Description

The present invention relates to sealing assemblies.

Difficulties have been encountered in prior wellhead sealing assemblies in sealing between the exterior of the casing and the interior of the wellhead housing since the exterior of the casing may vary considerably in its dimensions. Additionally, extremely cold temperatures have made sealing with elastomers difficult because they contract very measurably in cold environments.

In one example of the prior art a wellhead sealing assembly designed for sealing in the annulus between the first and second casings at the wellhead of a geothermal well, the sealing assembly includes a first ring with inner and outer seals mounted thereon and separate energising rings which are actuated by screws extending vertically through a flange spanning the annulus above the sealing assembly. This structure is shown in U.S. Patent No. 4,299,395. The structure includes a base ring with an inner and an outer shoulder and a first of the energising rings has a downwardly facing inner shoulder facing the inner base ring shoulder.

Another example of a wellhead sealing assembly is shown in U.S. Patent No. 2,768,841. The sealing assembly in this structure includes a base ring with a sealing ring above it and a top ring which has a tapered upper-outer surface engaged by tiedown screws extending through the wellhead housing in a radial direction.

The W.L. Todd et al U.S. Patent No. 3,494,638 discloses a sealing assembly energised by radially extending tiedown screws and the seal ring includes an upper ring, a lower ring and a seal ring between them with screws initially loading the seal rings. A similar structure is shown in the J.W. Thatch U.S. Patent No. 2,617,485.

According to the present invention there is provided a seal assembly comprising a base ring having an inner shoulder, and an outer shoulder, a first energising ring having a downwardly facing inner shoulder facing said inner base ring shoulder and a second energising ring characterised in that said base ring includes an annular recess which opens upwardly, said first energising ring includes a downwardly extending projection engaging in said annular recess and spaced from the bottom thereof, and upper outwardly extending lugs with upper tapered surfaces tapering downwardly and outwardly, the second energising ring surrounds said projection on said first energising ring and has upwardly facing slots to receive said lugs, a lower surface facing said outer base ring shoulder and upper tapered surfaces tapering outwardly and downwardly, said assembly including an inner seal ring within said energising ring projection and between said inner base ring shoulder and said shoulder on said first energising ring, an outer seal ring surrounding said energising ring projection and between said outer base ring shoulder and said shoulder on said second energising ring, and radially movable means arranged to engage the tapered surfaces on the energising rings to actuate the seal rings.

One form of the present invention provides an improved wellhead assembly with an improved sealing assembly in the annulus between the wellhead housing and the casing which includes separate inner and outer seal ring which can be separately energised by radially extending tiedown screws. The annulus sealing assembly can include separately energisable inner and outer seal rings which provide sealing under extremes of cold and heat.

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

FIGURE 1 is an elevation view of the improved wellhead structure of the present invention with the central portion omitted, with the left half thereof shown in section to illustrate the outer seal energizing structure and with the right half portions in section to illustrate the inner seal energizing structure.

FIGURE 2 is a plan view of the sealing assembly showing the tiedown screws schematically thereon to illustrate the operation of each set of screws with the energizing rings.

FIGURE 3 is a sectional view taken along line 3-3 in FIGURE 2 of the sealing assembly in its assembled position before it is set.

FIGURE 4 is similar section view of the sealing assembly but showing it in its set position.

FIGURE 5 is an exploded view of the components of the sealing assembly.

Wellhead assembly 10 as shown in FIGURE 1 includes housing 12 having upper flange 14 to which other structure, such as a Christmas tree (not shown), may be connected as desired. Housing 12 is tubular and includes upwardly facing lower tapered shoulder 16 which supports hanger ring 18 which supports casing 20 in its position extending through housing 12. Housing 12 also includes angled shoulder 22 above shoulder 16. Shoulder 22 is sized to support seal structure 24 as shown.

Seal structure 24 includes annular seal assembly 26 and tiedown screws 28a and 28b extending radially through housing flange 14. Annular seal assembly 26 includes base ring 30, inner seal ring 32, outer seal ring 34, outer energizing ring 36, inner energizing ring 38 and retaining screws 39. Base ring 30 includes upwardly facing inner shoul-

der 42, upwardly facing outer shoulder 44, annular groove or recess 46 between shoulders 42 and 44 and downwardly facing outer tapered surface 45. When seal structure 24 is positioned in housing 12, it is supported by engagement of surface 45 on shoulder 22 in housing 12. Outer seal ring 34 is positioned on shoulder 44 and is engaged by outer energizing ring 36. Inner seal ring 32 is positioned on shoulder 42 and is engaged by inner energizing ring 38. Inner energizing ring 38 includes depending annular projection 48 which is positioned between seal rings 32 and 34 and extends into recess 46.

As shown in FIGURES 2 and 5, inner energizing ring 38 also includes outwardly extending lugs 50 with their upper outer surfaces 52 tapered downwardly and outwardly. Outer energizing ring 36 is positioned around projection 48 of ring 38 and includes upwardly facing slots 54 in which lugs 50 of ring 38 are received and upper surfaces 56 which taper downwardly and outwardly. The interengagement of lugs 50 in slots 54 positions the upper surfaces of energizing rings 36 and 38 on approximately the same level so that they are in proper position to be engaged by tiedown screws 28b and 28a. The positioning of lugs 50 in slots 54 and the engagement of screws 28b and 28a with energizing rings 36 and 38 is best seen in FIGURE 2. The upper surface of energizing ring 38 has a plurality of tapped holes 58 to receive lifting lugs (not shown) for placing and removing sealing assembly 26. In this drawing the screws 28 are designated 28a for those screws which engage and energize inner energizing ring 38 and 28b for those screws which engage and energize outer energizing ring 36.

Seal assembly 26 is shown in FIGURE 3 in its assembled position without any forces being exerted on seal rings 32 and 34 which would compress the rings into their set positions. Seal assembly 26 as shown in FIGURE 4 has been moved to its set position with seal rings 32 and 34 being compressed axially to cause them to expand radially into sealing engagement with the surfaces against which they are to seal.

Retainer screws 39, as shown in FIGURE 3, keep the individual components of seal assembly 26 together so they can be installed and removed as one preassembled unit.

Claims

1. A seal assembly comprising a base ring (30) having an inner shoulder (42), and an outer shoulder (44), a first energising ring (38) having a downwardly facing inner shoulder facing said inner base ring shoulder and a second energising ring (36) characterised in that said base ring includes an annular recess (46) which opens upwardly, said first energising ring includes a downwardly extending projection (48) engaging in said annular recess (46) and spaced from the bottom thereof, and upper outwardly extending lugs (50) with upper tapered surfaces (52) tapering downwardly and outwardly, the second energising ring (30) surrounds said projection (48) on said first energising ring (38) and has upwardly facing slots (54) to receive said lugs (50), a lower surface facing said outer base ring shoulder (44) and upper tapered surfaces tapering outwardly and downwardly, said assembly including an inner seal ring (32) within said energising ring projection and between said inner base ring shoulder and said shoulder on said first energising ring, an outer seal ring (34) surrounding said energising ring projection and between said outer base ring shoulder and said shoulder on said second energising ring, and radially movable means (28a, 24b) arranged to engage the tapered surfaces on the energising rings to actuate the seal rings.

2. A seal assembly according to claim 1 characterised by including means (39) for retaining said first energising ring (38) in assembled relationship to said base ring (30).

3. A seal assembly according to claim 1, characterised in that said slots (54) on said second energising ring (36) allow sufficient energising movement of the lugs (50) of said first energising ring (38) to ensure proper energisation of said inner seal ring (32).

4. A seal assembly according to claim 1, characterised in that said slots (54) and lugs (50) are uniformly spaced around said energising ring (38) to allow independent energisation by engagement of their respective tapered surfaces by radially extending tiedown screws (28a, 28b).

Revendications

1. Ensemble constituant un joint d'étanchéité, comportant une bague de base (30) qui présente un épaulement intérieure (42) et un épaulement extérieur (44), une première bague de mise sous contrainte (38) qui présente un épaulement intérieur, faisant face vers le bas et faisant face audit épaulement intérieur de la bague de base et une seconde bague de mise sous contrainte (36), ensemble caractérisé par le fait que ladite bague de base présente une gouttière annulaire (46) qui s'ouvre vers le

der 42, upwardly facing outer shoulder 44, annular groove or recess 46 between shoulders 42 and 44 and downwardly facing outer tapered surface 45. When seal structure 24 is positioned in housing 12, it is supported by engagement of surface 45 on shoulder 22 in housing 12. Outer seal ring 34 is positioned on shoulder 44 and is engaged by outer energizing ring 36. Inner seal ring 32 is positioned on shoulder 42 and is engaged by inner energizing ring 38. Inner energizing ring 38 includes depending annular projection 48 which is positioned between seal rings 32 and 34 and extends into recess 46.

As shown in FIGURES 2 and 5, inner energizing ring 38 also includes outwardly extending lugs 50 with their upper outer surfaces 52 tapered downwardly and outwardly. Outer energizing ring 36 is positioned around projection 48 of ring 38 and includes upwardly facing slots 54 in which lugs 50 of ring 38 are received and upper surfaces 56 which taper downwardly and outwardly. The interengagement of lugs 50 in slots 54 positions the upper surfaces of energizing rings 36 and 38 on approximately the same level so that they are in proper position to be engaged by tiedown screws 28b and 28a. The positioning of lugs 50 in slots 54 and the engagement of screws 28b and 28a with energizing rings 36 and 38 is best seen in FIGURE 2. The upper surface of energizing ring 38 has a plurality of tapped holes 58 to receive lifting lugs (not shown) for placing and removing sealing assembly 26. In this drawing the screws 28 are designated 28a for those screws which engage and energize inner energizing ring 38 and 28b for those screws which engage and energize outer energizing ring 36.

Seal assembly 26 is shown in FIGURE 3 in its assembled position without any forces being exerted on seal rings 32 and 34 which would compress the rings into their set positions. Seal assembly 26 as shown in FIGURE 4 has been moved to its set position with seal rings 32 and 34 being compressed axially to cause them to expand radially into sealing engagement with the surfaces against which they are to seal.

Retainer screws 39, as shown in FIGURE 3, keep the individual components of seal assembly 26 together so they can be installed and removed as one preassembled unit.

Claims

1. A seal assembly comprising a base ring (30) having an inner shoulder (42), and an outer shoulder (44), a first energising ring (38) having a downwardly facing inner shoulder facing said inner base ring shoulder and a second energising ring (36) characterised in that said base ring includes an annular recess (46) which opens upwardly, said first energising ring includes a downwardly extending projection (48) engaging in said annular recess (46) and spaced from the bottom thereof, and upper outwardly extending lugs (50) with upper tapered surfaces (52) tapering downwardly and outwardly, the second energising ring (30) surrounds said projection (48) on said first energising ring (38) and has upwardly facing slots (54) to receive said lugs (50), a lower surface facing said outer base ring shoulder (44) and upper tapered surfaces tapering outwardly and downwardly, said assembly including an inner seal ring (32) within said energising ring projection and between said inner base ring shoulder and said shoulder on said first energising ring, an outer seal ring (34) surrounding said energising ring projection and between said outer base ring shoulder and said shoulder on said second energising ring, and radially movable means (28a, 24b) arranged to engage the tapered surfaces on the energising rings to actuate the seal rings.

2. A seal assembly according to claim 1 characterised by including means (39) for retaining said first energising ring (38) in assembled relationship to said base ring (30).

3. A seal assembly according to claim 1, characterised in that said slots (54) on said second energising ring (36) allow sufficient energising movement of the lugs (50) of said first energising ring (38) to ensure proper energisation of said inner seal ring (32).

4. A seal assembly according to claim 1, characterised in that said slots (54) and lugs (50) are uniformly spaced around said energising ring (38) to allow independent energisation by engagement of their respective tapered surfaces by radially extending tiedown screws (28a, 28b).

Revendications

1. Ensemble constituant un joint d'étanchéité, comportant une bague de base (30) qui présente un épaulement intérieure (42) et un épaulement extérieur (44), une première bague de mise sous contrainte (38) qui présente un épaulement intérieur, faisant face vers le bas et faisant face audit épaulement intérieur de la bague de base et une seconde bague de mise sous contrainte (36), ensemble caractérisé par le fait que ladite bague de base présente une gouttière annulaire (46) qui s'ouvre vers le

haut, par le fait que ladite première bague de mise sous contrainte présente un prolongement (48) qui s'étend vers le bas, vient en prise dans ladite gouttière annulaire (46) et est espacé du fond de cette gouttière, ainsi que des oreilles (50) qui s'étendent vers le bas, avec des surfaces supérieures (52) en dépouille vers le bas et vers l'extérieur, par le fait que la seconde bague de mise sous contrainte (36) entoure ledit prolongement (48) prévu sur ladite première bague de mise sous contrainte (38) et présente des encoches (54), faisant face vers le haut, pour recevoir lesdites oreilles (50), une surface inférieure faisant face audit épaulement extérieur (44) de la bague de base et les surfaces supérieures en dépouille partant en dépouille vers l'extérieur et vers le bas, ledit ensemble comportant une bague d'étanchéité intérieure (32) située à l'intérieur dudit prolongement de la bague de mise sous contrainte et entre ledit épaulement intérieur de la bague de base et ledit épaulement prévu sur ladite première bague de mise sous contrainte, une bague d'étanchéité extérieure (34) entourant ledit prolongement de la bague de mise sous contrainte, entre ledit épaulement extérieur de la bague de base et ledit épaulement prévu sur ladite seconde bague de mise sous contrainte, et des moyens (28a, 28b), mobiles dans le sens radial, étant disposés pour venir en prise avec les surfaces en dépouille des bagues de mise sous contrainte pour actionner les bagues d'étanchéité.

2. Ensemble constituant un joint d'étanchéité selon la revendication 1, caractérisé par le fait qu'il comporte des moyens (39) pour retenir ladite première bague de mise sous contrainte (38) assemblée avec ladite bague de base (30).

3. Ensemble constituant un joint d'étanchéité selon la revendication 1, caractérisé par le fait que lesdites encoches (54) prévues sur ladite seconde bague de mise sous contrainte (36) permettent un mouvement suffisant de mise sous contrainte de la part des oreilles (50) de ladite première bague de mise sous contrainte (38) pour assurer la mise sous contrainte correcte de ladite bague d'étanchéité intérieure (32).

4. Ensemble constituant un joint d'étanchéité selon la revendication 1, caractérisé par le fait que lesdites encoches (54) et oreilles (50) sont uniformément espacées autour de ladite bague de mise sous contrainte (38) pour permettre une mise sous contrainte indépendante par le fait que des vis de liage (28a, 28b), s'étendant radialement, viennent en prise avec les surfaces en dépouilles respectives.

Patentansprüche

1. Dichtungsanordnung mit einem Grundring (30), der eine innere Schulter (42) und eine äußere Schulter (44) aufweist, einen ersten Verstärkungsring (38), der eine nach unten weisende innere Schulter aufweist, die zu der inneren Grundringschulter hinweist, und einen zweiten Verstärkungsring (36), dadurch gekennzeichnet, daß der Grundring eine ringförmige Auskehlung (46) umfaßt, welche sich nach oben öffnet, wobei der erste Verstärkungsring einen nach unten verlaufenden Ansatz (48) aufweist, der in der ringförmigen Auskehlung (46) in Eingriff steht und von dessen Boden beabstandet ist, sowie obere sich auswärts erstreckende Nasen (50) mit oberen abgeschrägten Flächen (52), die nach außen und unten abgeschrägt sind, wobei der zweite Verstärkungsring (36) den Ansatz (48) an dem ersten Verstärkungsring (38) umgibt und nach oben weisende Schlitze (54) zum Aufnehmen der Nasen (50), eine zu der äußeren Grundringschulter (44) hinweisende untere Fläche und sich nach außen und unten verjüngende obere abgeschrägte Flächen aufweist, wobei die Anordnung einen inneren Dichtungsring (32) innerhalb des Verstärkungsringansatzes und zwischen der inneren Grundringschulter und der Schulter an dem ersten Verstärkungsring umfaßt, ferner einen äußeren Dichtungsring (34) umgebend den Verstärkungsringansatz und zwischen der äußeren Grundringschulter und der Schulter an dem zweiten Verstärkungsring sowie eine in Radialrichtung bewegliche Einrichtung (28a,24b), die dafür vorgesehen ist, die abgeschrägten Flächen an den Verstärkungsringen zu kontaktieren, um die Dichtungsringe zu betätigen.

2. Dichtungsanordnung nach Anspruch 1, gekennzeichnet durch eine Einrichtung (39) zum Festhalten des ersten Verstärkungsringes (38) in angebrachter Lage an dem Grundring (30).

3. Dichtungsanordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Schlitze (54) an den zweiten Verstärkungsring (36) eine ausreichende Verstärkungsbewegung der Nasen (50) des ersten Verstärkungsringes (38) zulassen, um eine geeignete Verstärkung des inneren Dichtungsringes (32) sicherzustellen.

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4. Dichtungsanordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Schlitze (54) und die Nasen (50) gleichförmig um den Verstärkungsring, (38) herum beabstandet sind, um unabhängige Verstärkung zulassen durch Kontaktieren ihrer jeweiligen abgeschrägten Flächen durch Spannschrauben (28a,28b), die sich radial erstrecken.