

DOG-TYPE LOCKOUT AND POSITION INDICATOR ASSEMBLY

Field of Invention

[0001] This invention relates in general to tension rings and in particular to a dog-type lockout assembly for a tension ring that has a manual lockdown feature and indicates the dog position.

BACKGROUND OF THE INVENTION

[0002] Locking mechanisms for oilfield equipment often include a cylindrical locking mechanism called a dog. The dog is put into a locking position between two components, such as a tension ring and a housing, to hold a position or take a load. For example, the dog can be part of a tension ring that can maintain a riser in stable tension when offshore platforms heave. When the riser is retrieved, the dog can be locked to a housing located on the riser to prevent it from falling and injuring personnel. An additional dog can lock onto another component for storage.

[0003] To prevent the accidental unlocking of the dogs, a manual lockout can be employed to secure the dog in a locked position. When the lockout is engaged, the dog is locked in an engaged position. When the lockout is disengaged, the dog is free to move between an engaged and a disengaged position. However, the actual position of the dog is unknown. For example, when a lockout is disengaged, the dog may still be in the engaged position. This may cause problems for the operators.

[0004] A need exists for a technique to manually lockdown dogs and indicate whether a dog is in a locked or unlocked position. The following technique may solve these problems.

Summary of the Invention

[0005] In an embodiment of the present technique, a dog-type lockout assembly is provided that integrates a position indicator that can provide visual confirmation as to whether the dog is in the engaged or disengaged position. The dogs can be manually locked down in the engaged position to prevent the dog from being accidentally disengaged. The dog-type lockout assembly allows two components, such as a tension ring and a housing, to be locked together to thereby hold a position or take a load.

[0006] In the illustrated embodiment, the dog-type lockout assembly has a tension ring. The tension ring can have eyelets disposed circumferentially around its exterior and adapted to receive wires that attach to the structure of a rig. The ring can be adapted to maintain tension on a drilling riser comprised of several thousand feet of pipe and extends from a rig down to the seafloor. The tension is applied to the riser via the wires attached to the ring to thereby prevent the riser from collapsing. The tension ring can apply tension to the riser through a housing connected to a slip joint.

[0007] When retrieving the drilling riser, in this example, the reaction point between the housing and the tension ring is removed and the tension wires go slack, allowing the tension ring to fall. This can be very dangerous to personnel working on platforms below the tension ring. To prevent the tension ring from falling during retrieval of the riser, a dog is used with the tension ring to lock into a mating passage on the housing. This prevents the tension ring from falling and allows the ring to be carried upwards to where another component can be mounted. The component can be, for example, a diverter support housing mounted on the rig. Another set of dogs on the tension ring can engage

with the diverter support housing when the tension ring contacts the diverter support from below. The tension ring can be stored in this position.

[0008] A hazard can arise if the dogs are accidentally disengaged by actuating the dogs hydraulically. To prevent this hazard, a manual lockdown can be used to ensure the dog remains in the engaged position. The lockdown can be a mechanically driven screw located behind the engaged dog. When the lockdown is retracted the dog can float into both engaged and disengaged positions. When the lockdown is extended, the dog is only permitted to be in an engaged position. The solution adds a floating ring and position indicator rod to the dog that rides along with the dog to show the position of the dog. The position indicator will visually appear recessed within the ring body when the dog is in the engaged position and will appear retracted from the ring body when the dog is in the disengaged position. The floating ring can easily be radially positioned to make it easier to manufacture an assembly.

[0009] The dog-type lockout thus integrates position indication in one assembly. The combination of features allowing manual lockdown of the dogs into an engaged position and providing visual confirmation as to whether the dogs are in an engaged or disengaged position, advantageously increase safety by preventing accidental disengagement of the dogs and providing a simple way to ascertain the position of the dogs.

Brief Description of the Drawings

[0010] Figure 1 is a sectional view of a tension ring in contact with a housing and lower dogs in the engaged position, in accordance with an embodiment of the invention;

[0011] Figure 2 is an enlarged sectional view of the dog and position indicator within a tensioner ring, in accordance with an embodiment of the invention;

[0012] Figure 3 is an enlarged sectional view of the dog and position indicator within a tensioner ring with the lockdown member retracted, in accordance with an embodiment of the invention;

[0013] Figure 4 is a sectional view of a tension ring in contact with a diverter housing and upper dogs in the locked position, in accordance with an embodiment of the invention.

Detailed Description of the Invention

[0014] Referring to Figure 1, an embodiment of the invention shows a tensioner ring or connector assembly 10 for connecting two members. One member can be, for example, an outer member such as the riser tensioner ring 10 itself and the other member can be, for example, an inner member such as a housing 11 on a slip joint 12 connected to a riser 14.

[0015] In this example, the connector assembly 10 can have eyelets 15 disposed circumferentially around its exterior and adapted to receive wires 16 that attach to a tension system that maintains constant tension. The tensioner ring 10 can be adapted to maintain tension on a drilling riser 14 comprised of several thousand feet of pipe that extends from a rig down to the seafloor. The tension is applied to the riser 14 via the wires attached to the ring 10 to thereby prevent the riser 14 from collapsing. The tensioner ring 10 can apply tension to the riser 14 through a housing 11 connected to a slip joint 12.

[0016] Referring to Figure 2, the tensioner ring 10 can comprise a frame or body 18 having at least one fluid cylinder or opening 19. An actuator comprising a lower dog 20 that is movable between an engaged position and a disengaged position in a lower fluid cylinder 21 in response to fluid pressure. Lower dog 20 has an annular piston 21 that sealingly engages opening 19. Hydraulic lines 22 can provide the fluid pressure to be exerted on piston 21. The lower dog 20 has an interior end 24 that extends through an interior opening 26 on the interior of the frame 18 when the lower dog 20 is in the engaged position. In the engaged position the lower dog 20 engages a mating hole or groove formed on the housing 11. To indicate the position of the lower dog 20 a collar or

floating ring 28 connected to the lower dog 20, carries a lower position indicator 30. In the illustrated embodiment, the lower position indicator 30 is recessed within an aperture or opening 32 on the frame 18 when the lower dog 20 is in the engaged position, thus providing a visual confirmation of dog's position. When the lower dog 20 is in the disengaged position, the lower position indicator 30 will extend out from the aperture 32 in the illustrated embodiment. Position indicator 30 is a rod that is parallel to an offset from an axis of opening 19. However, devices other than a rod may be used as a position indicator for the lower dog 20.

[0017] The openings 19 on the frame 18 can be covered by lower and upper caps 56, 58. The lower cap 56 has a threaded opening 36. The aperture 32 for the lower position indicator 30 can similarly be formed on the lower cap 56. The upper cap 58 can likewise have a threaded opening 54 that allows the upper locking member 52 to pass through it. The aperture 50 for the upper position indicator 48 can similarly be formed on the upper cap 58.

[0018] A lower lockdown member or screw 34 extends through threaded opening 36 of cap 56. In the illustrated embodiment, the lockdown member 34 is threaded to enable it to move between retracted and extended positions relative to the cap 56. Screw 34 has a base that abuts the head of a screw 37 attached to and forming part of lower dog 20. Extending the lower lockdown member 34 when the lower dog 20 is in the engaged position causes the lockdown member 34 to lock the lower dog 20 in the engaged position to prevent the dog 20 from moving to the disengaged position. The lower lockdown member 34 thus assures that the lower dog 20 will remain engaged to the housing 11 as the riser 14 is retrieved. Conversely, the lower dog 20 is free to move

between the engaged and disengaged positions when the lower lockdown member 34 is in the retracted position.

[0019] Continuing to refer to Figure 2, a similar locking mechanism can be used to store the housing 11 after the riser 14 is retrieved. An upper dog 38 can be located above the lower dog 20 and within the frame 18. The upper dog 38 has an annular piston 39 and slidingly moves between engaged and disengaged positions in an upper fluid cylinder 39 in response to fluid pressure. Hydraulic lines 40 can provide the fluid pressure. The upper dog 38 has an interior end 42 that can extend through an interior opening 44 on the interior of the frame 18 when the upper dog 38, is in the engaged position. In the engaged position the upper dog 38 engages a mating hole or groove formed on a member such as a diverter housing 70 (Figure 3). To indicate the position of the upper dog 38 a collar or floating ring 46 connected to the upper dog 38 carries an upper position indicator 48. In the illustrated embodiment, the upper position indicator 48 is recessed within an aperture or opening 50 on the frame 18 when the upper dog 38 is in the locked position, thus providing visual confirmation of the dog's position. When the upper dog 38 is in the disengaged position, the upper position indicator 48 will extend out from the aperture 50 in this embodiment.

[0020] An upper lockdown member or screw 52 extends through a threaded opening 54 in cap 58. Threads on rotary screw 52 enable it to move between retracted and extended positions relative to cap 58. Screw 52 has a base that abuts the head of a screw 55 attached to and forming part of upper dog 38. Extending the upper lockdown member 52 when the upper dog 38 is in the engaged position causes the base of the lockdown member 52 to engage the upper dog 38 and prevents the dog from moving to the

disengaged position. The upper lockdown member 52 thus assures that the upper dog 38 will remain engaged to the diverter housing 70 (Figure 3) to allow storage of the housing 11 within the diverter housing 70. The upper dog 38 is free to move between the engaged and disengaged positions when the upper lockdown member 52 is in the retracted position as shown in FIG. 2.

[0021] The portion of the frame 18 that houses the upper dog 38 can be radially offset outward farther than lower dog 20. This offset creates an incrementally larger inner diameter at the upper dog 38 portion of the frame 18 that facilitates engagement with the diverter housing 70.

[0022] While the invention has been shown in only one of its forms, it should be apparent to those skilled in the art that it is not so limited but is susceptible to various changes without departing from the scope of the invention.

WHAT IS CLAIMED IS:

1. A connector assembly for connecting two members, comprising:

an actuator adapted to be carried by a first member, the actuator being movable in response to fluid pressure between a disengaged position and an engaged position with a second member;

a frame mounted adjacent the actuator and having an opening;

a lockdown member extending through the opening in the frame and being movable between retracted and extended positions, such that movement of the lockdown member to the extended position while the actuator member is in the engaged position causes the lockdown member to engage the actuator and prevent the actuator from moving to the disengaged position, wherein the actuator is movable between the engaged and disengaged positions while the lockdown member is in the retracted position; and

a position indicator coupled to the actuator for movement therewith and protruding through an aperture in the frame to indicate the position of the actuator.

2. The assembly according to claim 1, wherein the opening in the frame is threaded and the lockdown member is threaded so that rotation moves it between the retracted and extended positions.

3. The assembly according to claim 1:

wherein the actuator moves along a longitudinal axis;

the lockdown member moves along the longitudinal axis; and

the position indicator rod is offset and parallel to the longitudinal axis.

4. The assembly according to claim 1, wherein the actuator is located within a fluid cylinder and comprises:

a piston reciprocally movable in the cylinder; and
a dog connected to the piston for movement therewith.

5. The assembly according to claim 1, further comprising:

a collar mounted to the actuator; and
wherein the position indicator is mounted to the collar.

6. The assembly according to claim 1, wherein the frame comprises a cap adapted to be secured to the outer member in alignment with and spaced from the actuator.

7. A connector assembly for connecting two tubular members, comprising:

an outer member adapted to be connected to one of the tubular members and
having a central opening;

an inner member that lands within the central opening, the inner member adapted
to be connected to the other of the tubular members;

a plurality of fluid cylinders on the outer member and spaced around the central
opening;

an actuator carried within each of the fluid cylinders, each of the actuators having
a dog on an inner end for engaging the inner member and being movable in response to
fluid pressure applied to the cylinder along a cylinder axis between inner and outer
positions;

a lockdown member mounted outward of each of the actuators, each lockdown
member being manually movable from a retracted position to an extended position, each

lockdown member having an inner end that engages an outer end of one of the actuators while the actuator is in the inner position and the lockdown member in its extended position, each of the actuators being freely movable in response to fluid pressure in the fluid cylinders while its lockdown member is in the retracted position; and

a position indicator coupled to each of the actuators for movement therewith and extending alongside one of the lockdown members to indicate the position of each of the actuators.

8. The assembly according to claim 7, wherein the outer member has a frame portion located outward from each the actuators and containing a threaded hole that receives each of the lockdown members.

9. The assembly according to claim 7, wherein:

each of the lockdown members is located on the cylinder axis of one of the fluid cylinders; and

each of the position indicators is located alongside and parallel with one of the cylinder axes.

10. The assembly according to claim 9, wherein the outer member has a frame portion located outward from each of the actuators, and each of the position indicators protrudes through an aperture provided in the frame portion.

11. The assembly according to claim 7, further comprising:

a collar mounted to each of the actuators; and

wherein each of the position indicators is mounted to the collar alongside the cylinder axis.

12. The assembly according to claim 7, wherein the outer member is a riser tensioner ring and the inner member is a housing on the riser that lands in the ring.

13. The assembly according to claim 7, wherein the fluid cylinders further comprise a set of upper fluid cylinders and a set of lower fluid cylinders.

14. The assembly according to claim 7, wherein the outer member further comprises a set of eyelets adapted for receiving a cable.

15. The assembly according to claim 7, wherein frame caps are mounted to the outer member outward from each fluid cylinder, each frame cap having a threaded hole for one of the lockdown members and an aperture for one of the position indicators.

16. A method of connecting first and second members, comprising:

mounting to the first member an actuator and a lockdown member;

mounting a position indicator rod to the actuator for movement therewith;

aligning the first and second members with each other;

with fluid pressure, moving the actuator from a disengaged position to an engaged position in engagement with the second member, the position indicator rod moving with the actuator to visually indicate the engaged position; then

manually moving the lockdown member from a retracted to an extended position into engagement with the actuator, thereby preventing movement of the actuator from the engaged position.

17. The method of claim 16, further comprising disconnecting the first and second members by:

manually moving the lockdown member from the extended position back to the retracted position, after which the indicator rod will still visually indicate that the actuator is in the engaged position; then

applying fluid pressure to the actuator to move the actuator to the disengaged position, the indicator rod moving along with the actuator to provide a visual indication that the actuator is in the disengaged position.

18. The method of claim 16, wherein:

the step of mounting to the first member an actuator and a lockdown member comprises mounting the lockdown member along a longitudinal axis of the actuator; and

the step of mounting a position indicator rod to the actuator comprises mounting the indicator rod alongside and parallel with the longitudinal axis.

19. The method of claim 16, wherein the position indicator protrudes a selected distance through an aperture while the actuator is in the disengaged position.

20. The method of claim 16, wherein the step of manually moving the lockdown member from a retracted to an extended position comprises rotating the lockdown member.