

Description

Background

This invention concerns a device for supporting a connection apparatus of the type often used in the oilfield industry for connecting tubular members in sealed relationship. These connection apparatuses are referred to as "clamps" and are used in a variety of applications such as connecting valves to outlets of wellhead housings, connecting wellhead housings in series in vertical relationship and connecting large pressure control devices known as blowout preventers in end-to-end relationship. These clamps are preferred over conventional bolted flange connections in many situations as they require a fewer number of bolts to be tightened and are therefore usually quicker to install or remove.

In the larger sizes however, these clamps are heavy and unwieldy and require some additional means for supporting them in a preferred position during installation. Previously, such means have included ad hoc methods as supporting the clamps with a fork truck or using various rigging arrangements with cables or straps supported by whatever hoisting equipment was available. These methods have proven unacceptable as the surrounding structure of the wellhead or blowout preventer interfered with the rigging arrangement or use of the fork truck. Additionally, these installations must often be done in hostile weather environments or underwater which impose even more problems in handling these large connecting structures.

This invention is for an apparatus which supports a clamp on one hub of a clamp type connection to facilitate installation and removal of the clamp. The invention also has a unique configuration for the bolts used to hold the clamp in its clamped position which allows a greater number of smaller bolts to be used on a clamp of conventional configuration. This use of smaller bolts allows lighter, easier to handle wrenching means to be used.

Prior clamp connections include the J. D. Watts et al. U. S. Patent No. 2,766,829 which discloses a clamp of the type whose installation the present invention is intended to facilitate. A seal ring typically used with this type of connection is also disclosed.

The R. L. Crain et al. U. S. Patent No. 3,403,931 shows a modification to the clamp of Watts whereby an axially extending shallow groove is cut in the clamp halves to allow flexure of the clamp body to better distribute the stresses developed in the clamp body during installation.

Another form of clamp connection is disclosed by B. Saunders in pending U. S. Patent Application 07/458,957 filed December 29, 1989 and assigned to the same assignee as the present application. This clamp connection uses a plurality of collet segments urged into engagement with hubs configured to receive them by a pair of cam rings operated by axially disposed bolting means. No means for holding the segments or cam rings

during installation or removal is disclosed.

Such holding means are however known from GB-A-2208532, which shows a fluid conduit connection apparatus according to the preamble of claim 1. In this prior reference, the holding means are secured to a structure which is fixed relative to the hub but which is different therefrom, and remote from the clamping means, which renders difficult any coupling operation.

An object of the present invention is therefore to provide an apparatus which facilitates the installation and removal of large clamps typically used in the oilfield industry.

Another object of the invention is to provide a supporting apparatus for clamps which requires only minimal modification of existing clamp hub configurations and does not interfere with the normal operation of the clamp.

A further object of the present invention is to provide a novel configuration for the bolting arrangement on a clamp required to maintain the clamp secured on the clamp hubs in order to reduce the size and weight of the wrenching means typically required to install these clamps.

A still further object of the present invention is to provide a clamp hub connection wherein the clamp segments, studs and nuts are retained on one hub to eliminate any loose pieces.

Accordingly, the fluid connection apparatus of the present invention is disclosed in claim 1.

Brief Description of the Drawings

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

FIGURE 1 is an elevation view, partly in section, of the clamp supporting apparatus supporting the clamp on the lower clamp hub of a blowout preventer which is suspended over a mating clamp hub on a wellhead connector.

FIGURE 2 is an elevation view of the clamp supporting apparatus with the blowout preventer hub connected to the wellhead connector hub by the clamp.

FIGURE 3 is a sectional view taken along lines 3-3 of FIGURE 1 of the clamp supporting apparatus and clamp in the fully open position.

FIGURE 4 is a sectional view taken along lines 4-4 of FIGURE 2 of the clamp supporting apparatus and clamp in the fully closed position.

FIGURE 5 is a sectional view taken along lines 5-5 of FIGURE 4 showing details of the bolt stud arrangement on the bolting lugs.

Description of the Preferred Embodiment

With reference to FIGURE 1, the improved clamp and supporting apparatus is denoted generally by numeral 10 and is composed of clamp assembly 12 and

guide rods 14. Guide rods 14 have external thread 16 formed at their inner end and wrenching flats 18 at their outer end as seen in FIGURES 3 and 4. Guide rods 14 are disposed horizontally in tapped holes 20 in the enlarged portion 22 of clamp hub 24 to support clamp assembly 12 in its open position. Clamp hub 24 is disposed on the lower end of blowout preventer 26 with a similarly shaped clamp hub 28 on the upper end thereof. Wellhead connector 30 sealingly engages hub 32 of wellhead housing 34 in a manner well known to those skilled in the art. Clamp hub 36 is disposed on the upper portion of wellhead connector 30 and is of the same size as clamp hub 24 for engagement therewith. Seal ring 38 is placed within clamp hub 36 before hub 24 is lowered into position thereon.

Clamp assembly 12 is composed of arcuate clamp halves 12a and 12b and suitable bolting means as studs 40 and nuts 42. Clamp halves 12a and 12b are semicircular in plan view as best seen in FIGURES 3 and 4 with bolting ears or lugs 44 disposed at each end. Clamp halves 12a and 12b are mirror images of one another differing only in the arrangement bolt studs 40 on bolting lugs 44.

As best seen in FIGURE 5, clamp halves 12a and 12b have tapered internal profiles 46 and 48, respectively, which engage complementary profiles 24a and 36a of hubs 24 and 36. When nuts 42 are tightened on studs 40 to the position shown in FIGURE 4 the sealed connection shown is established. Seal ring 38 is held in position by the engagement of clamp hubs 24 and 36 in a manner well known to those skilled in the art.

Studs 40 are arranged in a staggered pattern as best seen in FIGURE 5. Each bolting lug 44 has three studs 40 engaged in drilled and tapped holes 50 and three drilled through holes 52 as shown with the pattern in clamp half 12a being a mirror image of the pattern of clamp half 12b. The drilled holes 52 on a given bolting lug 44 of a clamp half as 12a receives the studs 40 of its mating clamp half 12b. This staggered arrangement of holes 52 and studs 40 allows a closer spacing of the bolting means, thereby allowing a larger number of smaller studs for a clamp of a given size. Each stud 40 has cross drilled holes 54a and 54b therein for purposes to be explained hereinafter.

A typical sequence of operations for use of the improved clamp and supporting apparatus 10 would be as follows. Guide rods 14 are installed in hub 22 as seen in FIGURE 1 with clamp assembly 12 supported thereon. FIGURE 3 shows this assembly in plan view with clamp halves 12a and 12b in the fully open position to allow clearance for installation over mating hub 36. A cotter pin 56 or piece of welding rod (not shown) may be inserted in holes 54a and 54b to ensure nuts 42 are not removed from studs 40 and clamp halves 12a and 12b cannot be prematurely moved to a closed position. As previously noted, seal ring 38 is placed within the bore of mating hub 36.

Blowout preventer 26 is lowered into position atop

wellhead connector 30 with hubs 22 and 36 in face to face contact. Cotter pins 56 are removed from holes 54b thereby allowing clamps halves 12a and 12b to be manually positioned on guide rods 14 with internal profiles 46 and 48 contacting complementary profiles 24a and 36a of hubs 24 and 36. Nuts 42 can then be tightened on studs 40 to the position shown in FIGURES 2 and 4 by suitable wrenching means, not shown. If desired, guide rods 14 can be removed using wrenching flats 18. When removal of clamp assembly 12 is required, guide rods 14 can be reinstalled in tapped holes 20 of hub 22. Nuts 42 can then be loosened and unscrewed to a position adjacent holes 54a. Clamp halves 12a and 12b are then manually guided on guide rods 14 to a position as shown in FIGURE 3 and cotter pins 56 placed in holes 54b to maintain the clamp halves in the full open position while the blowout preventer 26 is lifted from wellhead connector 30. Reassembly is then accomplished as previously described.

If an operator desires to use the improved clamp support apparatus with a clamp of conventional configuration, i. e., without the improved staggered bolting means configuration, the following steps are required. The hub that is to support the clamp during installation must have holes drilled and tapped therein in the parallel configuration as shown in FIGURE 3 and 4. Guide rods can then be installed therein as on the preferred embodiment. The clamp halves to be installed can be drilled with holes in a parallel configuration through the clamp body complementary to the placement of the guide rods in the hub. The clamp halves can then be supported on the guide rods for installation in the manner described for the preferred embodiment.

It should be noted the scope of the invention is not limited to the hubs and clamps lying in a horizontal plane as described for the preferred embodiment. The scope of the invention encompasses embodiments in which the hubs and clamps lie in a vertical plane as well as a horizontal plane or any position therebetween. Additionally, the scope of the invention includes embodiments in which there are more than two arcuate segments to the clamp body.

Claims

1. A fluid conduit connection apparatus, in particular for use in the oilfield industry, comprising:

- a first hub (24),
- a second hub (36),
- a sealing means (38) disposed between said hubs,
- a clamping means (12) for retaining said hubs in abutting sealed relationship, and
- a support means (14) for maintaining said clamping means in a disengaged open position prior to installation and guiding said clamping



guide rods 14. Guide rods 14 have external thread 16 formed at their inner end and wrenching flats 18 at their outer end as seen in FIGURES 3 and 4. Guide rods 14 are disposed horizontally in tapped holes 20 in the enlarged portion 22 of clamp hub 24 to support clamp assembly 12 in its open position. Clamp hub 24 is disposed on the lower end of blowout preventer 26 with a similarly shaped clamp hub 28 on the upper end thereof. Wellhead connector 30 sealingly engages hub 32 of wellhead housing 34 in a manner well known to those skilled in the art. Clamp hub 36 is disposed on the upper portion of wellhead connector 30 and is of the same size as clamp hub 24 for engagement therewith. Seal ring 38 is placed within clamp hub 36 before hub 24 is lowered into position thereon.

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45 Claims

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- a second hub (36),
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- a clamping means (12) for retaining said hubs in abutting sealed relationship, and
- a support means (14) for maintaining said clamping means in a disengaged open position prior to installation and guiding said clamping



means from said open position to a clamped position, characterized in that said support means includes a plurality of rods (14) positioned on either of said first and said second hubs and extending transversely from said hub, said rods being of sufficient length to support said clamping means (12) in said open position prior to installation.

2. A fluid conduit connection apparatus according to claim 1, wherein said clamping means includes :

- a plurality of arcuate clamping segments (12a, 12b) surrounding said hubs,
- said clamping segments having an internal profile (46, 48) for mating with an external profile (24a, 36a) on said hubs (24, 36),
- said segments having a lug (44) at each end with bolting means (40) disposed thereon, and said bolting means cooperating with the lug of said adjacent segments (12a, 12b), to secure said hubs in abutting relationship.

3. A fluid conduit connection apparatus according to claim 2, wherein :

- said guide rods (14) extend through openings in said arcuate clamping segments.

4. A fluid conduit connection apparatus according to claim 3, wherein :

- said guide rods (14) threadedly engage said hub, and
- said guide rods are removable from said hub when said clamping segments are in clamping engagement with said first and said second hub profiles.

5. A fluid conduit connection apparatus according to claim 4, wherein :

- the number of arcuate clamping segments (12a, 12b) is two, and
- said guide rods are parallel to said bolting means (40).

6. A fluid conduit connection apparatus according to anyone of claims 1-5, wherein :

- said hubs comprise abutting tubular members having enlarged end portions with tapered backfaces ;
- said clamping means comprise a pair of clamp halves (12a, 12b), with a complementary internal profile (46, 48) which engages said backfaces ;

- said clamp halves (12a, 12b) have a lug at each end;
- a bolting means (40) disposed on each lug (44) cooperates with a lug of said opposite clamp half to secure said end portions in abutting relationship ; and
- said unclamped position of said clamp halves is a planar position.

7. A fluid conduit connection apparatus according to claim 6, wherein said bolting means includes:

- a plurality of threaded studs (40) engaging threaded holes in said lugs,
- said studs (40) being disposed in staggered relationship on said lugs (44), to minimize spacing between adjacent studs,
- said lugs (44) having mating holes in complementary staggered relationship to the studs of a mating lug,
- said mating holes receiving said studs when said clamp halves (12a, 12b) are in clamping engagement with said enlarged end portions, and
- said clamp halves are retained in clamping engagement by threaded nuts (42) engaging said studs.

8. A clamping apparatus according to claim 7, wherein :

- said studs (40) are of sufficient length to permit said clamp halves to be opened to a position allowing their installation over said enlarged portion while said studs are in engagement with said lugs, and
- said studs have means thereon for holding said clamp halves (12a, 12b) in their open position.

9. A clamping apparatus according to claim 8, wherein :

- said guide rods extend through said clamp halves and threadedly engage said enlarged portion of said tubular members.

Patentansprüche

1. Vorrichtung zur Verbindung von Leitungen für fließfähige Medien, insbesondere zur Verwendung in der Ölgewinnungsindustrie, mit:

- einer ersten Nabe (24),
- einer zweiten Nabe (36),
- einer zwischen den Naben angeordneten Dich-



tung (38),

- einer Klemmanordnung (12) zum Halten der Naben in dichter Anlage aneinander und
- einer Unterstützungseinrichtung (14) zum Halten der Klemmanordnung in einer gelösten, offenen Stellung vor der Installation und zum Führen der Klemmanordnung aus der offenen Position in eine Klemmposition.

dadurch gekennzeichnet, daß die Unterstützungseinrichtung mehrere Stangen (14) aufweist, die an einer der ersten und zweiten Naben angebracht sind und quer von der Nabe ausgehen, welche Stangen eine hinreichende Länge besitzen, um die Klemmanordnung (12) in der offenen Stellung vor der Installation abzustützen.

2. Vorrichtung zur Verbindung von Leitungen für fließfähige Medien nach Anspruch 1, bei der die Klemmanordnung aufweist:

- mehrere bogenförmige Klemmsegmente (12a, 12b), die die Naben umgeben,
- wobei die Klemmsegmente ein Innenprofil (46, 48) aufweisen, das mit einem Außenprofil (24a, 36a) an den Naben (24, 36) in Eingriff gebracht werden kann,
- die Segmente an jedem Ende einen Ansatz (44) mit daran angebrachten Verschraubungseinrichtungen (40) aufweisen und
- die Verschraubungseinrichtungen mit dem Ansatz der benachbarten Segmente (12a, 12b) zusammenwirken, um die Naben in Anlage einander zu sichern.

3. Vorrichtung zur Verbindung von Leitungen für fließfähige Medien nach Anspruch 2, bei der:

- die Führungsstangen (14) sich durch Öffnungen in den bogenförmigen Klemmsegmenten erstrecken.

4. Vorrichtung zur Verbindung von Leitungen für fließfähige Medien nach Anspruch 3, bei der:

- die Führungsstangen (14) mit der Nabe in Gewindeeingriff stehen und
- die Führungsstangen von der Nabe lösbar sind, wenn die Klemmsegmente mit den Profilen der ersten und zweiten Nabe in Klemmeingriff stehen.

5. Vorrichtung zur Verbindung von Leitungen für fließfähige Medien nach Anspruch 4, bei der:

- die Anzahl der bogenförmigen Klemmsegmente (12a, 12b) zwei ist und
- die Führungsstangen zu den Verschraubungseinrichtungen (40) parallel sind.

6. Vorrichtung zur Verbindung von Leitungen für fließfähige Medien nach einem der Ansprüche 1 bis 5, bei der:

- die Naben aneinanderliegende rohrförmige Teile aufweisen, die vergrößerte Endabschnitte mit vejüngten rückseitigen Flächen aufweisen,
- die Klemmanordnung zwei Klemmenhälften (12a, 12b) aufweist, mit einem komplementären Innenprofil (46, 48), das sich an die rückseitigen Flächen anlegt,
- die Klemmenhälften (12a, 12b) einen Ansatz an jedem Ende aufweisen,
- ein an jedem Ansatz (44) angeordnetes Verschraubungsmittel (40) mit einem Ansatz der gegenüberliegenden Klemmenhälfte zusammenwirkt, um die Endabschnitte in Anlage aneinander zu sichern, und
- die nicht klemmende Position der Klemmenhälften eine planare Position ist.

7. Vorrichtung zur Verbindung von Leitungen für fließfähige Medien nach Anspruch 6, bei der die Verschraubungsmittel aufweisen:

- mehrere Gewindebolzen (40), die in Gewindebohrungen in den Ansätzen eingreifen,
- wobei die Bolzen (40) gestaffelt an den Ansätzen (44) angeordnet sind, um den Abstand zwischen benachbarten Bolzen zu minimieren,
- die Ansätze (44) komplementäre Löcher in zu den Bolzen eines zugehörigen Ansatzes komplementärer gestaffelter Anordnung aufweisen,
- diese Löcher die Bolzen aufnehmen, wenn die Klemmenhälften (12a, 12b) in Klemmeingriff mit den vergrößerten Endabschnitten stehen, und
- die Klemmenhälften durch auf die Bolzen aufgeschraubte Gewindemuttern (42) in Klemmeingriff gehalten werden.

8. Klemmvorrichtung nach Anspruch 7, bei der:



- die Bolzen (40) eine hinreichende Länge besitzen, so daß sie es gestatten, die Klemmenhälften in eine Position zu öffnen, in der sie über den vergrößerten Abschnitt gestülpt werden, während die Bolzen mit den Ansätzen in Eingriff stehen, und 5
 - die Bolzen mit daran angebrachten Mitteln versehen sind, die die Klemmenhälften (12a, 12b) in ihrer geöffneten Position halten. 10
- 9. Klemmvorrichtung nach Anspruch 8, bei der:**
- die Führungsstangen sich durch die Klemmenhälften erstrecken und mit dem vergrößerten Abschnitt der rohrförmigen Elemente in Gewindeeingriff stehen. 15
- Revendications 20**
- 1. Appareil de connexion de conduites de fluide, en particulier pour une utilisation dans l'industrie pétrolière, comprenant :**
- un premier moyeu (24),
 - un second moyeu (36),
 - un moyen d'étanchéité (38) disposé entre les moyeux,
 - des moyens de serrage (12) servant à retenir les moyeux suivant une disposition relative hermétiquement étanche bout à bout et
 - des moyens de support (14) servant à maintenir les moyens de serrage dans une position ouverte, hors contact, préalablement à une mise en place, et à guider les moyens de serrage de la position ouverte à une position serrée. 30
- caractérisé en ce que les moyens de support comprennent plusieurs tiges (14) qui sont disposées sur l'un ou l'autre des premier et second moyeux et qui s'étendent transversalement à partir de ce moyeu, les tiges ayant une longueur suffisante pour porter les moyens de serrage (12) dans la position ouverte, préalablement à une mise en place. 40
- 2. Appareil de connexion de conduites de fluide suivant la revendication 1, dans lequel les moyens de serrage comprennent :**
- plusieurs segments de serrage (12a, 12b) en arc de cercle qui entourent les moyeux,
 - les segments de serrage ayant une forme profilée intérieure (46, 48) qui épouse une forme profilée extérieure (24a, 36a) prévue sur les moyeux (24, 36),
 - lesdits segments comportant à chaque extrémité une patte (44) sur laquelle des moyens de 45
- boulonnage (40) sont disposés, ces moyens de boulonnage coopérant avec la patte des segments (12a, 12b) adjacents de façon à immobiliser les moyeux suivant une disposition relative bout à bout.
- 3. Appareil de connexion de conduites de fluide suivant la revendication 2, dans lequel :**
- les tiges de guidage (14) s'étendent dans des orifices pratiqués dans les segments de serrage en arc de cercle.
- 4. Appareil de connexion de conduites de fluide suivant la revendication 3, dans lequel :**
- les tiges de guidage (14) sont vissées dans le moyeu et
 - ces tiges de guidage sont agencées de façon à pouvoir être retirées du moyeu lorsque les segments de serrage sont en prise de serrage sur les première et seconde formes profilées des moyeux. 50
- 5. Appareil de connexion de conduites de fluide suivant la revendication 4, dans lequel :**
- les segments de serrage (12a, 12b) en arc de cercle sont au nombre de deux et
 - les tiges de guidage sont parallèles aux moyens de boulonnage (40). 55
- 6. Appareil de connexion de conduites de fluide suivant l'une quelconque des revendications 1 à 5, dans lequel :**
- les moyeux comprennent des pièces tubulaires venant bout à bout et comportant des parties d'extrémité plus larges présentant des faces arrière convergentes,
 - les moyens de serrage comprennent deux moitiés de pince (12a, 12b) comportant une forme profilée intérieure complémentaire (46, 48) qui coopère avec les faces arrière.
 - les moitiés de pince (12a, 12b) comportent une patte à chaque extrémité,
 - un moyen de boulonnage (40) disposé sur chaque patte (44) coopère avec une patte de la moitié de pince opposée, de façon à immobiliser les parties d'extrémité suivant une disposition relative bout à bout, et
 - la position desserrée des moitiés de pince est une position plane.
- 7. Appareil de connexion de conduites de fluide suivant la revendication 6, dans lequel les moyens de boulonnage comprennent :**



- plusieurs tiges filetées (40) vissées dans des trous taraudés pratiqués dans les pattes,
 - les tiges (40) étant disposées suivant une disposition relative en quinconce sur les pattes (44), de façon à rendre minimal l'espacement entre des tiges adjacentes, 5
 - les pattes (44) comportant des trous complémentaires disposés suivant une disposition relative en quinconce complémentaire de celle des tiges d'une patte associée, 10
 - les trous complémentaires recevant les tiges lorsque les moitiés de pince (12a, 12b) sont en prise de serrage avec les parties d'extrémité plus larges et
 - les moitiés de pince sont retenues en prise de serrage par des écrous (42) vissés sur les tiges. 15
8. Appareil de serrage suivant la revendication 7, dans lequel : 20
- les tiges (40) ont une longueur suffisante pour permettre que les moitiés de pince soient ouvertes jusqu'à une position permettant leur mise en place par-dessus ladite partie plus large alors que les tiges sont en prise sur les pattes et 25
 - les tiges comportent sur elles des moyens servant à maintenir les moitiés de pince (12a, 12b) dans leur position ouverte.
9. Appareil de serrage suivant la revendication 8, dans lequel : 30
- les tiges de guidage s'étendent à travers les moitiés de pince et sont vissées dans ladite partie plus large des pièces tubulaires. 35

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