WHAT IS CLAIMED IS:

1. A drill tool, comprising:

a bit body;

at least one bearing shaft extending from the bit body;

a cone mounted for rotation on the bearing shaft; and

a mechanical seal disposed between the bearing shaft and the cone in a seal gland, the mechanical seal including a rigid seal ring having a dynamic sealing surface with the cone and another non-sealing surface exposed to an aperture in the seal gland, the mechanical seal further including at least one cooling channel formed in the another non-sealing surface of the rigid seal ring, the cooling channel having an open end in fluid communication with the aperture in the seal gland.

2. The drill tool of claim 1 wherein the another non-sealing surface is exposed to drill cooling fluid during operation of the drill tool.

3. The drill tool of claim 2 wherein the drill cooling fluid is drilling mud.

4. The drill tool of claim 1 wherein the aperture in the seal gland fills with drill cooling fluid during operation of the drill tool.

5. The drill tool of claim 4 wherein the drill cooling fluid is drilling mud.

6. The drill tool of claim 1 wherein the cooling channel formed in the another non-sealing surface of the rigid seal ring comprises at least one groove.

7. The drill tool of claim 1 wherein the cooling channel formed in the another non-sealing surface of the rigid seal ring comprises at least one blind hole.

8. The drill tool of claim 1 wherein the cooling channel formed in the another non-sealing surface of the rigid seal ring comprises a groove which extends at least partially around a periphery of the rigid seal ring.

9. The drill tool of claim 1 wherein the cooling channel formed in the another non-sealing surface of the rigid seal ring comprises a set of blind holes which are distributed about a periphery of the rigid seal ring.

10. The drill tool of claim 1 wherein the cooling channel formed in the another non-sealing surface of the rigid seal ring comprises a serration or scallop.

11. The drill tool of claim 1 wherein the another non-sealing surface of the rigid seal ring is oriented generally perpendicularly to the dynamic sealing surface.

12. The drill tool of claim 1 wherein the another non-sealing surface of the rigid seal ring is positioned on an opposite side of the rigid seal ring from the dynamic sealing surface.

13. The drill tool of claim 1 wherein the mechanical seal further comprises an energizer adapted to urge the rigid seal ring and dynamic sealing surface towards the cone.

14. The drill tool of claim 1 wherein the energizer is a seal ring having a static sealing surface with the bearing shaft.

15. The drill tool of claim 1 wherein the cooling channel formed in the another non-sealing surface of the rigid seal ring comprises at least one groove having a side wall oriented perpendicular to the non-sealing surface of the rigid seal ring.

16. The drill tool of claim 1 wherein the cooling channel formed in the another non-sealing surface of the rigid seal ring comprises at least one blind hole having a side wall oriented perpendicular to the non-sealing surface of the rigid seal ring.

17. The drill tool of claim 1 wherein the cooling channel formed in the another non-sealing surface of the rigid seal ring comprises at least one groove having a side wall oriented non-perpendicular to the non-sealing surface of the rigid seal ring.

18. The drill tool of claim 1 wherein the cooling channel formed in the another non-sealing surface of the rigid seal ring comprises at least one blind hole having a side wall oriented non-perpendicular to the non-sealing surface of the rigid seal ring.

19. The drill tool of claim 1 wherein the another non-sealing surface of the rigid seal ring defines an outer diameter of the rigid seal ring.

20. The drill tool of claim 1 wherein the cone further comprises a seal sleeve member press-fit within an aperture of the cone, the seal sleeve member having a seal surface in contact with the dynamic sealing surface of the rigid seal ring and further comprising an additional cooling channel formed in the seal surface of the seal sleeve member, the additional cooling channel having an open end in fluid communication with the aperture in the seal gland.

21. Apparatus, comprising:

a mechanical seal adapted to be positioned between a journal and a rotating member, the mechanical seal defining a dynamic seal and including a rigid seal ring having a dynamic sealing surface and a non-sealing surface, and further including at least one cooling channel formed in the non-sealing surface of the rigid seal ring.

22. The apparatus of claim 21 wherein the non-sealing surface of the rigid seal ring is oriented generally perpendicularly to the dynamic sealing surface.

23. The apparatus of claim 21 wherein the at least one cooling channel comprises at least one groove.

24. The apparatus of claim 23 wherein the at least one groove extends along the non-sealing surface around at least a portion of a periphery of the rigid seal ring.

25. The apparatus of claim 23 wherein the at least one groove has a side wall oriented perpendicular to the non-sealing surface.

26. The apparatus of claim 23 wherein the at least one groove has a side wall oriented non-perpendicular to the non-sealing surface.

27. The apparatus of claim 21 wherein the at least one cooling channel comprises at least one blind hole.

28. The apparatus of claim 27 wherein the at least one blind hole comprises a set of blind holes which are distributed along the non-sealing surface about a periphery of the rigid seal ring.

29. The apparatus of claim 27 wherein the at least one blind hole has a side wall oriented perpendicular to the non-sealing surface.

30. The apparatus of claim 27 wherein the at least one blind hole has a side wall oriented non-perpendicular to the non-sealing surface.

31. The apparatus of claim 21 wherein the non-sealing surface of the rigid seal ring defines an outer diameter of the rigid seal ring.

32. The apparatus of claim 21 wherein the non-sealing surface of the rigid seal ring is positioned on an opposite side of the rigid seal ring from the dynamic sealing surface.

33. The apparatus of claim 21 further comprising a seal gland within which the mechanical seal is positioned, the at least one cooling channel formed in the non-sealing surface of the rigid seal ring being in fluid communication with an annular aperture defined by the seal gland.

34. The apparatus of claim 21 wherein the journal is a bearing shaft of a drill bit and the rotating member is a rotating cutter installed on the bearing shaft.

35. The apparatus of claim 21 wherein the at least one cooling channel comprises a serration or scallop.

36. The apparatus of claim 21 wherein the mechanical seal further includes a seal sleeve member, the seal sleeve member having a seal surface in contact with the dynamic sealing surface of the rigid seal ring and further comprising an additional cooling channel formed in the seal surface of the seal sleeve member.

CLAIMS

1. A drill tool, comprising:

a bit body;

at least one bearing shaft extending from the bit body;

a cone mounted for rotation on the bearing shaft; and

a mechanical seal disposed between the bearing shaft and the cone in a seal gland, the mechanical seal including a metal seal ring with a full metal body having a metal dynamic sealing surface in sliding contact with a metal surface associated with the cone and a metal non-sealing surface exposed to an aperture in the seal gland, the mechanical seal further including at least one cooling channel formed in the metal non-sealing surface and extending into the metal body of the metal seal ring, the cooling channel having an open end in fluid communication with the aperture in the seal gland.

2. The drill tool of claim 1 wherein the metal non-sealing surface is exposed to drill cooling fluid during operation of the drill tool.

3. The drill tool of claim 2 wherein the drill cooling fluid is drilling mud.

4. The drill tool of claim 2 wherein the aperture in the seal gland fills with drill cooling fluid during operation of the drill tool.

5. The drill tool of claim 1 wherein the metal dynamic sealing surface is a metal seal face in sliding contact with another metal seal face presented by the metal surface associated with said cone.

6. The drill tool of claim 1 wherein the cooling channel formed in the metal non-sealing surface of the metal seal ring comprises at least one groove which does not permit fluid passage completely through the metal seal ring.

7. The drill tool of claim 1 wherein the cooling channel formed in the non-sealing surface of the metal seal ring comprises at least one blind hole which does not permit fluid passage completely through the metal seal ring.

8. The drill tool of claim 1 wherein the cooling channel formed in the metal non-sealing surface of the metal seal ring comprises a groove which extends at least partially around a periphery of the metal seal ring and which does not permit fluid passage completely through the metal seal ring.

9. The drill tool of claim 1 wherein the cooling channel formed in the metal non-sealing surface of the metal seal ring comprises a set of blind holes which are distributed about a periphery of the metal seal ring and which do not permit fluid passage completely through the metal seal ring.

10. The drill tool of claim 1 wherein the cooling channel formed in the non-sealing surface of the metal seal ring comprises a serration or scallop.

11. The drill tool of claim 1 wherein the non-sealing surface of the metal seal ring is oriented generally perpendicularly to the metal dynamic sealing surface.

12. The drill tool of claim 1 wherein the metal non-sealing surface of the metal seal ring is positioned on an opposite side of the metal seal ring from the metal dynamic sealing surface.

13. The drill tool of claim 1 wherein the mechanical seal further comprises an energizer adapted to urge the metal seal ring and metal dynamic sealing surface towards the cone.

14. The drill tool of claim 13 wherein the energizer is a seal ring having a static sealing surface with the bearing shaft.

15. The drill tool of claim 1 wherein the cooling channel formed in the metal non-sealing surface of the metal seal ring comprises at least one groove having a side wall oriented perpendicular to the metal non-sealing surface of the metal seal ring and wherein the at least one groove does not pass completely through the metal seal ring.

16. The drill tool of claim 1 wherein the cooling channel formed in the metal non-sealing surface of the metal seal ring comprises at least one blind hole having a side wall oriented

perpendicular to the non-sealing surface of the metal seal ring and wherein the at least one blind hole does not pass completely through the metal seal ring.

17. The drill tool of claim 1 wherein the cooling channel formed in the metal non-sealing surface of the metal seal ring comprises at least one groove having a side wall oriented non-perpendicular to the non-sealing surface of the metal seal ring and wherein the at least one groove does not pass completely through the metal seal ring.

18. The drill tool of claim 1 wherein the cooling channel formed in the metal non-sealing surface of the metal seal ring comprises at least one blind hole having a side wall oriented non-perpendicular to the non-sealing surface of the metal seal ring and wherein the at least one blind hole does not pass completely through the metal seal ring.

19. The drill tool of claim 1 wherein the metal non-sealing surface of the metal seal ring defines an outer diameter of the metal seal ring.

20. The drill tool of claim 1 wherein the cone further comprises a metal seal sleeve member press-fit within an aperture of the cone, the seal sleeve member having a metal seal surface in sliding contact with the metal dynamic sealing surface of the metal seal ring and further comprising an additional cooling channel formed in the metal seal sleeve member, the additional cooling channel having an open end in fluid communication with the aperture in the seal gland.