POSITIVE LOCK SYSTEM

BACKGROUND

[0001] 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.

[0002] In some drilling and production systems, hangers, such as a tubing hanger, may be used to suspend strings of tubing for various flows in and out of the well. Such hangers may be disposed within a wellhead that supports both the hanger and the string. For example, a tubing hanger may be lowered into a wellhead and supported therein. To facilitate the running or lowering process, the tubing hanger may couple to a tubing hanger running tool (THRT). Once the tubing hanger has been lowered into a landed position within the wellhead by the THRT, the tubing hanger may then be rotatably locked into position. The THRT may then be disconnected from the tubing hanger and extracted from the wellhead. Unfortunately, existing systems used to rotatably lock a tubing hanger in place may be complicated and time consuming. Moreover, rotation of the tubing hanger may reduce the effectiveness of seals between the tubing hanger and the Christmas tree.

SUMMARY OF INVENTION

[0002a] According to a first aspect, there is provided a system, comprising: a positive lock system configured to energize a seal assembly in response to a first axial movement of a first piston, wherein the positive lock system comprises: a lock ring system, comprising: a load ring configured to engage a tubular; and a lock ring configured to radially energize the load ring by moving only in an axial direction in response to a second axial movement of a second piston after the first axial movement of the first piston.

[0002b] According to a second aspect, there is provided a system, comprising: a positive lock system, comprising: a hydraulic tool configured to energize a seal assembly and a lock ring system one after another, wherein the hydraulic tool comprises: a hydraulic body configured to couple to a hydraulic fluid source; a first piston coupled to the hydraulic body; and a second piston coupled to the hydraulic body, wherein the first piston is configured to move axially with respect to the hydraulic body and the second piston to energize the seal

assembly and align the lock ring system at an axial position between first and second tubulars, and the second piston is configured to move axially with respect to the hydraulic body and the first piston to energize the lock ring system at the axial position between the first and second tubulars after the first piston energizes the seal assembly.

[0002c] According to a third aspect, there is provided a system, comprising: a seal assembly configured to seal a space between a first tubular and a second tubular; and a positive lock system configured to energize the seal assembly in response to a first axial movement of a first piston, wherein the positive lock system comprises: a lock ring system, comprising: a load ring configured to engage the first tubular; and a lock ring configured to radially energize the load ring by moving only in an axial direction in response to a second axial movement of a second piston after the first axial movement of the first piston.

[0002d] According to a fourth aspect, there is provided a method, comprising driving a first piston coupled to a hydraulic body of a hydraulic tool to undergo a first axial movement, relative to the hydraulic body and a second piston, to energize a seal assembly between first and second tubulars and align a lock ring system at an axial position between the first and second tubulars; and driving the second piston coupled to the hydraulic body of the hydraulic tool to undergo a second axial movement, relative to the hydraulic body and the first piston, to energize the lock ring system at the axial position and hold the seal assembly after the first piston energizes the seal assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] Various features, aspects, and advantages of the present invention will become better understood when the following detailed description is read with reference to the accompanying figures in which like characters represent like parts throughout the figures, wherein:

CLAIMS

The invention claimed is:

1. A system, comprising: a positive lock system configured to energize a seal assembly in response to a first axial movement of a first piston, wherein the positive lock system comprises: a lock ring system, comprising: a load ring configured to engage a tubular; and a lock ring configured to radially energize the load ring by moving only in an axial direction in response to a second axial movement of a second piston after the first axial movement of the first piston.

2. The system of claim 1, wherein the load ring comprises a plurality of radial teeth configured to engage the tubular.

3. The system of claim 1, wherein the lock ring comprises a plurality of radial protrusions configured to increase a contact pressure between the load ring and the lock ring in a locked position.

4. The system of claim 1, comprising a guide pin configured to axially guide the lock ring.

5. The system of claim 1, wherein the lock ring is configured to move in the axial direction from a first axial position to a second axial position, the lock ring and the load ring axially overlap with one another in the second position, the load ring is disposed in a first radial position in the first axial position of the lock ring, and the load ring is disposed in a second radial position in the second axial position of the lock ring.

6. The system of claim 1, wherein the lock ring is configured to move in the axial direction to surround the load ring and drive the load ring radially inward.

7. The system of claim 1, wherein the lock ring is configured to move in the axial direction to be surrounded by the load ring and drive the load ring radially outward.

8. The system of claim 1, comprising a tool having the first and second pistons, wherein the tool is retrievable after energizing the seal assembly and the lock ring system.

9. The system of claim 8, wherein the tool comprises a hydraulic body, the first piston is configured to undergo the first axial movement in response to a first hydraulic fluid to energize the seal assembly, and the second piston is configured to undergo the second axial movement in response to a second hydraulic fluid to energize the lock ring system.

10. The system of claim 1, wherein the first piston is configured to undergo the first axial movement to energize the seal assembly after shearing through a shear pin.

11. The system of claim 1, wherein the first piston is configured to undergo the first axial movement to energize the seal assembly and align the lock ring system at an axial position relative to the tubular.

12. A system, comprising: a positive lock system, comprising: a hydraulic tool configured to energize a seal assembly and a lock ring system one after another, wherein the hydraulic tool comprises: a hydraulic body configured to couple to a hydraulic fluid source; a first piston coupled to the hydraulic body; and a second piston coupled to the hydraulic body, wherein the first piston is configured to move axially with respect to the hydraulic body and the second piston to energize the seal assembly and align the lock ring system at an axial position between first and second tubulars, and the second piston is configured to move axially with respect to the hydraulic body and the first piston to energize the lock ring system at the axial position between the first and second tubulars after the first piston energizes the seal assembly.

13. The system of claim 12, wherein the first and second pistons are concentric annular pistons.

14. The system of claim 12, wherein the first tubular comprises a hanger of a mineral extraction system.

15. The system of claim 12, wherein the lock ring system comprises a load ring and a lock ring, and the hydraulic tool is configured to axially move the lock ring to energize the load ring via axial movement of the second piston.

16. A system, comprising: a seal assembly configured to seal a space between a first tubular and a second tubular; and a positive lock system configured to energize the seal assembly in response to a first axial movement of a first piston, wherein the positive lock system comprises: a lock ring system, comprising: a load ring configured to engage the first tubular; and a lock ring configured to radially energize the load ring by moving only in an axial direction in response to a second axial movement of a second piston after the first axial movement of the first piston.

17. The system of claim 16, wherein the seal assembly comprises a metal-to-metal seal.

18. The system of claim 16, wherein the first tubular comprises a hanger of a mineral extraction system.

19. The system of claim 16, comprising a hydraulic tool having the first and second pistons, and the hydraulic tool is retrievable after the first piston energizes the seal assembly and the second piston energizes the lock ring system.

20. The system of claim 16, wherein the lock ring system is configured to hold the seal assembly in an energized state after the first piston energizes the seal assembly and the second piston energizes the lock ring system.

21. A method, comprising driving a first piston coupled to a hydraulic body of a hydraulic tool to undergo a first axial movement, relative to the hydraulic body and a second piston, to energize a seal assembly between first and second tubulars and align a lock ring system at an axial position between the first and second tubulars; and driving the second piston coupled to the hydraulic body of the hydraulic tool to undergo a second axial movement, relative to the hydraulic body and the first piston, to energize the lock ring system at the axial position and hold the seal assembly after the first piston energizes the seal assembly.

22. The method of claim 21, comprising retrieving the hydraulic tool having the first and second pistons after energizing the seal assembly and the lock ring system.

23. The method of claim 21, wherein driving the first piston comprises hydraulically driving the first piston, and driving the second piston comprises hydraulically driving the second piston.