CLAIMS

1. An earth-boring tool, comprising:

a body;

a rotating member disposed over a protrusion from the body and configured to rotate relative to the body;

a bearing assembly disposed within a cavity of the rotating member, the bearing assembly comprising:

an annular-shaped inner bearing race member coupled with the protrusion;

an annular-shaped outer bearing race member coupled with the rotating member; and

at least one roller disposed between the inner bearing race member and the outer bearing race member, the at least one roller contacting each of the inner bearing race member and the outer bearing race member;

a bearing retainer affixed within the cavity of the rotating member and configured to retain the bearing assembly within the cavity of the rotating member; and

a seal assembly comprising:

an annular sealing element rotationally coupled with the bearing retainer and defining a first sealing surface;

a second sealing surface defined by the inner bearing race member; and

an energizing element disposed between the bearing retainer and the annular sealing element and creating a sealing engagement between the first sealing surface of the annular sealing element and the second sealing surface of the inner bearing race member.

2. The earth-boring tool of claim 1, wherein the bearing retainer comprises a flange, and wherein the annular sealing element is retained between the flange of the bearing retainer and the second sealing surface of the inner bearing race member when the bearing retainer is installed in the cavity of the rotating member.

3. The earth-boring tool of claim 2, wherein the energizing element is disposed radially outward from a portion of the sealing element and radially inward from a portion of the

bearing retainer with respect to a rotational axis about which the rotating member rotates with respect to the body protrusion.

4. The earth-boring tool of claim 3, wherein the energizing element is compressed between a portion of the annular sealing element and a portion of the bearing retainer such that the energizing element exhibits a compressive strain when the bearing retainer is installed in the cavity of the rotating member.

5. The earth-boring tool of claim 4, wherein the energizing element produces a biasing force urging the first sealing surface of the annular sealing element into sealing engagement with the second sealing surface of the inner bearing race member when the energizing element is compressed between the bearing retainer and the annular sealing element.

6. The earth-boring tool of claim 2, further comprising a secondary annular seal element disposed between the flange of the bearing retainer and a portion of the annular sealing element opposite the first sealing surface.

7. The earth-boring tool of claim 6, wherein a portion of the annular sealing element opposite the first sealing surface abuts the secondary seal element.

8. The earth-boring tool of claim 1, wherein the annular sealing element and the energizing element are integral.

9. The earth-boring tool of claim 8, wherein the annular sealing element and the energizing element are formed from a metal alloy.

10. The earth-boring tool of claim 9, wherein elastic deformation of the energizing element produces a biasing force maintaining the first sealing surface of the annular sealing element in sealing engagement with the second sealing surface of the inner bearing race member when the bearing retainer is affixed within the cavity of the rotating member.

11. The earth-boring tool of claim 8, wherein the annular sealing element and energizing element are integral with the bearing retainer.

12. The earth-boring tool of claim 1, wherein at least one of the first sealing surface and the second sealing surface comprise a wear-resistant coating.

13. The earth-boring tool of claim 1, further comprising a plurality of rollers disposed between and contacting the inner bearing race member and the outer bearing race member.

14. The earth-boring tool of claim 1, wherein the earth-boring tool comprises a drill bit, the protrusion comprises a shaft protruding from a leg of the bit body, and the rotating member comprises a roller-cone carrying cutting elements.

15. A drill bit, comprising:

a bit body;

at least one cone rotatably coupled to the bit body and configured to rotate relative to the bit body;

a bearing assembly disposed within the at least one cone and between the at least one cone and the bit body, the bearing assembly comprising:

an annular-shaped inner bearing race member coupled with the protrusion;

an annular-shaped outer bearing race member coupled with the rotating member; and

at least one roller disposed between the inner bearing race member and the outer bearing race member, the at least one roller contacting each of the inner bearing race member and the outer bearing race member;

a bearing retainer affixed within the at least one cone and configured to retain the bearing assembly within the at least one cone;

an annular sealing element disposed at least partially within the at least one rotating cone and defining a first sealing surface;

a second sealing surface defined by the bearing assembly and facing generally radially outward from an axis of rotation of the bit body; and

an energizing element disposed between the bearing retainer and the annular sealing element and creating a sealing engagement between the first sealing surface of the annular sealing element and the second sealing surface of the bearing assembly.

16. A method of assembling a drill bit, the method comprising:

inserting a bearing assembly within a cavity of a roller cone, the bearing assembly comprising:

an annular-shaped inner bearing race member coupled with the protrusion;

an annular-shaped outer bearing race member coupled with the rotating member; and

at least one roller disposed between the inner bearing race member and the outer bearing race member, the at least one roller contacting each of the inner bearing race member and the outer bearing race member;

affixing a bearing retainer within the cavity of the roller cone;

disposing a seal assembly within the cavity of the roller cone; and

affixing the roller cone over a shaft protruding from a body of one of a roller-cone drill bit and a hybrid drill bit, comprising:

rotationally coupling an annular sealing element of the sealing assembly to the bearing retainer, the annular sealing element defining a first sealing surface;

disposing an energizing element between the bearing retainer and the annular sealing element to create a sealing engagement between the first sealing surface of the annular sealing element and a second sealing surface of the inner bearing race member of the bearing assembly.

17. The method of claim 16, further comprising compressing the energizing element between the bearing retainer and the second sealing surface of the inner bearing race member of the bearing assembly such that the energizing element exhibits a compressive strain.

18. The method of claim 16, further comprising elastically deforming the energizing element comprising a metal alloy.

19. The earth-boring tool of claim 1, wherein the bearing retainer extends between and contacts both of the rotating member and the protrusion.

20. The earth-boring tool of claim 1, wherein the energizing element is disposed radially outward from the annular sealing element.