# IMPROVED LINER HANGER SYSTEM

## BACKGROUND

The present disclosure relates generally to equipment utilized and operations performed in conjunction with a subterranean well and, more particularly, to an improved liner hanger system.

When performing subterranean operations, a wellbore is typically drilled and completed to facilitate removal of desired materials (e.g., hydrocarbons) from a subterranean formation. Often, once a wellbore is drilled, a casing may be inserted into the wellbore. Cement may then be used to install the casing in the wellbore and prevent migration of fluids in the annulus between the casing and the wellbore wall. In certain implementations, the casing may be made of heavy steel.

Once an upper portion of the wellbore has been drilled and cased, it may be desirable to continue drilling and to line a lower portion of the wellbore with a liner lowered through the upper cased portion thereof. Liner hangers are typically used to mechanically support an upper end of the liner from the lower end of a previously installed casing. Additionally, liner hangers may be used to seal the liner to the casing.

Traditional liner hangers utilized slips for mechanically supporting the liner from the casing and packers to seal the different components. Expandable liner hangers ("ELH(s)") such as VERSAFLEX™, available from Halliburton Energy Services, have been recently developed and provide an improvement over traditional liner hangers. Specifically, ELHs utilize elastomeric rings (e.g., rings made of rubber) carried on a section of expandable tubing to provide both mechanical support and a fluid seal. Accordingly, once an ELH is placed at a desired position downhole within a casing, an expansion cone may be forced through the ELH. The expansion cone expands the elastomeric rings of the ELH, bringing them into contact with the casing to provide both mechanical support and a fluid seal between the casing and a liner.

It is often desirable to use an ELH in a larger size casing (e.g., casing having a diameter of between approximately 5.5" and approximately 22") and/or a high pressure high temperature ("HPHT") environment downhole. However, the properties of elastomeric rings of an ELH are often susceptible to changes in pressure and temperature. Accordingly, the high pressures and high temperatures of HPHT environments can adversely impact the ELH's ability to provide mechanical support and/or seal the liner to the casing. These adverse impacts become even more pronounced in instances when the liner is installed in a large casing.

## SUMMARY OF INVENTION

According to a first aspect of the present invention, there is provided a system for performing subterranean operations comprising: a liner hanger positioned within a casing, wherein the liner hanger comprises a spiked portion having one or more metallic spikes, each of the one or more metallic spikes extending in a circular ring along an outer perimeter of the liner hanger; wherein the one or more metallic spikes ~~comprise~~ are tapered to a flat portion, wherein at least one of the one or more metallic spikes is expandable, and wherein the flat portion of each of the one or more metallic spikes ~~interfaces with~~ deforms the casing when the spike is in the expanded position; ~~and~~, wherein each of the one or more metallic spikes provides a metal-to-metal seal between the liner hanger and the casing when the spike is in the expanded position; and a liner coupled to the liner hanger.

According to a second aspect of the present invention, there is provided a method for coupling a liner to a casing of a cased wellbore in a subterranean formation comprising: coupling a liner hanger to the liner, wherein the liner hanger comprises a spiked portion having a first metal spike tapered to a flat portion; lowering the liner and the liner hanger downhole through the casing; and expanding the first spike, wherein the first metal spike causes deformation of the casing and provides a metal-to-metal seal between the liner hanger and the casing when the first metal spike is in the expanded position, and wherein expanding the first metal spike couples the liner hanger to the casing.

According to a third aspect of the present invention, there is provided a system for supporting a liner in a casing comprising: a liner hanger coupled to the liner; a first metal spike and a second metal spike formed on a spiked portion of the liner hanger, wherein each of the first metal spike and the second metal spike tapered to a flat portion and extends in a circular ring along an outer perimeter of the liner hanger, wherein the first metal spike is positioned at a first axial location along the liner hanger and the second metal spike is positioned at a second axial location along the liner hanger, ~~and~~ wherein expanding at least one of the first metal spike and the second metal spike deforms the casing to couples the liner to the casing~~.~~, and wherein each of the first metal spike and the second metal spike provides a metal-to-metal seal between the liner hanger and the casing when in the expanded position.

WHAT IS CLAIMED IS:

1. A system for performing subterranean operations comprising:

a liner hanger positioned within a casing,

wherein the liner hanger comprises a spiked portion having one or more metallic spikes, each of the one or more metallic spikes extending in a circular ring along an outer perimeter of the liner hanger;

wherein the one or more metallic spikes ~~comprise~~ are tapered to a flat portion,

wherein at least one of the one or more metallic spikes is expandable, and

wherein the flat portion of each of the one or more metallic spikes ~~interfaces with~~ deforms the casing when the spike is in the expanded position~~; and~~,

wherein each of the one or more metallic spikes provides a metal-to-metal seal between the liner hanger and the casing when the spike is in the expanded position; and

a liner coupled to the liner hanger.

~~2. The system of claim 1, wherein the one or more spikes extend along an outer perimeter of the liner hanger.~~

32. The system of claim 1, wherein the one or more metallic spikes are made from a material selected from a group consisting of Aluminum, steel, and a combination thereof.

43. The system of claim 1, wherein expanding the one or more metallic spikes couples the liner hanger to the casing.

54. The system of claim 1, wherein a spike height of the one or more metallic spikes is selected from a value between an upper spike height boundary and a lower spike height boundary.

65. The system of claim 1, further comprising a sealing element, wherein the sealing element is positioned at a distal end of the spiked portion.

76. The system of claim 65, wherein the sealing element is selected from a group consisting of rubber, polymeric materials and ductile metals.

87. The system of claim 1, wherein the one or more metallic spikes comprise a first spike positioned at a first axial location along the liner hanger and a second spike positioned at a second axial location along the liner hanger.

98. A method for coupling a liner to a casing of a cased wellbore in a subterranean formation comprising:

coupling a liner hanger to the liner,

wherein the liner hanger comprises a spiked portion having a first metal spike tapered to a flat portion;

lowering the liner and the liner hanger downhole through the casing; and

expanding the first spike, wherein the first metal spike causes deformation of the casing and provides a metal-to-metal seal between the liner hanger and the casing when the first metal spike is in the expanded position, and

wherein expanding the first metal spike couples the liner hanger to the casing.

~~10~~9. The method of claim ~~9~~8, wherein a spike height of the first metal spike is selected from a value between an upper spike height boundary and a lower spike height boundary.

~~11~~10. The method of claim ~~9~~8, further comprising a sealing element, wherein the sealing element is positioned at a distal end of the spiked portion.

~~12~~11. The method of claim ~~9~~8, wherein the spiked portion further comprises a second metal spike extending in a circular ring along an outer perimeter of the liner hanger, wherein the first metal spike is positioned at a first axial location along the liner hanger and the second metal spike is positioned at a second axial location along the liner hanger.

~~13~~12. The method of claim ~~9~~8, wherein the first metal spike is formed by machining.

~~14~~13. The method of claim ~~9~~8, wherein the first metal spike is made from a material selected from a group consisting of Aluminum, steel, and a combination thereof.

~~15~~14. A system for supporting a liner in a casing comprising:

a liner hanger coupled to the liner;

a first metal spike and a second metal spike formed on a spiked portion of the liner hanger,

wherein each of the first metal spike and the second metal spike tapered to a flat portion and extends in a circular ring along an outer perimeter of the liner hanger,

wherein the first metal spike is positioned at a first axial location along the liner hanger and the second metal spike is positioned at a second axial location along the liner hanger, ~~and~~

wherein expanding at least one of the first metal spike and the second metal spike deforms the casing to couples the liner to the casing~~.~~, and

wherein each of the first metal spike and the second metal spike provides a metal-to-metal seal between the liner hanger and the casing when in the expanded position.

~~16~~15. The system of claim ~~15~~14, wherein a spike height of the first metal spike and the second metal spike is selected from a value between an upper spike height boundary and a lower spike height boundary.

~~17~~16. The system of claim ~~15~~14, further comprising a sealing element, wherein the sealing element is positioned at a distal end of the spiked portion.

~~18~~17. The system of claim ~~17~~16, wherein the sealing element is selected from a group consisting of rubber, polymeric materials and ductile metals.

~~19~~18. The system of claim ~~15~~14, wherein at least one of the first metal spike and the second metal spike is formed by machining.

~~20~~19. The system of claim ~~15~~14, wherein at least one of the first metal spike and the second metal spike is made of a material selected from a group consisting of Aluminum, steel, and a combination thereof.