CLAIMS

1. A metal seal ring having a longitudinal axis and an axis of symmetry that is normal to said longitudinal axis, comprising:

a flange, said axis of symmetry extending though said flange;

a sealing front side surface comprised of a plurality of first sealing areas and a plurality of second sealing areas, each of said second sealing areas being located between said flange and one of said first sealing areas; and

a non-sealing back side surface, said non-sealing back side surface comprising:

a plurality of spaced-apart protrusions, each of which has a radially innermost surface that is located at a first radial distance from said longitudinal axis and a first axial distance from said axis of symmetry; and

a plurality of recesses, each of which is located between one of said protrusions and said axis of symmetry, each recess having a radially outermost surface that is located at a second radial distance from said longitudinal axis and a second axial distance from said axis of symmetry, wherein said second radial distance is greater than said first radial distance and said second axial distance is less than said first axial distance.

2. The metal seal ring of claim 1, wherein said non-sealing back side surface further comprises an inner surface that is positioned between said plurality of recesses, at least a portion of said inner surface being located a third radial distance from said longitudinal axis, wherein said third radial distance is less than said second radial distance and greater than said first radial distance.

3. The metal seal ring of claim 2, wherein said at least a portion of said inner surface is located on said axis of symmetry.

4. The metal seal ring of claim 2, wherein said inner surface is a cylindrical surface.

5. The metal seal ring of claim 4, wherein a first of said plurality of recesses is positioned between a first edge of said inner surface and a first one of said protrusions, and a second of said plurality of recesses is positioned between a second edge of said inner surface and a second one of said protrusions.

6. The metal seal ring of claim 1, wherein said first and second sealing areas are convex radiused surfaces.

7. The metal seal ring of claim 1, wherein said first and second sealing areas are separated by a recess containing a material that is softer than a metal material of said first and second sealing areas, wherein said softer material is one of a metal or an elastomer.

8. The metal seal ring of claim 1, further comprising a plurality of notches that extend into said sealing front side surface, each of said notches being located between said flange and one of said second sealing areas.

9. The metal seal ring of claim 8, wherein each of said notches comprises a bottom cylindrical surface.

10. The metal seal ring of claim 1, wherein a ratio of said second axial distance to said first axial distance falls within a range of about 0.38-0.63, and a ratio of said second radial distance to said first radial distance falls within a range of about 0.79-1.32.

11. A metal seal ring having a longitudinal axis and an axis of symmetry that is normal to said longitudinal axis, comprising:

a flange, said axis of symmetry extending though said flange;

a plurality of sealing members extending from said flange, each of said sealing members comprising a sealing front side surface comprised of a plurality of first sealing areas and a plurality of second sealing areas, each of said second sealing areas being located between said flange and one of said first sealing areas, each of said sealing members, when viewed in a cross-section that includes said longitudinal axis of said seal ring, having an axial length from said flange as measured in a direction parallel to said longitudinal axis and a centroid that is located at a centroid axial distance from said flange as measured in a direction parallel to said longitudinal axis, wherein said centroid axial distance is greater than one-third of said axial length of said sealing member; and

a non-sealing back side surface.

12. A metal seal ring having a longitudinal axis and an axis of symmetry that is normal to said longitudinal axis, comprising:

a flange, said axis of symmetry extending though said flange;

a plurality of sealing members extending from said flange, each of said sealing members comprising a sealing front side surface comprised of a plurality of first sealing areas and a plurality of second sealing areas, each of said second sealing areas being located between said flange and one of said first sealing areas, each of said sealing members, when viewed in a cross-section that includes said longitudinal axis of said seal ring, comprising:

a plurality of spaced-apart protrusions, each of which has a radially innermost surface that is located at a first axial distance from said axis of symmetry as measured in a direction parallel to said longitudinal axis; and

a centroid, wherein a center of said centroid is located a centroid axial distance from said axis of symmetry, as measured in a direction parallel to said longitudinal axis, wherein said first axial distance is greater than or equal to said centroid axial distance; and

a non-sealing back side surface.

13. The metal seal ring of claim 12, wherein said seal ring further comprises a recess that is located between said protrusion and said axis of symmetry, said recess having a radially outermost surface that is located at a first radial distance from said longitudinal axis and said center of said centroid is positioned at a centroid radial distance from said longitudinal axis, and wherein said first radial distance is greater than or equal to said centroid radial distance.

14. The metal seal ring of claim 12, wherein said radially innermost surface is located at a first radial distance from said longitudinal axis and said center of said centroid is positioned at a centroid radial distance from said longitudinal axis, and wherein said centroid radial distance is greater than said first radial distance.

15. A metal seal ring having a longitudinal axis and an axis of symmetry that is normal to said longitudinal axis, comprising:

a flange, said axis of symmetry extending though said flange; and

a plurality of sealing members extending from said flange, each of said sealing members comprising:

a sealing front side surface comprising a first sealing area and a second sealing area, wherein said second sealing area is located between said flange and said first sealing area; and

a non-sealing back side surface, said non-sealing back side surface comprising:

a protrusion which has a radially innermost surface and a first radial thickness as measured from said radially innermost surface to said sealing front side surface along a line that is parallel to said axis of symmetry; and

a recess that is located between said protrusion and said axis of symmetry, said recess having a radially outermost surface and a second radial thickness as measured from said radially outermost surface to said sealing front side surface along a line that is parallel to said axis of

symmetry, wherein said second radial thickness is less than said first radial thickness.

16. The metal seal ring of claim 15, wherein said second radial thickness is less than one-half of said first radial thickness.

17. A metal seal ring having a longitudinal axis and an axis of symmetry that is normal to said longitudinal axis, comprising:

a flange, said axis of symmetry extending though said flange;

a sealing front side surface comprised of a plurality of first sealing areas and a plurality of second sealing areas, each of said second sealing areas being located between said flange and one of said first sealing areas; and

a non-sealing back side surface, said non-sealing back side surface comprising:

a plurality of spaced-apart protrusions, each of which has a radially innermost surface that is located at a first radial distance from said longitudinal axis and a first axial distance from said axis of symmetry; and

a plurality of recesses, each of which is located between one of said protrusions and said axis of symmetry, each recess having a radially outermost surface that is located at a second radial distance from said longitudinal axis and a second axial distance from said axis of symmetry, wherein a ratio of said second axial distance to said first axial distance falls within a range of about 0.38-0.63, and a ratio of said second radial distance to said first radial distance falls within a range of about 0.79-1.32.

18. The metal seal ring of claim 17, wherein said non-sealing back side surface further comprises a cylindrical inner surface that is positioned between said plurality of recesses and wherein each of said plurality of recesses is positioned between said cylindrical inner surface and one of said protrusions.

19. The metal seal ring of claim 17, wherein said first and second sealing surfaces are convex radiused surfaces.

20. The metal seal ring claim of 17, wherein said first and second sealing surfaces are separated by a recess containing a material that is softer than a metal material of said first and second sealing areas, wherein said softer material is one of a metal or an elastomer.

21. The metal seal ring of claim 17, further comprising a plurality of notches that extend into said sealing front side surface, each of said notches being located between said flange and one of said second sealing surfaces.