the preferred embodiment, support ring 222 has radially directed holes disposed therein which serve to equalize any pressure within seal legs 214 and 216. The support ring 222 is made of a much harder and stiffer material than seal apparatus 210 thereby giving the legs of support ring 222 a greater stiffness than seal legs 214 and 216. This greater stiffness maintains the initial interference of sealing surface 218 with seal bore 116 and the initial interference of sealing surface 220 with seal diameter 120.

As in the preferred embodiment, support ring 222 is slightly longer than seal legs 214 and 216 to provide a preset length to the seal assembly 210. This preset length permits retainer ring 142 to maintain seal assembly 210 in its proper position, without axial movement, against radial shoulder 122. Retainer ring 142 has internal thread 144 which engages the external thread 124 of seal nose 112 to secure seal assembly 210 in position. A snap ring 146 engages groove 148 in thread 124 to lock retainer ring 142 in position.

Claims

1. An annular seal assembly for sealing the annulus between a seal bore (60,116) and a seal member disposed therein, the seal assembly comprising an annular base (68,126,212); an inner (72,76,130,216) and an outer (70,74,128,214) seal leg extending from the base to define: a seal annulus therebetween and having, in use, an initial sealing interference with the seal member and the seal bore; the inner and the outer seal legs each terminating in a tip; means (94,98,142,146) for retaining the seal assembly on the seal member; and an annular support ring (86,136,222) disposed between the inner and the outer seal legs supporting the inner and outer seal legs, in use, in sealing engagement with the seal bore; characterised in that the seal assembly is a metal to metal seal assembly and further comprises an enlarged diameter seal surface (78,80,132,218) on the outer seal leg and a reduced diameter seal surface (82,84,134,220) on the inner seal leg, the reduced diameter seal surface having, in use, an initial sealing interference with the seal member, and the enlarged diameter seal surface having, in use, an initial sealing interference with the seal bore upon insertion of the seal member into the seal annulus; and the

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extending axially and downwardly therefrom. Outer seal leg 128 has enlarged diameter sealing surface 132 disposed intermediately thereon which provides an initial sealing interference with seal bore 116 of tubing hanger 118. Inner seal leg 130 has reduced diameter sealing surface 134 disposed intermediately thereon which provides an initial sealing interference with seal surface 120 of seal nose 112.

A support ring 136 is positioned between seal legs 128 and 130. Support ring 136 is annularly shaped with enlarged portion 138 positioned on one end thereof. When support ring 136 is positioned between seal legs 128 and 130 the enlarged portion 138 contacts the inside of seal legs 128 and 130 and maintains the initial interference of sealing surface 132 with seal bore 116 and the initial interference of sealing surface 134 with seal diameter 120. This support is at the tips of the seal legs to minimize the deflection of the seal legs and maintain the sealing contact of sealing surfaces 132 and 134 with seal bores 116 and 120, respectively.

As in the preferred embodiment, support ring 136 has axially directed holes 139 intersected by radially directed holes 140 disposed therein which serve to equalize any pressure within seal legs 128 and 130 at any time. Support ring 136 is slightly longer than seal legs 128 and 130 thereby providing a preset length to the seal assembly 110. This preset length permits retainer ring 142 to maintain seal assembly 110 in its proper position, without axial movement, against radial shoulder 122. Retainer ring 142 has internal thread 144 which engages the external thread 124 of seal nose 112 to secure seal assembly 110 in position. A snap ring 146 engages groove 148 in thread 124 to lock retainer ring 142 in position.

A second alternate embodiment showing another form of the improved metal-to-metal seal is shown in FIGURE 4. Those items which are unchanged from the previous embodiment of FIGURE 3 retain the same numeral designation. The improved metal seal 210 is disposed on reduced diameter portion 120 of seal nose 112, in sealing engagement with seal bore 116 of tubing hanger 118. Seal apparatus 210 includes annular base portion 212 which abuts radial shoulder 122. Outer seal leg 214 and inner seal leg 216 extend axially from annular base 212. Outer seal leg 214 has enlarged diameter sealing surface 218 disposed intermediately thereon which provides an initial sealing interference with seal bore 116 of tubing hanger 118. Inner seal leg 216 has reduced diameter sealing surface 220 disposed intermediately thereon which provides an initial sealing interference with seal surface 120 of seal nose 112.

A support ring 222 is positioned between seal legs 214 and 216. Support ring 222 is an annular ring with a generally U shaped cross section. Support ring 222 has an enlarged outer diameter portion 224 and a reduced diameter inner portion 226 disposed near the tips of the legs of ring 222. When support ring 222 is positioned between seal legs 214 and 216, an enlarged base portion 228 contacts the inside of seal legs 214 and 216 at their juncture with base portion 212. This contact positions the enlarged annular portion 224 and reduced annular portion 226 of support ring 222 opposite the seal surfaces 218 and 220, respectively, of seal apparatus 210. As in the preferred embodiment, support ring 222 has radially directed holes disposed therein which serve to equalize any pressure within seal legs 214 and 216. The support ring 222 is made of a much harder and stiffer material than seal apparatus 210 thereby giving the legs of support ring 222 a greater stiffness than seal legs 214 and 216. This greater stiffness maintains the initial interference of sealing surface 218 with seal bore 116 and the initial interference of sealing surface 220 with seal diameter 120.

As in the preferred embodiment, support ring 222 is slightly longer than seal legs 214 and 216 to provide a preset length to the seal assembly 210. This preset length permits retainer ring 142 to maintain seal assembly 210 in its proper position, without axial movement, against radial shoulder 122. Retainer ring 142 has internal thread 144 which engages the external thread 124 of seal nose 112 to secure seal assembly 210 in position. A snap ring 146 engages groove 148 in thread 124 to lock retainer ring 142 in position.

Claims

1. An annular seal assembly for sealing the annulus between a seal bore (60,116) and a seal member disposed therein, the seal assembly comprising an annular base (68,126,212); an inner (72,76,130,216) and an outer (70,74,128,214) seal leg extending from the base to define: a seal annulus therebetween and having, in use, an initial sealing interference with the seal member and the seal bore; the inner and the outer seal legs each terminating in a tip; means (94,98,142,146) for retaining the seal assembly on the seal member; and an annular support ring (86,136,222) disposed between the inner and the outer seal legs supporting the inner and outer seal legs, in use, in sealing engagement with the seal bore; characterised in that the seal assembly is a metal to metal seal assembly and further comprises an enlarged diameter seal surface (78,80,132,218) on the outer seal leg and a reduced diameter seal surface (82,84,134,220) on the inner seal leg, the reduced diameter seal surface having, in use, an initial sealing interference with the seal member, and the enlarged diameter seal surface having, in use, an initial sealing interference with the seal bore upon insertion of the seal member into the seal annulus; and the

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support ring maintains the reduced diameter seal surface in sealing engagement with the seal member, wherein the annular support ring has an enlarged portion (88,138,224,226), radially disposed and supporting the inner and outer seal legs, the annular support ring including a plurality of radially disposed circumferentially spaced holes (92,140) preventing fluid block during assembly and installation and balancing pressure distribution within the seal.

2. An assembly according to claim 1, wherein the annular support ring (86,136) has a substantially rectangular configuration.

3. An assembly according to claim 2, wherein each of the radially disposed circumferentially spaced holes (92,140) is intersected by an axially disposed hole (90,139).

4. An assembly according to claim 2 or claim 3, wherein the support ring (86,136) supports the inner (72,76,130) and the outer (70,74,128) seal legs at their tips.

5. An assembly according to claim 4, wherein the support ring (86,136) has a reduced cross section which extends axially inwardly from the tip to the juncture of the inner (72,76,130) and outer (70,74,128) seal legs with the base (68,126,212) and prevents axial movement of the support ring with respect to the seal legs.

6. An assembly according to claim 2 or claim 3, wherein the support ring supports the inner and the outer seal legs on their interior adjacent to the enlarged diameter seal surface and adjacent the reduced diameter seal surface.

7. An assembly according to any one of the preceding claims, further comprising second inner (72) and outer (70) seal legs similar to the inner (76) and outer (74) seal legs and extending from the opposite side of the base (68) with a second support ring (86) disposed therebetween, the second seal legs sealing against the seal member and seal bore in the same way as the inner and outer seal legs.

8. An assembly according to claim 1, wherein the support ring (222) has a generally U shaped configuration having the enlarged portion (224,226) adjacent to the enlarged diameter (218) and reduced diameter (224) seal surfaces.

Patentansprüche

1. Ringdichtungseinrichtung zur Abdichtung des Ringraumes zwischen einer Dichtungsbohrung (116) und einem darin angeordneten Dichtungsteil, wobei die Dichtungseinrichtung aufweist: eine ringförmige Basis (68, 126, 212); einen inneren (72, 76, 130, 216) und einen äußeren (70, 74, 128, 214) Dichtungsschenkel, die von der Basis ausgehen, um einen Dichtungsringraum zwischen diesen zu bilden, und die im Einsatz einen anfänglichen Dichtungseingriff mit dem Dichtungsteil und der Dichtungsbohrung aufweist, wobei die inneren und äußeren Dichtungsschenkel jeweils in einer Spitze enden; Einrichtungen (94, 98, 142, 146), um die Dichtungseinrichtung auf dem Dichtungsteil zu halten; und einen zwischen den inneren und äußeren Dichtungsschenkeln angeordneten ringförmigen Haltering (86, 136, 222), der im Einsatz die inneren und äußeren Dichtungsschenkel in dichtendem Eingriff mit der Dichtungsbohrung hält, **dadurch gekennzeichnet, daß** die Dichtungseinrichtung eine Metall-zu-Metall-Dichtungseinrichtung ist und ferner eine Dichtungsfläche (78, 80, 132, 218) mit vergrößertem Durchmesser auf dem äußeren Dichtungsschenkel und eine Dichtungsfläche (82, 84, 134, 220) mit verringertem Durchmesser auf dem inneren Dichtungsschenkel umfaßt, wobei die Dichtungsfläche mit verringertem Durchmesser im Einsatz einen anfänglichen Dichtungseingriff mit dem Dichtungsteil und die Dichtungsfläche mit vergrößertem Durchmesser im Einsatz einen anfänglichen Dichtungseingriff mit der Dichtungsbohrung nach Einsatz des Dichtungsteils in den Dichtungsringraum bereitstellt, und daß der Haltering die Dichtungsfläche mit verringertem Durchmesser in dichtendem Eingriff mit dem Dichtungsteil hält, wobei der ringförmige Haltering einen vergrößerten Abschnitt (88, 138, 224, 226) aufweist, der radial angeordnet ist und den inneren und äußeren Dichtungsschenkel trägt, wobei der ringförmige Haltering eine Vielzahl von radial angeordneten, um den Umfang beabstandeten Löchern (92, 140) umfaßt, die ein Blockieren des Strömungsmittels während des Zusammenbaus und der Installation verhindern und die die Druckverteilung innerhalb der Dichtung ausbalancieren.

2. Einrichtung nach Anspruch 1, bei der der ringförmige Haltering (86, 136) eine im wesentlichen rechteckige Foram aufweist.

3. Einrichtung nach Anspruch 2, bei der jedes der radial angeordneten, auf dem Umfang beabstandeten Löcher (92, 140) von einem axial angeordneten Loch (90, 139) durchschnitten

wird.

4. Einrichtung nach Anspruch 2 oder 3, bei der der Haltering (86, 136) die inneren (72, 76, 130) und äußeren (70, 74, 128) Dichtungsschenkel an ihren Spitzen hält.

5. Einrichtung nach Anspruch 4, bei der der Haltering (86, 136) einen verringerten Querschnitt hat, der sich axial von der Spitze nach innen zum Verbindungspunkt der inneren (72, 76, 130) und äußeren (70, 74, 128) Dichtungsschenkel mit der Basis (68, 126, 212) erstreckt und eine axiale Bewegung des Halterings in Bezug auf die Dichtungsschenkel verhindert.

6. Einrichtung nach Anspruch 2 oder 3, bei der der Haltering die inneren und äußeren Dichtungsschenkel auf ihrer Innenseite, benachbart der Dichtungsfläche mit vergrößertem Durchmesser und benachbart der Dichtungsfläche mit verringertem Durchmesser abstützt.

7. Einrichtung nach einem der vorhergehenden Ansprüche, er ferner umfaßt zweite innere (72) und äußere (70) Dichtungsschenkel, ähnlich den inneren (76) und äußeren (74) Dichtungsschenkeln umfaßt, die sich auf der gegenüberliegenden Seite der Basis (68) erstrecken, wobei ein zweiter Haltering (86) zwischen ihnen angeordnet ist und wobei die zweiten Dichtungsschenkel abdichtend an dem Dichtungsteil und der Dichtungsbohrung in gleicher Weise wie die inneren und äußeren Dichtungsschenkel angreifen.

8. Einrichtung nach Anspruch 1, der Haltering (222) eine im allgemeinen U-förmige Anordnung besitzt, wobei der vergrößerte Bereich (224, 226) benachbart der vergrößerten Durchmesserabdichtungsfläche (218) und der verringerten Durchmesserabdichtungsfläche (220) angeordnet ist.

Revendications

1. Joint d'étanchéité annulaire, destiné à assurer l'étanchéité de l'annulaire situé entre un alésage d'étanchéité (60, 116) et une pièce d'étanchéité disposée dans ce dernier, ce joint d'étanchéité comprenant une base annulaire (68, 126, 212), une branche intérieure de joint (72, 76, 130, 216) et une branche extérieure de joint (70, 74, 128, 214), qui s'étendent à partir de la base de façon à définir entre elles une cavité annulaire de joint et présentent, en position d'utilisation, un ajustement serré initial d'étanchéité avec la pièce d'étanchéité et l'alésage d'étanchéité et qui se terminent chacune par une partie extrême, des moyens (94, 98, 142, 146) servant à retenir le joint d'étanchéité sur la pièce d'étanchéité et une bague annulaire de soutien (86, 136, 222) disposée entre les branches intérieure et extérieure de joint et maintenant ces branches intérieure et extérieure de joint, en position d'utilisation, en contact d'étanchéité avec l'alésage d'étanchéité, caractérisé en ce qu'il est constitué d'un joint d'étanchéité métal-sur-métal et comprend en outre une surface d'étanchéité (78, 80, 132, 218) à diamètre augmenté sur la branche extérieure de joint et une surface d'étanchéité (82, 84, 134, 220) à diamètre réduit sur la branche intérieure de joint, la surface d'étanchéité à diamètre réduit présentant, en position d'utilisation, un ajustement serré initial d'étanchéité avec la pièce d'étanchéité, tandis que la surface de joint à diamètre augmenté présente, en position d'utilisation, un ajustement serré initial d'étanchéité avec l'alésage d'étanchéité lors de l'insertion de la pièce d'étanchéité dans la cavité annulaire du joint, et en ce que la bague de soutien maintient la surface d'étanchéité à diamètre réduit en contact d'étanchéité avec la pièce d'étanchéité et comporte une partie plus large (88,138, 224, 226) disposée radialement et soutenant les branches intérieure et extérieure du joint, cette bague annulaire de soutien comportant plusieurs perçages (92, 140), disposés radialement et espacés circonférentiellement, qui empêchent un blocage du fluide pendant l'assemblage et la mise en place et équilibrent la répartition de pression à l'intérieur du joint.

2. Joint d'étanchéité suivant la revendication 1, dans lequel la bague annulaire de soutien (86, 136) a une forme pratiquement rectangulaire.

3. Joint d'étanchéité suivant la revendication 2, dans lequel chacun des perçages (92, 140) disposés radialement et espacés circonférentiellement est recoupé par un perçage (90, 139) disposé axialement.

4. Joint d'étanchéité suivant l'une des revendications 2 et 3, dans lequel la bague de soutien (86, 136) soutien les branches intérieure (72, 76, 130) et extérieure (70, 74, 128) du joint à leurs parties extrêmes.

5. Joint d'étanchéité suivant la revendication 4, dans lequel la bague de soutien (86, 136) comporte une section transversale réduite qui s'étend axialement vers l'intérieur de la partie extrême à la jonction des branches intérieure (72, 76, 130) et extérieure (70, 74, 128) du joint avec sa base (68, 126, 212) et empêche un déplace-

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ment axial de cette bague de soutien vis-à-vis des branches du joint.

6. Joint d'étanchéité suivant l'une des revendications 2 et 3, dans lequel la bague de soutien soutient les branches intérieure et extérieure du joint par leurs surfaces intérieures, en un emplacement adjacent à la surface à diamètre augmenté du joint et en un emplacement adjacent à la surface à diamètre réduit du joint.

7. Joint d'étanchéité suivant l'une quelconque des revendications précédentes, comprenant en outre des secondes branches intérieure (72) et extérieure (70) de joint qui sont analogues aux branches intérieure (76) et extérieure (74) du joint et s'étendent à partir du côté opposé de la base (68), une seconde bague de soutien (86) étant disposée entre ces secondes branches et ces dernières assurant l'étanchéité vis-à-vis de la pièce d'étanchéité et de l'alésage d'étanchéité de la même manière que les branches .ntérieure et extérieure du joint.

8. Joint d'étanchéité suivant la revendication 1, dans lequel la bague de soutien (222) a une forme générale en U qui comporte les parties (224, 226) à diamètre augmenté et à diamètre réduit en une position adjacente aux surfaces (218) à diamètre augmenté et (220) à diamètre réduit du joint.