Description

Subsea wellheads normally have a large diameter conductor casing, such as a thirty inch (76 cm) casing, on which a housing is supported which housing extends upwardly and downwardly from the wellhead and is supported from the conductor casing. In low pressure drilling structures or high pressure production risers, external cyclic loads are imparted to the wellhead housing. It is preferred to transmit these cyclic loads from the wellhead housing to the conductor casing. When such cyclic loads are allowed to enter the smaller casing connected to the wellhead housing, fatigue in the smaller casing may result.

In prior structures large external bending loads are usually reacted through a force couple system created when the wellhead housing and a smaller casing (20" (51 cm)) move relative to the conductor casing until contact is made. The force couple system is sometimes accomplished using bosses located on the wellhead housing and heavy wall extension that contact the conductor housing (large casing 30 " (76 cm)) when relative movement occurs. These bosses, however, require radial clearance to enable the wellhead housing to be run inside the conductor housing. The radial clearance between components allows the smaller casing to react those cyclic loads insufficient to move the wellhead housing enough to create the force couple. Reacting these loads in the smaller casing could result in fatigue of the smaller casing.

Also prior axial attachment of the wellhead housing and conductor casing is accomplished by one component carrying spring loaded latching segments, pins or a split ring that engage in a mating groove on the other component (e.g., U. S. Patent Nos. 3,468,558 and 3,871,449). These attachment mechanisms, due to design clearances, allow axial movement of the wellhead housing. Axial movement of the wellhead housing could result in some load transfer mechanism, such as moment bosses or double angle tapers, to be disengaged when the smaller casing is cemented. Having the load transfer mechanism between the wellhead housing and conductor casing disengaged could create a fatigue problem in the smaller casing.

Another prior art arrangement is described in US-A-4012059. This describes a structure substantially in accordance with the pre-characterising part of claim 1.

An object of the present invention is to provide an improved subsea wellhead structure which transmits external cyclic loading from the wellhead housing to the conductor casing.

The present invention provides a subsea wellhead comprising a conductor casing positioned in the well bore and having an internal upwardly facing shoulder, and an internal latching groove above said shoulder, a housing having an external downwardly facing shoulder supported on said casing shoulder, a first external groove above said housing shoulder with a lower surface, said first housing groove opening to said latching groove, a split latching and loading ring within said first housing groove and having an internal surface tapering upwardly and outwardly and actuating means, characterised in that the lower surface tapers slightly upwardly and outwardly, the housing has a second external groove spaced above the first groove, the wellhead includes a cam ring having an external surface tapering upwardly and outwardly to mate with the internal tapered surface of said latching and loading ring, said actuating means are operable to move said cam ring behind said latching and loading ring to ensure transfer of loads from the upper portion of said housing through said latching and loading ring into said conductor casing, and means are operable to coact between said cam ring and said second housing groove to retain said cam ring in a set position behind said latching and loading ring.

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 subsea wellhead structure of the present invention.

Figure 2 is a partial section view through the improved structure prior to the latching and loading connection being made.

Figure 3 is another similar partial sectional view showing the completion of the latching and loading connection.

Subsea wellhead structure 10 is shown in position at the bottom of the body of water and is supported by landing platform 12 and actuating means 14 is lowered on tugger lines 16 extending upwardly from eyes 18 on arms 20 of guide structure 22. With structure 10 supported as shown on guide structure 22 it is lowered over guide lines 24 and is landed on guide posts 26 as shown.

The details of subsea wellhead structure 10 is more completely shown in Figures 2 and 3. Subsea wellhead structure 10 includes conductor casing 28 which has external groove 30, internal upwardly facing shoulder 32, internal groove 34 above shoulder 32 and internal tapered surface 36 which tapers downwardly and inwardly to internal bore 38 of casing 28. Normally, conductor casing 28 is the large diameter casing, such as a thirty inch (76 cm) casing, of the wellhead. Structure 10 also includes wellhead housing 40 with it external downwardly facing shoulder 42 which is adapted to seat on shoulder 32 of conductor casing 28, external groove 46 which faces and registers with internal

groove 34 in conductor casing 28 and upper external groove 48 above groove 46. Split latching and loading ring 50 is positioned on shoulder 52 which forms the lower surface of groove 46 and is tapered upwardly and outwardly at a slight angle, for example, an angle of approximately five degrees with respect to horizontal. Ring 50 includes internal tapered surface 54 and upper tapered surface 56. Cam ring 58 surrounds housing 40 and in running position is releasably secured thereto by suitable means, such as shear pins 60. Lower external surface 62 is tapered to engage and mate with tapered surface 56 and the exterior of cam ring 58 above surface 62 is tapered surface 64 which mate with and functions to cam split ring 50 when cam ring 58 is moved downwardly within split ring 50 as shown in FIGURE 3. Upper surface 66 of cam ring 58 is exposed for suitable engagement of actuating means 14 as hereinafter described. Immediately below upper surface 66 is a plurality of bores 68 extend radially through cam ring 58 and pins 70 extend therefrom and are biased inwardly by springs 72.

Actuating means 14 is provided to move cam ring 58 into position wedging split ring 50 into its latched and loaded position as shown in FIGURE 3. Actuating means 14 includes structural ring 74, from which arms 20 extend, locking ring 76 which is supported from ring 74 by rods 78 of pistons 80 and locking segments 82 which are actuated by pistons 84 and are connected to the inner end of piston rods 86. When actuating means 14 is lowered into position surrounding conductor casing 28 and wellhead housing 40 as shown in FIGURE 2 it is lowered downward until locking segments 82 engage within external groove 30 of conductor casing 28. In this position actuating means 14 is locked in position and ready to actuate cam ring 58. Annular depending projection 88 of structural ring 76 engages upper surface 66 of cam ring 58. The energization of pistons 80 moves ring 74 downward by retracting their rods 78. This downward movement is sufficient to move cam ring 58 into its wedging position. Also, sufficient force is developed to shear pins 60.

The wedging of split ring 50 outwardly by cam ring 58 also causes a wedging of ring 50 between surface 52 which tapers upwardly in the outward direction and upper shoulder 90 of groove 34. Also, the downward facing shoulder 42 of wellhead housing 40 is brought into tight engagement with the upward facing shoulder 32 of conductor casing 28. Split ring 50 is in tight between shoulders 52 and 90 and shoulder 42 of well housing 40 engages shoulder 32 of conductor casing 28.

In this position the cyclic loading on the upper end of wellhead housing 40 is transmitted through split ring 50 into the upper end of conductor casing 28 and through shoulder 42 of wellhead housing 40 into shoulder 32 of conductor casing 28 so that the smaller casing members are isolated from such cyclic loading to protect them from possible fatigue failure.

Claims

1. A subsea wellhead comprising a conductor casing (28) positioned in the well bore and having an internal upwardly facing shoulder (32), and an internal latching groove (34) above said shoulder, a housing (40) having an external downwardly facing shoulder (42) supported on said casing shoulder (32), a first external groove (46) above said housing shoulder with a lower surface (52), said first housing groove (46) opening to said latching groove (34), a split latching and loading ring (50) within said first housing groove (46) and having an internal surface tapering upwardly and outwardly and actuating means (14), characterised in that the lower surface (52) tapers slightly upwardly and outwardly, the housing (40) has a second external groove (48) spaced above the first groove, the wellhead includes a cam ring (58) having an external surface (64) tapering upwardly and outwardly to mate with the internal tapered surface of said latching and loading ring, said actuating means (14) are operable to move said cam ring behind said latching and loading ring to ensure transfer of loads from the upper portion of said housing through said latching and loading ring into said conductor casing, and means (70) are operable to coact between said cam ring (58) and said second housing groove (48) to retain said cam ring (58) in a set position behind said latching and loading ring.

2. A subsea wellhead according to claim 1, wherein said cam ring (58) has its upper surface (66) exposed on the exterior of said housing to be engaged by said actuating means (14) for moving said latching and loading ring (50) into its latched and load transfer position.

3. A subsea wellhead according to claim 1 or claim 2, wherein when said cam ring (58) is set said latching and loading ring (50) is retained in position partly in both of said first external housing groove (46) and said casing internal groove (34).

4. A subsea wellhead structure according to any preceding claim including means (60) releasably retaining said cam ring (58) out of wedging contact with said latching and loading split

groove 34 in conductor casing 28 and upper external groove 48 above groove 46. Split latching and loading ring 50 is positioned on shoulder 52 which forms the lower surface of groove 46 and is tapered upwardly and outwardly at a slight angle, for example, an angle of approximately five degrees with respect to horizontal. Ring 50 includes internal tapered surface 54 and upper tapered surface 56. Cam ring 58 surrounds housing 40 and in running position is releasably secured thereto by suitable means, such as shear pins 60. Lower external surface 62 is tapered to engage and mate with tapered surface 56 and the exterior of cam ring 58 above surface 62 is tapered surface 64 which mate with and functions to cam split ring 50 when cam ring 58 is moved downwardly within split ring 50 as shown in FIGURE 3. Upper surface 66 of cam ring 58 is exposed for suitable engagement of actuating means 14 as hereinafter described. Immediately below upper surface 66 is a plurality of bores 68 extend radially through cam ring 58 and pins 70 extend therefrom and are biased inwardly by springs 72.

Actuating means 14 is provided to move cam ring 58 into position wedging split ring 50 into its latched and loaded position as shown in FIGURE 3. Actuating means 14 includes structural ring 74, from which arms 20 extend, locking ring 76 which is supported from ring 74 by rods 78 of pistons 80 and locking segments 82 which are actuated by pistons 84 and are connected to the inner end of piston rods 86. When actuating means 14 is lowered into position surrounding conductor casing 28 and wellhead housing 40 as shown in FIGURE 2 it is lowered downward until locking segments 82 engage within external groove 30 of conductor casing 28. In this position actuating means 14 is locked in position and ready to actuate cam ring 58. Annular depending projection 88 of structural ring 76 engages upper surface 66 of cam ring 58. The energization of pistons 80 moves ring 74 downward by retracting their rods 78. This downward movement is sufficient to move cam ring 58 into its wedging position. Also, sufficient force is developed to shear pins 60.

The wedging of split ring 50 outwardly by cam ring 58 also causes a wedging of ring 50 between surface 52 which tapers upwardly in the outward direction and upper shoulder 90 of groove 34. Also, the downward facing shoulder 42 of wellhead housing 40 is brought into tight engagement with the upward facing shoulder 32 of conductor casing 28. Split ring 50 is in tight between shoulders 52 and 90 and shoulder 42 of well housing 40 engages shoulder 32 of conductor casing 28.

In this position the cyclic loading on the upper end of wellhead housing 40 is transmitted through split ring 50 into the upper end of conductor casing 28 and through shoulder 42 of wellhead housing 40 into shoulder 32 of conductor casing 28 so that the smaller casing members are isolated from such cyclic loading to protect them from possible fatigue failure.

Claims

1. A subsea wellhead comprising a conductor casing (28) positioned in the well bore and having an internal upwardly facing shoulder (32), and an internal latching groove (34) above said shoulder, a housing (40) having an external downwardly facing shoulder (42) supported on said casing shoulder (32), a first external groove (46) above said housing shoulder with a lower surface (52), said first housing groove (46) opening to said latching groove (34), a split latching and loading ring (50) within said first housing groove (46) and having an internal surface tapering upwardly and outwardly and actuating means (14), characterised in that the lower surface (52) tapers slightly upwardly and outwardly, the housing (40) has a second external groove (48) spaced above the first groove, the wellhead includes a cam ring (58) having an external surface (64) tapering upwardly and outwardly to mate with the internal tapered surface of said latching and loading ring, said actuating means (14) are operable to move said cam ring behind said latching and loading ring to ensure transfer of loads from the upper portion of said housing through said latching and loading ring into said conductor casing, and means (70) are operable to coact between said cam ring (58) and said second housing groove (48) to retain said cam ring (58) in a set position behind said latching and loading ring.

2. A subsea wellhead according to claim 1, wherein said cam ring (58) has its upper surface (66) exposed on the exterior of said housing to be engaged by said actuating means (14) for moving said latching and loading ring (50) into its latched and load transfer position.

3. A subsea wellhead according to claim 1 or claim 2, wherein when said cam ring (58) is set said latching and loading ring (50) is retained in position partly in both of said first external housing groove (46) and said casing internal groove (34).

4. A subsea wellhead structure according to any preceding claim including means (60) releasably retaining said cam ring (58) out of wedging contact with said latching and loading split

ring (50).

5. A subsea wellhead structure according to claim 4, wherein said releasable retaining means (60) includes at least one shear pin connecting said cam ring (58) to said housing (40).

6. A subsea wellhead structure according to any preceding claim wherein said means (70) operable to coact between said cam ring (58) and said housing (40) includes spring loaded pins (70) carried by said cam ring (58) and adapted to engage within said second external housing groove (48) to retain said cam ring in its set position.

7. A subsea wellhead according to any preceding claim wherein said actuating means (14) includes a first piston (84) connected to move a locking segment (82) into an external groove (82) of said conductor casing (28), and a ring (74) movably supported from said locking segment and engageable with said cam ring to move it into wedging engagement with said latching and loading ring.

Revendications

1. Tête de puits sous-marine comportant un chemisage conducteur (28) mis en place dans le forage du puits et possédant un épaulement interne (32) faisant face vers le haut, et une gorge interne (34) de verrouillage située au-dessus dudit épaulement, une enveloppe (40) possédant un épaulement externe (42) faisant face vers le bas et supporté par ledit épaulement (32) du chemisage, une première gorge externe (46) située au-dessus dudit épaulement de l'enveloppe et présentant une surface inférieure (52), ladite première gorge (46) de l'enveloppe étant orientée vers ladite gorge (34) de verrouillage, un anneau fendu (50) de verrouillage et de mise en charge situé à l'intérieur de ladite première gorge (46) de l'enveloppe et possédant une surface interne évasée vers le haut et vers l'extérieur et des moyens (14) de mise en action, caractérisée en ce que la surface inférieure (52) est évasée légèrement vers le haut et vers l'extérieur, l'enveloppe (40) possède une seconde gorge externe (48) située à une certaine distance au-dessus de la première gorge, la tête de puits comprend un anneau formant came (58) possédant une surface externe (64) évasée vers le haut et vers l'extérieur de manière à épouser la surface interne évasée dudit anneau de verrouillage et de mise en charge, lesdits moyens (14) de mise en action peuvent être manoeuvrés de façon à déplacer ledit anneau formant came et le mettre en place derrière ledit anneau de verrouillage et de mise en charge, de manière à assurer une transmission des efforts provenant de la partie supérieure de ladite enveloppe par l'intermédiaire dudit anneau de verrouillage et de mise en charge jusque dans ledit chemisage conducteur, et des moyens (70) sont susceptibles d'être manoeuvrés de manière à agir conjointement entre ledit anneau (58) formant came et ladite seconde gorge (48) de l'enveloppe de façon à retenir ledit anneau (58) formant came en une position calée située derrière ledit anneau de verrouillage et de mise en charge.

2. Tête de puits sous-marine selon la revendication 1, dans laquelle ledit anneau (58) formant came a sa surface supérieure (66) qui est découverte à l'extérieur de ladite enveloppe de façon à ce que lesdits moyens (14) de mise en action viennent en contact avec cette surface afin de déplacer ledit anneau (50) de verrouillage et de mise en charge jusque dans sa position verrouillée et de transmission d'efforts.

3. Tête de puits sous-marine selon la revendication 1 ou la revendication 2, dans laquelle lorsque ledit anneau (58) formant came est calé ledit anneau (50) de verrouillage et de mise en charge est retenu en place partiellement dans chacun des deux éléments constitués par ladite première gorge externe (46) de l'enveloppe et ladite gorge interne (34) du chemisage.

4. Structure de tête de puits sous-marine selon l'une quelconque des revendications précédentes, comprenant des moyens (60), susceptibles d'être relâchés, qui retiennent ledit anneau (58) formant came à l'abri de tout contact de clavetage avec ledit anneau fendu (50) de verrouillage et de mise en charge.

5. Structure de tête de puits sous-marine selon la revendication 4, dans laquelle lesdits moyens (60) de retenue susceptibles d'être relâchés comprennent un goujon cisaillable qui relie ledit anneau (58) formant came à ladite enveloppe (40).

6. Structure de tête de puits sous-marine selon l'une quelconque des revendications précédentes dans laquelle lesdits moyens (70) susceptibles d'être manoeuvrés de manière à agir conjointement entre ledit anneau (58) formant came et ladite enveloppe (40) comprennent des ergots (70) poussés par des ressorts char-

gés, portés par ledit anneau (58) formant came et aptes à venir s'emboîter à l'intérieur de ladite seconde gorge externe (48) de l'enveloppe de façon à retenir ledit anneau formant came à sa position calée.

7. Tête de puits sous-marine selon l'une quelconque des revendications précédentes dans laquelle lesdits moyens (14) de mise en action comprennent un premier piston (84) raccordé de façon à déplacer un segment (82) de verrouillage jusque dans une gorge externe (30) dudit chemisage conducteur (28), et un anneau (74) supporté avec la faculté de se déplacer par ledit segment de verrouillage et susceptible de venir en contact avec ledit anneau formant came de façon à le déplacer jusqu'à ce qu'il s'emboîte par clavetage sur ledit anneau de verrouillage et de mise en charge.

Patentansprüche

1. Ein Unterseebohrlochkopf mit einem Führungsmantel (28), der in der Bohrlochbohrung angeordnet ist und eine innere nach oben weisende Schulter (32) und eine innere Einrastrille (34) oberhalb der Schulter aufweist, einem Gehäuse (40), das eine äußere nach unten weisende Schulter (42), die auf der Mantelschulter (32) gehalten ist, und eine erste äußere Rille (46) oberhalb der Gehäuseschulter mit einer unteren Oberfläche (52) aufweist, wobei die erste Gehäuserille (46) zu der Einrastrille (34) hin öffnet, einem gespalteten Einrast- und Belastungsring (50), der innerhalb der ersten Gehäuserille (46) angeordnet ist und eine innere Oberfläche, die nach oben und außen spitz zuläuft, aufweist, und mit eine Antriebseinrichtung (14), **dadurch gekennzeichnet,** daß die untere Oberfläche (52) geringfügig nach oben und außen spitz zuläuft das Gehäuse (40) eine zweite äußere Rille (48) aufweist, welche oberhalb der ersten Rille angeordnet ist, der Bohrlochkopf einen Nockenring (58) enthält, welcher eine äußere Oberfläche (64) aufweist, welche nach oben und außen spitz zuläuft, um mit der inneren, spitz zulaufenden Oberfläche des Einrast- und Belastungsrings zusammenzupassen, wobei die Antriebseinrichtung (14) in der Lage ist, den Nockenring hinter den Einrast- und Belastungsring zu bewegen, um die Übertragung von Belastungen von dem oberen Teil des Gehäuses über den Einrast- und Belastungsring in dem Führungsmantel zu sichern, und daß Einrichtungen (70) betreibbar sind, um zwischen dem Nockenring (58) und der zweiten Gehäuserille (48) zusammenzuwirken, um den Nockenring (48) in einer eingestellten Position hinter dem Einrast- und Belastungsring zu halten.

2. Ein Unterseebohrlochkopf nach Anspruch 1, wobei der Nockenring (58) seine obere Fläche (66) frei auf der Außenseite des Gehäuses hat, um mit der Antriebseinrichtung (14) in Eingriff zu kommen, um den Einrast- und Belastungsring (50) in seine eingerastete und zur Belastungsübertragung vorgesehene Position zu bringen.

3. Ein Unterseebohrlochkopf nach Anspruch 1 oder 2, wobei, wenn der Nockenring (58) eingestellt ist, der Einrast- und Belastungsring (50) teilweise sowohl in der ersten äußeren Gehäuserinne (46) als auch in der Mantelinnenrille (34) in Position gehalten wird.

4. Ein Unterseebohrlochkopfaufbau nach wenigstens einem der vorhergehenden Ansprüche, welcher eine Einrichtung (60) enthält, welche lösbar den Nockenring (58) außer Keileingriffskontakt mit dem Einrast- und Belastungsring (50) hält.

5. Ein Unterseebohrlochkopfaufbau nach Anspruch 4, wobei die lösbare Halteeinrichtung (60) wenigstens einen Scherstift enthält, welcher den Nockenring (58) mit dem Gehäuse (40) verbindet.

6. Ein Unterseebohrlochkopfaufbau nach wenigstens einem der vorhergehenden Ansprüche, wobei die zur Zusammenarbeit zwischen dem Nockenring (58) und dem Gehäuse (40) betreibbare Einrichtung (70) durch eine Feder beaufschlagbare Stifte (70) enthält, die durch den Nockenring (58) getragen werden und dazu vorgesehen sind, mit der zweiten äußeren Gehäuserille (48) in Eingriff zu kommen, um den Nockenring in seiner eingestellten Position zu halten. .

7. Ein Unterseebohrlochkopf nach wenigstens einem der vorhergehenden Ansprüche, wobei die Antriebseinrichtung (14) einen ersten Kolben (84) enthält, welcher angeschlossen ist, um ein Verschließsegment (82) in einer äußeren Rille (82) des Führungsmantels (28) zu bewegen, und einen Ring (74) enthält, der bewegbar von dem Verschließelement gehaltert ist und in Eingriff mit dem Nockenring bringbar ist, um ihn in Verkeilungseingriff mit dem Einrast- und Belastungsring zu bringen.

* C L M S *