

CONNECTOR SYSTEM AND METHOD OF CONNECTING

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Provisional Patent Application No. 60/934,259, entitled "Connector System and Method", filed on June 12, 2007, which is herein incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention relates generally to connection systems for various components, such as fluid conduits. More particularly, the present invention relates to a novel stab-type connector for coupling a pair of components together in an end-to-end relationship.

BACKGROUND

[0003] This section is intended to introduce the reader to various aspects of art that may be related to various aspects of the present invention, which are described and/or claimed below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present invention. Accordingly, it should be understood that these statements are to be read in this light, and not as admissions of prior art.

[0004] As will be appreciated, oil and natural gas have a profound effect on modern economies and societies. Indeed, devices and systems that depend on oil and natural gas are ubiquitous. For instance, oil and natural gas are used for fuel in a wide variety of vehicles, such as cars, airplanes, boats, and the like. Further, oil and natural gas are frequently used to heat homes during winter, to generate electricity, and to manufacture an astonishing array of everyday products.

[0005] In order to meet the demand for such natural resources, numerous companies invest significant amounts of time and money in searching for and extracting oil, natural gas, and other subterranean resources from the earth. Particularly, once a desired resource is discovered below the surface of the earth, drilling and production systems are often employed to access and extract the resource. These systems may be located onshore or offshore depending on the location of a desired resource. Further, such systems generally include a wellhead assembly through which the resource is extracted. These wellhead assemblies may include a wide variety of components and/or conduits, such as various casings, valves, and the like, that control drilling and/or extraction operations. Additionally, various production and transport systems may also employ pipes or other fluid conduits, in addition to the components noted above.

[0006] As will be appreciated, various fluid conduits or other components of a production or transport system are typically coupled to one another to enable oil, gas, or the like to be extracted from the ground and routed to a desired location. Such fluid conduits (or "tubular members") are often coupled together in end-to-end relationships via various connectors that facilitate flow of oil, gas, or the like between the conduits. In some instances, these connectors may be subjected to large axial loads, such as gravity (particularly in the case of suspended conduits) or internal pressures within the conduits. Also, it will be appreciated that the space available for connecting conduit members may be limited in some applications. Consequently, there is a need for a durable connector that, among other things, has a low profile, provides a sealed connection between two components (e.g., fluid conduits), and can withstand the axial loads expected within a given system.

SUMMARY

[0007] Certain aspects commensurate in scope with the originally claimed invention are set forth below. It should be understood that these aspects are presented merely to

provide the reader with a brief summary of certain forms the invention might take and that these aspects are not intended to limit the scope of the invention. Indeed, the invention may encompass a variety of aspects that may not be set forth below.

[0008] Embodiments of the present invention generally relate to a novel connector for joining two components, such as tubular members or conduits. In some exemplary embodiments, the exemplary connector includes a collar configured to receive each of the two components in an end-to-end arrangement. In one embodiment, the collar is configured to be threaded onto a first of the two components and to be coupled to the second of the two components via a load ring disposed between the collar and the second component. A locking ring may also be provided to maintain and/or facilitate engagement of the load ring with the collar and to secure the first and second components to one another.

[0009] Various refinements of the features noted above may exist in relation to various aspects of the present invention. Further features may also be incorporated in these various aspects as well. These refinements and additional features may exist individually or in any combination. For instance, various features discussed below in relation to one or more of the illustrated embodiments may be incorporated into any of the above-described aspects of the present invention alone or in any combination. Again, the brief summary presented above is intended only to familiarize the reader with certain aspects and contexts of the present invention without limitation to the claimed subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] These and other features, aspects, and advantages of the present invention will become better understood when the following detailed description is read with reference to the accompanying drawings in which like characters represent like parts throughout the drawings, wherein:

[0011] FIG. 1 is a front elevational view of a system including two connection members coupled to one another via a collar in accordance with one embodiment of the present invention;

[0012] FIG. 2 is an exploded cross-sectional view of the system of FIG. 1, illustrating various features of the exemplary system, including a load ring and a locking ring coupled to one of the connection members via set screws, in accordance with one embodiment of the present invention;

[0013] FIGS. 2A and 2B illustrate exemplary toothed surfaces of the load ring of FIG. 2 that may be provided in accordance with certain embodiments of the present invention;

[0014] FIG. 3 is a cross-sectional view of the system of FIG. 2, illustrating the stabbing of one connection member to the other connection member in accordance with one embodiment of the present invention;

[0015] FIG. 4 is a partial detail view generally taken along line 4-4 of FIG. 3, illustrating portions of the load ring and the locking ring disposed within the collar and accessible through a window of the collar in accordance with one embodiment of the present invention;

[0016] FIG. 5 is a cross-sectional view of the system of FIG. 3, illustrating the removal of the set screws from the load ring and engagement of the load ring with the collar in accordance with one embodiment of the present invention;

[0017] FIG. 6 is a partial detail view generally taken along line 6-6 of FIG. 5, illustrating portions of the load ring and the locking ring disposed within the collar and accessible through a window of the collar following removal of the set screws from the load ring in accordance with one embodiment of the present invention;

[0018] FIG. 7 is a cross-sectional view of the system of FIG. 5, illustrating the positioning of the locking ring between the load ring and a connection member to secure

the load ring in engagement with the collar in accordance with one embodiment of the present invention;

[0019] FIG. 8 is a cross-sectional view of the system of FIG. 7, illustrating the removal of the locking ring to facilitate disengagement of the load ring from the collar and the securing of the load ring to the connection member in accordance with one embodiment of the present invention; and

[0020] FIG. 9 is an exploded cross-sectional view of the system of FIG. 8, depicting the separation of the two connection members in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

[0021] One or more specific embodiments of the present invention will be described below. In an effort to provide a concise description of these embodiments, all features of an actual implementation may not be described in the specification. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which may vary from one implementation to another. Moreover, it should be appreciated that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

[0022] When introducing elements of various embodiments of the present invention, the articles "a," "an," "the," and "said" are intended to mean that there are one or more of the elements. The terms "comprising," "including," and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements. Moreover, the use of "top," "bottom," "above," "below," and variations of

these terms is made for convenience, but does not require any particular orientation of the components.

[0023] Turning now to the present figures, an exemplary system 10 including a stab-type connector is illustrated in FIGS. 1 and 2 in accordance with one embodiment of the present invention. The exemplary system 10 includes a pair of connection members configured to be coupled to one another, such as a pin member or component 12 coupled to a box member or component 14. In one embodiment, the connector of the system 10 includes a union ring or collar 16 configured to cooperate with a load ring 50 and a locking ring 62 to secure the pin member 12 to the box member 14, as discussed in greater detail below.

[0024] Either or both of the pin member 12 and the box member 14 may include various mounting features 18, such as recesses, to facilitate coupling of such members to one or more additional components. In some embodiments, the pin and box members 12 and 14 are configured to enable coupling of various tubular members to one another. For example, each of the pin member 12 and the box member 14 may be coupled to a respective pipe via recesses or some other mounting features 18, allowing the two pipes to be secured to one another via the connector. Similarly, the pin and box members 12 and 14 could also be used to couple various other components together, such as a pipe to a wellhead component, a first wellhead component to a second wellhead component (e.g., in a stacked wellhead arrangement), or the like.

[0025] While the mounting features 18 in the presently illustrated embodiment include recesses configured to receive a fastener, it will be appreciated that the pin and box members 12 and 14 may be coupled to their respective components in any suitable fashion, including through threaded connections, studs, flanges, clamps, welding, or other mounting techniques. Indeed, in some embodiments, one or both of the pin and box members 12 and 14 may be provided as an integral part of such respective components. For instance, in one embodiment, the box member 14 is integrally formed as a portion of a wellhead and the pin member 12 is coupled to or integral with a "Christmas tree" or other wellhead component to be mounted on the wellhead. While

certain embodiments may be described in an oil or gas (or other resource) production context, it should be noted that the presently-disclosed connection system may also be used to couple component unrelated to oil or gas production in full accordance with the present techniques.

[0026] In the presently illustrated embodiment, the box member 14 includes a bore 20 and the pin member 12 includes a bore 22. Various additional components may be received within either or both of the bores 20 and 22. For example, in one embodiment, a fluid conduit 24, such as a pipe or wellhead member, is received within the bore 20 of the box member 14. The fluid conduit 24 includes an internal bore 26, which is generally aligned with the bore 22 when the pin and box members 12 and 14 are connected to one another. A seal ring 28 and a plurality of seals 30 may also be included to inhibit fluid leakage from the various bores of the system 10.

[0027] In one embodiment, to facilitate coupling of the pin member 12 and the box member 14, the collar 16 is threaded onto an end 32 of the box member 14 via mating threaded surfaces 34 and 36. The collar 16 may also include recesses 38, which are configured to receive set screws that prevent further rotation of the collar 16 on the end 32. The exemplary collar 16 is configured to receive an end 44 of the pin member 12, in addition to the end 32 of the box member 14, such that the pin member 12 and the box member 14 may be secured to one another in an end-to-end arrangement. Notably, in the presently illustrated embodiment, the collar 16 also includes an aperture or window 40 that facilitates user access to the load ring 50 and securing of the pin and box members 12 and 14, as discussed in further detail below.

[0028] To facilitate locking of the pin and box members 12 and 14 to one another, the pin member 12 of one embodiment includes a groove 46 for receiving the load ring 50 and the locking ring 62. The exemplary load ring 50 is configured to engage the collar 16 when the pin member 12 (and at least a portion the groove 46 containing the load ring 50) is inserted into the collar 16. In some embodiments, the load ring 50 includes a number of teeth 52 configured to engage a plurality of complimentary teeth 54 provided on an inner surface of the collar 16. Such teeth 52 and 54 may be provided

in various configurations, such as rectangular teeth or angled teeth, as generally depicted in FIGS. 2A and 2B, respectively.

[0029] The load ring 50 may be positioned and retained within the groove 46, and secured to the pin connection 12, via one or more set screws 56 inserted through respective apertures 58 of the load ring 50 and into threaded recesses 60 of the pin member 12. Likewise, the locking ring 62 may be secured within the groove 46 via one or more set screws 64 inserted through respective apertures 66 of the locking ring 62 and into recesses 68 of the pin member 12. Notably, in the presently illustrated embodiment, the dimensions of the groove 46, the load ring 50, and the locking ring 62 are such that the load ring 50 and/or the locking ring 62 can be substantially positioned and retained within the groove 46. As may be appreciated, such an arrangement allows the pin member 12 to be freely inserted or removed from the collar 16 without interference from the load ring 50 and/or the locking ring 62.

[0030] In some embodiments, the load ring 50 may be a split ring, such as a C-ring. Further, in the presently illustrated embodiment, the load ring 50 is outwardly biased when positioned within the groove 46 to facilitate locking of the pin member 12 to the box member 14 as discussed below. The locking ring 62 may also be split in one or more places to facilitate attachment of the locking ring 62 within the groove 46.

[0031] An exemplary method for coupling the pin member 12 and the box member 14 may be better understood with reference to FIGS. 3-7. In some embodiments, following installation of the load ring 50 and the locking ring 62 within the groove 46, the pin member 12 is inserted into the collar 16, as generally illustrated in FIG. 3. Further, the set screws 56 in the load ring 50 may be aligned with the window 40 of the collar 16, such as depicted in FIG. 4, to enable a user to access the set screws 56 through the window 40. It will be appreciated that, while the exemplary window 40 of FIG. 4 is presently illustrated as a generally rectangular window, other configurations (e.g., elliptical, circular, or the like) are also envisaged.

[0032] In some embodiments, the set screws 56 are then removed from the load ring 50 to permit the toothed surface 76 of the load ring 50 to engage a complementary surface 78 of the collar 16, as generally illustrated in FIG. 5 and 6. As noted above, in some embodiments, the load ring 50 is outwardly biased such that removal of the set screws 56 automatically results in radial expansion of the load ring 50 from the groove 46 toward the collar 16. However, in other embodiments, a user may instead manually bring surfaces 76 and 78 into engagement. In addition to removing the set screws 56 from the load ring 50, the set screws 64 may also be removed from the apertures 66 to permit movement of the locking ring 62.

[0033] For instance, in one embodiment, the locking ring 62 is moved axially from an unlocked position, as generally illustrated in FIG. 5, into a locked position between the load ring 50 and the pin member 12, as generally provided in FIG. 7. It should be noted that such interposition of the locking ring 62 facilitates positive engagement of the load ring 50 to the collar 16 such that the teeth 52 and 54 generally prevent relative axial motion of the pin member 12, the box member 14, and the collar 16 with respect to one another. Once the locking ring 62 is positioned between the load ring 50 and the pin member 12, the set screws 64 may be installed through apertures 70 to retain the locking ring 62 in its locked position.

[0034] Additionally, once the pin member 12 is secured to the collar 16, the collar 16 may be rotated on the threads 34 to remove any axial clearance, or "slack," in the connection between the pin member 12 and the box member 14. As will be appreciated, such slack may be attributable, at least in part, to the tolerances of the pin member 12 and the box member 14. In some embodiments, the system 10 is configured to minimize the amount of rotation of the collar 16 needed to remove such slack. For example, in various embodiments, the collar 16 can be rotated less than or equal to a one-half turn (i.e., 180 degrees), less than or equal to a one-quarter turn (i.e., 90 degrees), or even less than or equal to a one-eighth turn (i.e., 45 degrees) on the threads 34 to remove the slack in, and to preload, the connection. Further, in at least one embodiment, the rotation of the collar 16 on the threads 34 is the only rotation

needed in the system 10 to couple the pin member 12 to the box member 14. A cover plate (not shown) may also be provided over or within the window 40 to protect the connection between the collar 16 and the load ring 50.

[0035] It should be noted that, in the presently illustrated embodiment, the collar 16, the load ring 50 and the locking ring 62 are members of a low-profile, or slender, connector suitable for use in an array of connection applications, including those that may provide a limited amount of space for connecting various members, such as in certain conductor sharing, split compact, and/or stacked wellheads. Further, it will be appreciated that the present system 10 allows for simple installation and coupling of two tubular members or components. Additionally, the pin and box members 12 and 14 may also be disconnected from one another in a simple and convenient fashion, as discussed below.

[0036] For instance, an exemplary manner of uncoupling of the pin member 12 from the box member 14 is generally illustrated in FIGS. 8 and 9. In some embodiments, such as those including a split locking ring 62, the locking ring 62 is moved from the space between the load ring 50 and the pin member 12 and may be removed from the groove 46 entirely. Alternatively, a locking ring 62 (whether split or not) may instead be simply moved out of engagement with the load ring 50 and the pin member 12 and optionally secured in the groove 46 via set screws 64, as generally illustrated in FIG. 3. The load ring 50 may then be secured against the pin member 12 within the groove 46 via the set screws 56, as depicted in FIG. 8. Particularly, in one exemplary embodiment, a C-clamp may be advantageously used to align apertures 58 of the load ring 50 with recesses 60 of the pin member 12 such that the set screws 56 may be inserted through the window 40 and the apertures 58, and into the recesses 60. The pin member 12 may then be pulled apart from the box connection 14 as provided in FIG. 9.

[0037] While the invention may be susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and have been described in detail herein. However, it should be understood

that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the following appended claims.

CLAIMS:

1. A connector for securing a first component to a second component, the connector comprising:

a collar configured to receive the first component and the second component, the collar including a first end configured for coupling to the first component and a second end configured for coupling to the second component;

a load ring configured to be received within a groove of the second component and, when the groove and the load ring are at least partially positioned within the second end of the collar, to move between a first position, in which the load ring is spaced apart from the second end of the collar, and a second position, in which the load ring is in engagement with the second end of the collar; and

a locking ring configured to be received within the groove adjacent the load ring and configured to be selectively positioned with respect to the groove and the load ring to inhibit disengagement of the load ring from the second end of the collar when the load ring is in the second position.

2. The connector of claim 1, wherein the load ring is configured to be outwardly biased when disposed within the groove such that the load ring is biased toward engagement with the second end of the collar when the groove and the load ring are at least partially positioned therein.

3. The connector of claim 1, wherein the load ring comprises a toothed surface configured to engage a complimentary surface of the second end of the collar.

4. The connector of claim 1, wherein the locking ring is configured to be moved within the groove between an unlocked position, which permits radial movement

of the load ring between the first and second positions, and a locked position in which the locking ring retains the load ring in the second position.

5. The connector of claim 4, wherein the locking ring is configured to be radially interposed between the load ring and the second component in the locked position.

6. The connector of claim 4, wherein the locking ring comprises an aperture configured to align with a recess in the second component when the locking ring is in the locked position, and the aperture and the recess are configured to receive a set screw to retain the locking ring in the locked position.

7. The connector of claim 1, wherein the first end of the collar includes a threaded surface configured to engage a complimentary surface of the first component to facilitate coupling of the first end of the collar to the first component.

8. The connector of claim 1, wherein the first component comprises a box connection member, the second component includes a pin connection member having an outer surface in which the groove is formed, and at least one of the box connection member or the pin connection member is configured to be coupled to an additional component.

9. The connector of claim 8, wherein the additional component comprises at least one of a wellhead component or a pipe.

10. The connector of claim 8, comprising the box connection member and the pin connection member.

11. The connector of claim 1, wherein the locking ring comprises a split locking ring.

12. The connector of claim 1, wherein the load ring comprises a C-ring.

13. The connector of claim 1, wherein the locking ring is configured to be secured in the first position to facilitate insertion and removal of the second component from the collar.

14. The connector of claim 1, wherein the collar comprises a window configured to facilitate access by a user to a circumferential portion of the load ring when the load ring is disposed within the collar and to enable the user to effect movement of the load ring between the first and second positions.

15. A system comprising:

a first component including a collar threaded onto and extending from a first end of the first component;

a second component including a second end disposed within the collar;

a load ring disposed within a groove of the second component and within the collar, the load ring comprising an outer surface positioned in engagement with a mating inner surface of the collar; and

a locking ring radially interposed between the load ring and the second component, wherein the locking ring cooperates with the load ring to secure the second component to the first component.

16. The system of claim 15, wherein the outer surface of the load ring and the inner surface of the collar comprise mating teeth.

17. The system of claim 15, wherein the collar comprises a window axially aligned with the locking ring to permit a user to disengage the outer surface of the load ring from the mating inner surface of the collar via the window.

18. A method comprising:

providing a first component including a box connector and a second component including a pin connector;

installing a load ring in a groove of the second component;

inserting the pin connector into the box connector such that the load ring within the groove is aligned with a collar of the box connector;

positioning the load ring into engagement with an inner surface of the collar; and

inserting a locking ring between the load ring and the second component within the groove such that the locking ring retains the load ring in engagement with the collar and facilitates securing of the first component to the second component.

19. The method of claim 18, wherein installing the load ring in the groove comprises installing an outwardly-biased C-ring in the groove and securing the outwardly-biased C-ring to the second component via one or more set screws.

20. The method of claim 19, wherein positioning the load ring comprises removing the one or more set screws via an access window through the collar to enable the outwardly-biased C-ring to radially extend into engagement with the inner surface of the collar.

21. The method of claim 18, wherein inserting the locking ring comprises axially moving the locking ring from a first position within the groove to a second position within the groove.

22. The method of claim 18, wherein inserting the locking ring comprises securing the locking ring between the load ring and the second component via set screws.

23. The method of claim 18, comprising:
removing the locking ring from between the load ring and the second component;
securing the load ring to the second component and in spaced relation to the inner surface of the collar; and
removing the pin connector from the box connector.

24. The method of claim 23, wherein securing the load ring to the second component comprises securing a portion of the load ring exposed by an access window in the collar to the second component.

25. The method of claim 24, wherein securing the load ring comprises using a C-clamp to align an aperture in the load ring with a recess in the second component and inserting a set screw into the recess through the aperture.

26. The method of claim 23, wherein removing the locking ring comprises moving the locking ring within the groove and securing the locking ring to the second component via one or more set screws.

27. The method of claim 18, comprising rotating the collar to facilitate removal of slack from between the box connector and the pin connector.

28. The method of claim 27, wherein rotating the collar comprises rotating the collar no more than a one-quarter turn to remove the slack from between the box connector and the pin connector.

29. The method of claim 28, wherein rotating the collar comprises rotating the collar no more than a one-quarter turn to remove the slack from between the box connector and the pin connector and to provide a preloaded connection.