

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:
 - an area (206; 306, 406; 506; 606; 707; 906) 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.
2. The MS seal of claim 1, 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 notches (608B, 622B) is disposed vertically with respect to an alignment of the MS seal in the wellhead or in an angle with respect to the alignment of the MS seal in the wellhead.
4. The MS seal of claim 1, 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 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 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, the one or more notches further comprises channels (622A, 622B) extending around a circumference of the MS seal.

8. A method of 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 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.

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.

12. 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 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. A 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 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.