CLAIMS

What is claimed is:

1. A metal-to-metal (MS) seal ~~(202; 302; 402; 502; 602; 702; 902)~~ for a wellhead ~~(112)~~, ~~characterized by:~~ comprising two sides;

an area ~~(206; 306, 406; 506; 606; 707; 906)~~ between the two sides to receive an energizing element ~~(218; 518)~~; and

~~one or more notches (208; 308A, 308B; 408A, 408B) on at least one side (210C, 210D; 310A, 310B) of the MS seal provide movable portions for the at least one side of the MS seal, the one or more notches allowing fluid (924) from a lower area to enter between the one or more notches, the movable portions caused to extend toward a wall (216) of the wellhead by the fluid to form a first sealing of at least a portion of the wellhead~~one or more slits on at least one of the two sides to change a stiffness of the MS seal and to enable at least one movable portion for the at least one of the two sides, the one or more slits to allow fluid from a lower area relative to the MS seal to cause the at least one movable portion to extend towards a wall of the wellhead and to form a first seal with at least one portion of the wellhead.

2. The MS seal of claim 1, wherein the energizing element is adapted to cause the at least one movable portion to form a second seal with the at least one portion of the wellhead~~further characterized by: the energizing element for energizing the seal in the wellhead, the energizing element causing the movable portions to form a second seal prior to the first seal~~.

3. The MS seal of claim 1, wherein the one or more slits~~notches (608B, 622B) is~~are disposed vertically with respect to an alignment of the MS seal in the wellhead or disposed in an angle with respect to the alignment of the MS seal in the wellhead.

4. The MS seal of claim 1, wherein a first one of the two sides is adapted to be against a side of the wellhead and a second one of the two sides is adapted to be against a hanger of the wellhead ~~wherein the at least one side of the MS seal is adapted to be against a side of the wellhead and a second side of the MS seal is adapted to be against a hanger of the wellhead~~.

5. The MS seal of claim 4, wherein the one or more slits are located at a lower portion of the at least one of the two sides ~~The MS seal of claim 1, wherein the at least one side of the MS seal comprises bumps, wickers, or grooves (210A, 210B, 212A, 212B) therein to engage with the wellhead or a hanger~~.

6. The MS seal of claim 4, wherein a first one of the two sides is comprised of an upper portion and a lower portion, and wherein the first one of the two sides has a higher overall height than a second one of the two sides~~The MS seal of claim 1, wherein the MS seal is comprised of an alloy seal, stainless steel, or nickel alloy adapted for high pressure and high temperature metal-to-metal sealing.~~

7. The MS seal of claim 1, wherein the two sides comprise bumps, wickers, or grooves therein to engage with the wellhead or a hanger ~~The MS seal of claim 1, the one or more notches further comprises channels (622A, 622B) extending around a circumference of the MS seal~~.

8. The MS seal of claim 1, wherein a material of the MS seal is comprised an alloy seal, stainless steel, or nickel alloy, the material adapted for high pressure and high temperature metal-to-metal~~A method of~~ sealing. ~~manufacturing a metal-to-metal (MS) seal, characterized by:~~

~~forming (1002) a circumferential metal ring (202; 302; 402; 502; 602; 702; 902)~~

~~having an area (206; 306, 406; 506; 606; 707; 906) to receive an energizing element (218; 518);~~

~~and machining one or more notches (1004) on at least one side (210C, 210D; 310A,~~

~~310B) of the MS seal to provide movable portions for the at least one side of the MS seal, the~~

~~one or more notches allowing fluid (924) from a lower area to enter between the one or more~~

~~notches, the movable portions caused to extend toward a wall of the wellhead by the fluid to~~

~~form a first seal of at least a portion of the wellhead~~.

9. The MS seal of claim 1, wherein the one or more slits further comprise at least one channel extending around a circumference of the MS seal ~~The method of manufacturing the MS seal of claim 8, further~~

~~characterized by: enabling the area to receive the energizing element for energizing the seal in the~~

~~wellhead, the energizing element causing the movable portions to form a second seal prior to the~~

~~first seal~~.

10. ~~The method of manufacturing the MS seal of claim 8, wherein the~~

~~machining of the one or more notches achieves the one or more notches having a vertical~~

~~disposition (608B)with respect to an alignment of the MS seal in the wellhead or having an~~

~~angled disposition (622B) with respect to the alignment of the MS seal in the wellhead~~A method of manufacturing a metal-to-metal (MS) seal, comprising:

forming a circumferential metal ring having an area between two sides of the circumferential metal ring, the area to receive an energizing element; and

machining one or more slits on at least one of the two sides to change a stiffness of the MS seal and to enable at least one movable portion for the at least one of the two sides, the one or more slits to allow fluid from a lower area relative to the MS seal to cause the at least one movable portion to extend towards a wall of the wellhead and to form a first seal with at least one portion of the wellhead.

11. ~~The method of manufacturing the MS seal of claim 8, wherein the~~

~~machining is of lath turning, face grooving, electrical discharge machining (EDM), 3D printing,~~

~~material forming, and rolling~~ The method of claim 10, wherein the energizing element is adapted to cause the at least one movable portion to form a second seal prior to the first seal.

12. The method of claim 10, wherein the machining of the one or more slits enables a vertical disposition of the one or more slits with respect to an alignment of the MS seal in the wellhead or enables an angled disposition for the one or more slits with respect to the alignment of the MS seal in the wellhead~~The method of manufacturing the MS seal of claim 8, further~~

~~characterized by:~~

~~positioning a spacer (624A, 624B) between the one or more notches to achieve a~~

~~predetermined amount of movement for the movable portions; and~~

drilling a channel (608A, 608B) to connect to the one or more notches to comprise the fluid for providing the predetermined amount of movement for the movable

portions.

13. The method of claim 10, wherein the machining is one or more of: a lathe turning operation, a face grooving operation, an electrical discharge machining (EDM), a three-dimensional (3D) printing, a material forming operation, and a rolling operationThe method of manufacturing the MS seal of claim 8, further

characterized by:

drilling channels (608A, 608B) around a circumference of the MS seal to connect to the one or more notches, the channels allowing the fluid to fill around the circumference of the

MS seal to form a third seal for the wellhead.

14. The method of claim 10, further comprising:

positioning a spacer between the one or more slits to achieve a predetermined amount of movement for the movable portions representing a change in the stiffness of the MS seal; and

drilling a channel to connect the one or more slits, the channel to comprise the fluid to enable the predetermined amount of movement for the movable portionsA method of sealing a wellhead, characterized by:

positioning (1002), between the wellhead and a hanger, a circumferential metal

ring having an area to receive an energizing element and having at least one side for positioning

in a first position in the wellhead;

energizing (1006) the circumferential metal ring using the energizing element to

achieve a second position in the wellhead for the circumferential metal ring, the energizing

causing movable portions of the at least one side to form a first seal between the wellhead and

the hanger; and

allowing fluid (1008) from a lower area of the wellhead to enter between one or more notches adjacent to the movable portions, the fluid in the notches causing the movable portion to extend toward a wall of the wellhead to form a second seal between the wellhead and the hanger.

15. The method of claim 10, further comprising:

drilling at least one channel around a circumference to connect the one or more slits, the at least one channel to allow the fluid to fill around the circumference to enable the MS seal to form a third seal with the wellheadThe method of claim 14, further characterized by:

enabling the fluid to flow, from below the wellhead into the one or more notches;

and

]\enabling the fluid to reach a predetermined pressure to achieve the second seal.

16. A method of sealing a wellhead, comprising:

positioning, in a first position in the wellhead and between the wellhead and a hanger, a circumferential metal ring having an area between two sides, the area to receive an energizing element, the circumferential metal ring to comprise at least one slit on at least one of the two sides, the slit to change a stiffness of the circumferential metal ring;

energizing the circumferential metal ring using the energizing element to achieve a second position, in the wellhead, for the circumferential metal ring, the energizing to cause at least one movable portion enabled by the slit to form a first seal between the wellhead and the hanger; and

allowing fluid from a lower area of the wellhead to cause the at least one movable portion to extend towards a wall of the wellhead, the at least one movable portion to form a second seal between the wellhead and the hanger.

17. The method of claim 16, further comprising:

enabling the fluid to reach a predetermined pressure to achieve the second seal.

18. The method of claim 16, wherein the energizing element is an e-ring having a taper shape to energize the circumferential metal ring.

19. The method of claim 16, wherein the circumferential metal ring is a U-cup having the two sides and having the area disposed in a U-shape in between the two sides.

20. The method of claim 16, wherein the at least one of the two sides is textured by forming bumps, wickers, or grooves on the at least one of two sides.