

Description

The present invention relates to a wellhead structure as mentioned in the preamble of claim 1. Such structures are known e.g. from US-A-2134311. Compact wellheads have been used to provide a suspension and sealing system for casing and tubing strings from a single head which reduces the stack-up height and reduces the number of connections required. Also, with such compact wellhead the blowout preventer stack is not removed during installation of the casing and tubing. Normally, with the use of such compact heads, the last string of pipe with the casing hangers attached is run into the well and the casing hangers are landed rather than using slips to support a casing string and cutting the string for the installation of a hanger thereon. This system would utilize the slips for support and the elastomeric seals to provide the annulus seal.

Some hangers have utilized slips to engage and support the well string. U. S. -A- 2,920,909 and US-A-3,311,168 disclose such structure. Other hangers have had an external shoulder which is adapted to seat on an internal housing seat, such as is shown in U. S. -A- 3,561,527 and US-A-3,797,864. Such hangers are provided normally with external threads on their lower ends and have their well strings threaded thereon.

In the past it has been known that a portion of a remote connector could be remotely cold formed onto the end of a subsea pipeline so that a repair section would be connected to the existing pipeline. Examples of cold forming are shown in U. S. -A- 3,432,916, US-A-4,330,144; and US-A-4,388,752. U. S. -A- 4,662,663 suggests the use of a material within the grooves to compensate for any build-up of pressure therein during forming. U. S. -A- 2,134,311 discloses the roll forging of the upper end of a string into grooves within the interior of casing head to support and seal the upper end of the string therein.

Reference is also made to US-A-4892149 which discloses the securing of a tubular member within an annular wall member in a cold forging operation.

According to the present invention a wellhead structure comprises a string within a well bore, a housing surrounding the upper end of the string, and means connecting the housing to the upper end of the string, and characterised by a bushing positioned generally coaxially within the housing, the bushing having been cold forged into engagement with at least one of the housing and the string such that it assists in providing a gripping and sealing engagement between the string and housing, and a resilient annulus carried by the bushing and arranged to transmit forging forces to the

string during the cold forging.

The present invention relates to a wellhead structure in which a string, such as a casing or tubing string, is sealed to the housing without the aid of elastomeric seals and includes an internal bushing which may provide a substantial inner diameter which is unrestricted except for a landing shoulder included in the structure. Also, the internal bushing may be used in the cold forging of the string into a housing recess to improve the gripping and sealing engagement therebetween. The bushing may include a series of projections which alternate with the gripping and sealing projections within the housing recess and includes a resilient annulus which may be between the exterior of the bushing and the interior of the string to ensure the uniform application of pressure against the interior of the string and also to permit retraction of the forging tool in instances where large casing is being forged into a housing with a restricted inner diameter.

These and other objects and advantages of the present invention are hereinafter set forth and explained with reference to the drawings wherein:

FIGURE 1 is a partial longitudinal sectional view of one form of the improved wellhead structure of the present invention having an internal bushing which includes an external resilient insert for exerting the forging pressure uniformly over the interior of the string and also to permit retraction of the forging tool in instances where large casing is being forged into a housing with a restricted inner diameter.

FIGURE 2 is a view similar to FIGURE 1 but showing the structure after it has been cold forged.

As shown in FIGURE 1, casing string 10 is positioned within outer well casing 12. Both strings 10 and 12 have been cemented within the well. Bushing 14 has been lowered to the position shown wherein its upper outwardly extending flange 16 is in engagement with the upper end of casing string 10 and its exterior surface is positioned within the casing string 10 as shown. Housing 18 has been lowered onto flange 16 of bushing 14 and the top of the outer well casing 12 and its depending portion is positioned in close surrounding relationship to the exterior of casing string 10 and its outer downwardly facing shoulder 20 is seated on the upper end of casing 12 while its inner downwardly facing shoulder 22 is seated on the upper surface of flange 16 of bushing 14.

The contour of the interior surface 24 of housing 18 immediately below shoulder 22 is serrated with teeth 25. Recess 26 is below surface 24 and ends in serrated teeth 28. Recess 26 includes inward lands 30 projecting inwardly.

Bushing 14 includes upper annular body portion 32 from which flange 16 extends outwardly, lower body portion 34 and inner body portion 36 extending between portions 32 and 34. Upper body portion forms upper downwardly facing shoulder 38 and lower body portion forms lower upwardly facing shoulder 40 with resilient annulus 42 positioned between shoulders 38 and 40. The exterior of upper body portion 32 includes sharp teeth 32a and the exterior of lower body portion includes sharp teeth 34a as shown. When bushing 14 and housing 18 are landed, a suitable cold forging tool is lowered therein and pressurized to exert the cold forging pressure on the interior of bushing 14. This pressure is transmitted through inner body portion 36 to resilient annulus 42 and to the interior of casing 10 so that it is uniformly cold forged into recess 26 on the interior of casing 12 and thus into tight gripping and sealing engagement with lands 30 and surfaces 24 and 28. The completed structure is illustrated in FIGURE 2.

Claims

1. A wellhead structure comprising:
 - a string (10) within a well bore,
 - a housing (18) surrounding the upper end of the string, and
 - means (25, 28) connecting the housing to the upper end of the string, and
 - characterised by
 - a bushing (14) positioned generally coaxially within the housing, the bushing having been cold forged into engagement with at least one of the housing (18) and the string (10) such that it assists in providing a gripping and sealing engagement between the string and housing, and a resilient annulus (42) carried by the bushing (14) and arranged to transmit forging forces to the string during the cold forging.
2. A wellhead structure according to claim 1, wherein the resilient annulus (42) is positioned in a recess on the exterior of the bushing (14).
3. A wellhead structure according to claim 1 or claim 2, wherein the interior surface of the housing includes a plurality of lands (30) which engage the exterior surface of the casing (10).
4. A wellhead structure according to Claim 3, wherein the internal surface of the housing (18) also includes serrated teeth (28) above and below the lands, the bushing external surfaces includes serrated teeth at positions corresponding to those on the housing (18), the teeth having been forged into gripping engagement with the string (10).

Patentansprüche

1. Bohrlochkopfstruktur, umfassend:
 - einen Strang (10) innerhalb eines Bohrloches,
 - ein Gehäuse (18), welches das obere Ende des Stranges umgibt, und
 - Mittel (25, 28), die das Gehäuse mit dem oberen Ende des Stranges verbinden,
 - gekennzeichnet durch**
 - eine Buchse (14), die im wesentlichen coaxial innerhalb des Gehäuses angeordnet ist, und die durch Kaltverformung mit dem Gehäuse (18) und/oder dem Strang (10) so in Eingriff gebracht wurde, daß sie zur Gewährleistung einer festen und dichten Verbindung zwischen dem Strang und dem Gehäuse beiträgt, und einen elastischen Ring (42), der von der Buchse (14) gehalten wird und so angeordnet ist, daß er die Umformkräfte während der Kaltverformung auf den Strang überträgt.
2. Bohrlochkopfstruktur nach Anspruch 1, **dadurch gekennzeichnet**, daß der elastische Ring (42) in einer Ausnehmung an der Außenseite der Buchse (14) angeordnet ist.
3. Bohrlochkopfstruktur nach Anspruch 1 oder 2, **dadurch gekennzeichnet**, daß die Innenfläche des Gehäuses eine Vielzahl von Stegen (30) aufweist, welche mit der Außenfläche des Stranges (10) zusammenwirken.
4. Bohrlochkopfstruktur nach Anspruch 3, **dadurch gekennzeichnet**, daß die Innenfläche des Gehäuses (18) oberhalb und unterhalb der Stege zusätzlich Rippen (28) mit sägezahnförmigem Querschnitt besitzt, und die Außenfläche der Buchse Rippen mit sägezahnförmigem Querschnitt an Stellen aufweist, die mit denen am Gehäuse (18) übereinstimmen, und die Rippen in festen Eingriff mit dem Strang (10) verformt worden sind.

Revendications

1. Structure de tête de puits comprenant :
 - une rame (10) à l'intérieur d'un trou de puits,
 - un boîtier (18) entourant l'extrémité supérieure de la rame, et
 - des moyens (25, 28) reliant le boîtier à l'extrémité supérieure de la rame, et
 caractérisée par :
 - un raccord de réduction (14) positionné globalement dans le sens coaxial à l'intérieur du boîtier, le raccord de réduction ayant été forgé à froid pour le mettre en position de contact avec au moins l'un



Bushing 14 includes upper annular body portion 32 from which flange 16 extends outwardly, lower body portion 34 and inner body portion 36 extending between portions 32 and 34. Upper body portion forms upper downwardly facing shoulder 38 and lower body portion forms lower upwardly facing shoulder 40 with resilient annulus 42 positioned between shoulders 38 and 40. The exterior of upper body portion 32 includes sharp teeth 32a and the exterior of lower body portion includes sharp teeth 34a as shown. When bushing 14 and housing 18 are landed, a suitable cold forging tool is lowered therein and pressurized to exert the cold forging pressure on the interior of bushing 14. This pressure is transmitted through inner body portion 36 to resilient annulus 42 and to the interior of casing 10 so that it is uniformly cold forged into recess 26 on the interior of casing 12 and thus into tight gripping and sealing engagement with lands 30 and surfaces 24 and 28. The completed structure is illustrated in FIGURE 2.

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- du boîtier (18) ou de la rame (10), de telle sorte qu'il aide à fournir un moyen de contact serré et étanche entre la rame et le boîtier, et
- une chambre annulaire élastique (42) portée par le raccord de réduction (14) et disposée de façon à transmettre des forces de forgeage à la rame au cours du forgeage à froid.
2. Structure de tête de puits selon la revendication 1, dans laquelle la chambre annulaire (42) se trouve dans un évidement formé sur l'extérieur du raccord de réduction (14).
3. Structure de tête de puits selon la revendication 1 ou la revendication 2, dans laquelle la surface intérieure du boîtier comprend une pluralité de surfaces d'appui (30) qui viennent en contact avec la surface extérieure du cuvelage (10).
4. Structure de tête de puits selon la revendication 3, dans laquelle la surface intérieure du boîtier (18) comprend également des dents (28) en forme de dents de scie au-dessus et au-dessous des surfaces d'appui, les surfaces extérieures du raccord de réduction comprennent des dents en forme de dents de scie au niveau de positions correspondant à celles des dents formées sur le boîtier (18), les dents ayant été forgées pour les mettre en position de contact serré avec la rame (10).

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