

MULTI-METAL SEAL 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 position within the wellhead by the THRT, a seal is formed in the gap between the spool and the hanger to block fluid flow. Unfortunately, existing systems used to seal the gap between the spool and the hanger may be complicated and time consuming.

SUMMARY OF INVENTION

[0002a] According to a first aspect, there is provided a system, comprising: a first tubular; a second tubular, wherein the first and second tubulars are configured to be disposed one inside another about an axis; a multi-metal seal system configured to seal an annular space between a first surface of the first tubular and a second surface of the second tubular, wherein the multimetal seal system comprises: a first metal seal portion with a first angled surface and a second angled surface; a second metal seal portion with a third angled surface;

and a third metal seal portion with a fourth angled surface; wherein the first angled surface selectively engages the third angled surface at a first angled interface and the second angled surface selectively engages the fourth angled surface at a second angled interface, and wherein the first and second angled interfaces are configured to drive the first metal seal portion only in a first radial direction relative to the axis and seal radially against the first surface, drive the second metal seal portion only in a second radial direction relative to the axis and seal radially against the second surface, and drive the third metal seal portion only in the second radial direction relative to the axis and seal radially against the second surface.

[0002b] According to a second aspect, there is provided a system, comprising: a multi-metal seal system configured to seal an annular space between a first surface of a first tubular and a second surface of a second tubular, wherein the multimetal seal system comprises: a first metal seal portion with a first angled surface and a second angled surface; a second metal seal portion with a third angled surface; and a third metal seal portion with a fourth angled surface; wherein the first angled surface selectively engages the third angled surface at a first angled interface and the second angled surface selectively engages the fourth angled surface at a second angled interface, and wherein the first and second angled interfaces are configured to drive the first metal seal portion radially away from the second surface and seal radially against the first surface, drive the second metal seal portion radially away from the first surface and seal radially against the second surface, and drive the third metal seal portion radially away from the first surface and seal radially against the second surface; and a lock ring system configured to hold the multi-metal seal system in a sealed position, wherein the lock ring system comprises: 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.

[0002c] According to a third aspect, there is provided a system, comprising: a multi-metal seal system configured to seal an annular space about an axis and between a first surface of a first tubular and a second surface of a second tubular,

wherein the multi-metal seal system comprises: a first metal seal portion with a first angled surface and a second angled surface; a second metal seal portion with a third angled surface; and a third metal seal portion with a fourth angled surface; wherein the first angled surface selectively engages the third angled surface at a first angled interface and the second angled surface selectively engages the fourth angled surface at a second angled interface, and wherein the first and second angled interfaces are configured to drive the first metal seal portion radially away from the second and third metal seal portions to seal the annular space between the first and second tubulars by driving the first metal seal portion only in a first radial direction relative to the axis to seal radially against the first surface, driving the second metal seal portion only in a second radial direction relative to the axis to seal radially against the second surface, and driving the third metal seal portion only in the second radial direction relative to the axis to seal radially against the second surface.

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:

[0004] FIG. 1 is a block diagram of an embodiment of a mineral extraction system with a multi-metal seal system;

CLAIMS

The invention claimed is:

1. A system, comprising: a first tubular; a second tubular, wherein the first and second tubulars are configured to be disposed one inside another about an axis; a multi-metal seal system configured to seal an annular space between a first surface of the first tubular and a second surface of the second tubular, wherein the multimetal seal system comprises: a first metal seal portion with a first angled surface and a second angled surface; a second metal seal portion with a third angled surface; and a third metal seal portion with a fourth angled surface; wherein the first angled surface selectively engages the third angled surface at a first angled interface and the second angled surface selectively engages the fourth angled surface at a second angled interface, and wherein the first and second angled interfaces are configured to drive the first metal seal portion only in a first radial direction relative to the axis and seal radially against the first surface, drive the second metal seal portion only in a second radial direction relative to the axis and seal radially against the second surface, and drive the third metal seal portion only in the second radial direction relative to the axis and seal radially against the second surface.
2. The system of claim 1, wherein the multi-metal seal system forms a first fluid chamber between the first metal seal portion and the first surface of the first tubular, the multi-metal seal system forms a second fluid chamber axially between the second and third metal seal portions and radially between the first metal seal portion and the second surface of the second tubular, and the first metal seal portion comprises a passage configured to enable fluid to flow between the first and second fluid chambers.
3. The system of claim 2, comprising a seal test passage fluidly coupled to the first fluid chamber, the second fluid chamber, and the passage, wherein the seal test passage is configured to supply a fluid to test the first, second, and third metal seal portions.

4. The system of claim 1, wherein the first metal seal portion has a radial thickness that increases along the first metal seal portion as the first and second angled surfaces extend axially toward one another between opposite axial ends of the first metal seal portion, and the second and third metal seal portions are driven to seal radially against the second surface as the second and third metal seal portions are driven to move axially toward one another while the third and fourth angled surfaces slide along the respective first and second angled surfaces.
5. The system of claim 1, comprising a first seal sleeve configured to couple to the first and second metal seal portions.
6. The system of claim 5, comprising a second seal sleeve configured to support the first and third metal seal portions.
7. The system of claim 5, wherein the first seal sleeve couples to the second metal seal portion with a threaded connector or a pin.
8. The system of claim 1, wherein the first metal seal portion seals radially against only the first surface and not the second surface, the second metal seal portion seals radially against only the second surface and not the first surface, and the third metal seal portion seals radially against only the second surface and not the first surface.
9. The system of claim 1, comprising a hydrocarbon extraction system with a hydraulic tool configured to actuate the multi-metal seal system.
10. The system of claim 1, comprising a lock ring system configured to block movement of the multi-metal seal system.
11. The system of claim 10, wherein the lock ring system comprises a load ring configured to move in a radial direction between a first position that allows movement of the multi-metal seal system and a second position that blocks movement of the multi-metal seal system, and a lock ring configured to radially energize the load ring to move from the first position to the second position by moving only in an axial direction, wherein the lock ring is configured to hold the load

ring in the second position.

12. A system, comprising: a multi-metal seal system configured to seal an annular space between a first surface of a first tubular and a second surface of a second tubular, wherein the multimetal seal system comprises: a first metal seal portion with a first angled surface and a second angled surface; a second metal seal portion with a third angled surface; and a third metal seal portion with a fourth angled surface; wherein the first angled surface selectively engages the third angled surface at a first angled interface and the second angled surface selectively engages the fourth angled surface at a second angled interface, and wherein the first and second angled interfaces are configured to drive the first metal seal portion radially away from the second surface and seal radially against the first surface, drive the second metal seal portion radially away from the first surface and seal radially against the second surface, and drive the third metal seal portion radially away from the first surface and seal radially against the second surface; and a lock ring system configured to hold the multi-metal seal system in a sealed position, wherein the lock ring system comprises: 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.

13. The system of claim 12, wherein the multi-metal seal system comprises a first seal sleeve configured to couple to the first and second metal seal portions and energize the multi-metal seal system by moving axially.

14. The system of claim 13, comprising a second seal sleeve configured to support the first and third metal seal portion while the first seal sleeve moves axially.

15. The system of claim 12, comprising a hydrocarbon extraction system with a hydraulic tool configured to actuate the multi-metal seal system and the lock ring system.

16. A system, comprising: a multi-metal seal system configured to seal an annular space about an axis and between a first surface of a first tubular and a second surface of a second tubular, wherein the multi-metal seal system comprises: a first metal seal portion with a first angled surface and a second angled surface; a second

metal seal portion with a third angled surface; and a third metal seal portion with a fourth angled surface; wherein the first angled surface selectively engages the third angled surface at a first angled interface and the second angled surface selectively engages the fourth angled surface at a second angled interface, and wherein the first and second angled interfaces are configured to drive the first metal seal portion radially away from the second and third metal seal portions to seal the annular space between the first and second tubulars by driving the first metal seal portion only in a first radial direction relative to the axis to seal radially against the first surface, driving the second metal seal portion only in a second radial direction relative to the axis to seal radially against the second surface, and driving the third metal seal portion only in the second radial direction relative to the axis to seal radially against the second surface.

17. The system of claim 16, wherein the multi-metal seal system comprises a first seal sleeve configured to couple to the first and second metal seal portions and energize the multi-metal seal system by moving axially.

18. The system of claim 17, comprising a second seal sleeve configured to support the first and third metal seal portion while the first seal sleeve moves axially.

19. The system of claim 16, comprising a hydrocarbon extraction system with a hydraulic tool configured to actuate the multi-metal seal system.

20. The system of claim 16, comprising a lock ring system configured to block movement of the multi-metal seal system.