We claim:

1. An implantable prosthetic device, comprising:

a frame that is radially expandable and compressible between a radially compressed configuration and a radially expanded configuration, the frame comprising

a first set of a plurality of struts extending in a first direction, and

a second set of a plurality of struts extending in a second direction;

wherein each strut of the first set of struts is pivotably connected to at least one strut of the second set of struts;

wherein each strut is curved helically with respect to a first, longitudinal axis of the frame; and

wherein each strut is curved with respect to a second axis that is perpendicular to the first, longitudinal axis of the frame.

2. The implantable prosthetic device of claim 1, wherein each strut is concave with respect to an outflow end of the frame.

3. The implantable prosthetic device of claim 1, wherein each strut is convex with respect to an outflow end of the frame.

4. The implantable prosthetic device of claims 1-3, wherein when the frame is in a radially expanded configuration the frame tapers from a first diameter at a first location on the frame to a second diameter at a second location on the frame axially spaced from the first location, the first diameter being greater than the second diameter.

5. The implantable prosthetic device of claims 1-4, wherein each strut comprises a plurality of segments between locations where struts are pivotally connected to each other and wherein each segment is curved with respect to the second axis such that the strut is curved along a length of the strut.

6. The implantable prosthetic device of claims 1-4, wherein each strut comprises a plurality of segments between locations where struts are pivotally connected to each other

and each segment is offset from each adjacent segment such that the strut is curved along a length of the strut.

7. The implantable prosthetic device of claims 1-6, wherein each strut extends from a first end of the frame to an axially opposed second end of the frame.

8. The implantable prosthetic device of claims 1-7, further comprising a valve assembly comprising a plurality of leaflets mounted inside the frame.

9. An implantable prosthetic device, comprising:

a frame having first and second opposing axial ends, the frame comprising:

a first set of a plurality of struts extending in a first direction, and

a second set of a plurality of struts extending in a second direction,

wherein each strut is curved along a length of the strut and has first and second longitudinal edges extending along the length, the first longitudinal edge forming a convex curve facing the first end of the frame and the second longitudinal edge forming a concave curve facing the second end of the frame.

10. The implantable prosthetic device of claim 9, wherein each strut extends from the first end of the frame to the second end.

11. The implantable prosthetic device of claim 9 or 10, wherein a projection of each strut in a plane parallel to a longitudinal axis of the frame is curved.

12. The implantable prosthetic device of any of claims 9-11, wherein the frame has a first diameter at the first end and a second diameter at the second end.

13. The implantable prosthetic device of claim 12, wherein when the frame is in a radially expanded configuration the second diameter is larger than the first diameter.

14. The implantable prosthetic device of claim 13, wherein when the frame is in a radially compressed configuration the second diameter is smaller than the first diameter.

15. An implantable prosthetic device, comprising:

a frame movable between a radially compressed configuration and a radially expanded configuration;

wherein in the radially expanded configuration the frame has a tapered frustoconical shape; and

wherein the frame has a first draft angle when in the radially compressed configuration and a second draft angle when in the radially expanded configuration.

16. The implantable prosthetic device of claim 15, wherein the first draft angle is less than the second draft angle.

17. The implantable prosthetic device of claim 15, wherein the first draft angle is greater than the second draft angle.

18. An implantable prosthetic device, comprising:

a frame having first and second opposing axial ends, the frame comprising:

a first set of a plurality of struts extending in a first direction, and

a second set of a plurality of struts extending in a second direction,

wherein each strut comprises a non-Euclidian geometry.

19. The implantable prosthetic device of claim 18, wherein each strut comprises an elliptic geometry.

20. The implantable prosthetic device of claim 18, wherein each strut comprises a hyperbolic geometry.

21. An implantable prosthetic device, comprising:

a frame having first and second opposing axial ends, the frame comprising:

a first set of a plurality of struts extending in a first direction, and

a second set of a plurality of struts extending in a second direction,

wherein each strut of the first plurality of struts is pivotably coupled to one or more struts of the second plurality of struts, and

wherein each strut is plastically and elastically deformable when radially compressed such that the frame is at least partially self-expandable without permanent plastic deformation.

22. A medical device assembly comprising:

a radially expandable and compressible prosthetic valve; and

a delivery apparatus comprising:

a plurality of connecting members having distal end portions releasably coupled to the prosthetic valve; and

a tension member connecting to the plurality of connecting members such that when the prosthetic valve is in a radially expanded state, tensioning the tension member pulls the connecting members radially inwardly and causes the prosthetic valve to compress from the radially expanded state to a radially compressed state.

23. The assembly of claim 22, wherein the tension member forms a loop around the connecting members.

24. The assembly of any of claims 22-23, wherein the delivery apparatus further comprises a tension member actuator having a distal end portion coupled to the tension member and a proximal end portion coupled to a handle of the delivery apparatus, wherein applying a proximal directed force to the tension member actuator is effective to tension the tension member, which in turn applies a radially directed force to the connecting members to radially compress the prosthetic valve.

25. The assembly of any of claims 22-24, wherein each connecting member comprises a retaining member and the tension member extends through each retaining member.

26. The assembly of claim 25, wherein the retaining members comprise eyelets.

27. The assembly of claim 24, wherein the tension member is connected to the distal end portion of the tension member actuator at a location radially offset inwardly toward a longitudinally axis of the delivery apparatus.

28. The assembly of any of claims 24 or 27, wherein the delivery apparatus further comprises a sheath extending coaxially over the tension member actuator.

29. The assembly of any of claims 22-28, wherein the prosthetic valve comprises a frame and a plurality of actuators mounted to the frame and being operable to radially expand the prosthetic valve to the radially expanded state and the delivery apparatus comprises a plurality of actuator assemblies releasably connected to the actuators of the prosthetic valve and the connecting members are components of the actuator assemblies.

30. The assembly of claim 29, wherein the actuator assemblies comprise actuator members releasably connected to the actuators of the prosthetic valve and the connecting members comprise support tubes extending over the actuator members.

31. The assembly of any of claims 22-30, wherein the prosthetic valve has a tapered shape in a partially compressed state having a first diameter at a distal end and a second diameter at a proximal end, the second diameter being greater than the first diameter, and the tension member, when tensioned, compresses the prosthetic valve from the partially compressed state to a further compressed state in which the prosthetic valve is less tapered than in the partially compressed state.

32. The assembly of claim31, wherein the prosthetic valve is substantially cylindrical in the further compressed state.

33. An implantable prosthetic device, comprising:

a frame that is radially expandable and compressible between a radially compressed configuration and a radially expanded configuration, the frame comprising

a first set of a plurality of struts extending in a first direction, and

a second set of a plurality of struts extending in a second direction;

wherein each strut of the first set of struts is pivotably connected to at least one strut of the second set of struts;

wherein each strut is curved helically with respect to a longitudinal axis of the frame; and

wherein each strut is concave with respect to a line extending through an inflow end and an outflow end of the frame and crossing the longitudinal axis at an arbitrary angle.

34. A delivery assembly, comprising:

a prosthetic valve movable between a radially expanded configuration and a radially compressed configuration;

a delivery apparatus comprising:

a handle,

a plurality of actuators extending distally from the handle and configured to releasably couple the prosthetic valve and to move the prosthetic valve between the radially expanded and compressed configurations; and

a crimping mechanism extending distally from the handle of the delivery apparatus, the crimping mechanism comprising:

a tension member actuator defining an inner lumen,

a tension member extending through the inner lumen and having a loop portion configured to be placed around the prosthetic valve; and

wherein relative movement between the tension member actuator and the tension member in a longitudinal direction is effective to tighten the loop portion around the prosthetic valve, thereby radially compressing the prosthetic valve.

35. The delivery assembly of claim 34, further comprising a sheath extending distally from the handle over the plurality of actuators and the crimping mechanism, wherein the crimping mechanism has a first retracted position relative to the sheath and a second exposed position relative to the sheath.

36. The delivery assembly of claim 34 or 35, wherein the loop portion self-expands when advanced from the tension member actuator.

37. The delivery assembly of claim 36, wherein the loop portion comprises a closed loop.

38. The delivery assembly of claim 36, wherein the loop portion comprises an open loop.

39. The delivery assembly of any of claims 34-38, wherein the tension member comprises a wire.

40. A delivery assembly, comprising:

a prosthetic valve movable between a radially compressed configuration and a radially expanded configuration;

a delivery apparatus, comprising:

a handle,

a shaft having a proximal end portion and a distal end portion, the shaft extending distally from the handle, and

a plurality of actuators coupled to the prosthetic valve and configured to move the prosthetic valve between the compressed and expanded configurations;

a nose piece coupled to the distal end portion of the shaft; and

a capsule coupled to the nose piece, the capsule configured to extend over at least a distal end portion of a prosthetic heart valve in the compressed configuration when the prosthetic heart valve is mounted around the shaft;

wherein the capsule is configured to slide distally off of the distal end portion of the prosthetic heart valve when the prosthetic valve moves from the compressed configuration to the expanded configuration.

41. The delivery assembly of claim 40, wherein the capsule comprises a fabric.

42. The delivery assembly of claim 40, wherein the capsule comprises a non-textile polymer membrane.

43. The delivery assembly of any of claims 40-42, wherein the prosthetic valve has a non-cylindrical shape when in the radially compressed configuration and when in the radially expanded configuration.

44. The delivery assembly of any of claims 40-43, wherein the capsule is configured to extend over less than half the length of the radially compressed prosthetic valve.

45. A crimping mechanism, comprising:

a support tube configured to be coupled to a prosthetic valve, the support tube defining a lumen;

a connector disposed within the lumen of the support tube;

a tension member coupled to the connector and configured to extend around a circumference of the prosthetic valve;

a tension member actuator configured to be releasably coupled the connector; and

wherein applying a proximally directed force to the tension member actuator is effective to tension the tension member, which in turn is configured to apply a radially directed force to a frame of the prosthetic valve to radially compress the prosthetic valve.

46. The mechanism of claim 45, wherein the connector comprises a coupling portion, and wherein the tension member actuator comprises a receiving portion configured to be releasably coupled to the coupling portion.

47. The mechanism of claim 46, wherein the coupling portion comprises threads, and the receiving portion comprises corresponding threads.

48. The mechanism of any of claims 45-47, wherein the tension member comprises a wire.

49. The mechanism of any of claims 45-48, further comprising a sheath extending at least partially over the tension member actuator, the sheath having a distal end portion configured to abut a proximal end portion of the support tube.

50. A medical device assembly, comprising:

a radially expandable and compressible prosthetic valve having a frame;

a delivery apparatus comprising:

a handle,

a plurality of actuators extending distally from the handle and configured to be releasably coupled to the prosthetic valve and to move the prosthetic valve between the radially expanded and compressed configurations; and

a crimping mechanism comprising:

a support tube coupled to the prosthetic valve, the support tube defining a lumen,

a connector comprising a coupling portion, the connector disposed within the lumen of the support tube,

a tension member coupled to the connector and extending around a circumference of the prosthetic valve,

a tension member actuator extending from the handle of the delivery apparatus and configured to be releasably coupled to the connector; and

wherein applying a proximally directed force to the tension member actuator is effective to tension the tension member, which is turn applies a radially directed force to the frame of the prosthetic valve to fully compress the prosthetic valve.

51. The assembly of claim 50, wherein the tension member comprises a wire.

52. The assembly of claim 50 or 51, wherein the prosthetic valve has a tapered shape in a partially expanded state having a first diameter at a distal end and a second diameter at a proximal end, the second diameter being greater than the first diameter, and wherein the prosthetic valve in in the fully compressed state is less tapered than in the partially expanded state after tensioning the tension member.

53. The assembly of clam 52, wherein the prosthetic valve is substantially cylindrical in the fully compressed state.

54. The assembly of any of claims 50-53, wherein the support tube is mounted to one of the actuators.

55. The assembly of any of claims 50-54, wherein the tension member comprises a loop that extends around the circumference of the prosthetic valve and through an opening of the connector.

56. The assembly of any of claims 50-55, wherein the tension member comprises a suture.

57. The assembly of any of claims 50-56, wherein the prosthetic valve comprises a sleeve on the outside of the frame and the tension member extends through the sleeve.

58. The assembly of any of claims 50-57, further comprising a sheath extending at least partially over the tension member actuator, the sheath having a distal end portion configured to abut a proximal end portion of the support tube.

59. An implantable prosthetic device, comprising:

a frame that is radially expandable and compressible between a radially compressed configuration and a radially expanded configuration, the frame comprising

a first set of a plurality of struts extending in a first direction, and

a second set of a plurality of struts extending in a second direction,

wherein each strut of the first and second sets of struts comprises a plurality of segments including an inflow segment, an outflow segment, and one or more central segments having a first length;

wherein the outflow segment of each strut of the first set of struts is pivotably connected to the outflow segment of at least one strut of the second set of struts to form a plurality of outflow crowns;

wherein the inflow segment of each strut of the first set of struts is pivotably connected to the inflow segment of at least one strut of the second set of struts to form a plurality of inflow crowns; and

wherein the plurality of outflow or inflow crowns comprise at least one crown comprising outflow or inflow segments having a length less than or greater than the first length.

60. The implantable prosthetic device of claim 59, wherein each crown of the plurality of outflow crowns or inflow crowns comprises outflow or inflow segments having a length less than or greater than the first length.

61. The implantable prosthetic device of claim 59, wherein alternating crowns of the plurality of outflow crowns or inflow crowns comprise outflow or inflow segments having a length less than or greater than the first length

62. The implantable prosthetic device of any of claims 59-61, wherein when the frame is in the radially compressed configuration, an inflow end portion of the frame curves radially inward.

63. The implantable prosthetic device of any of claims 59-62, wherein when the frame is in the radially expanded configuration, an inflow end portion of the frame flares radially outward.

64. An implantable prosthetic device, comprising:

a frame that is radially expandable and compressible between a radially compressed configuration and a radially expanded configuration, the frame having an inflow end portion and an outflow end portion and comprising a plurality of struts;

wherein each strut comprises a plurality of segments including an inflow segment, an outflow segment, and one or more central segments; and

wherein the outflow segments have a first width and the inflow segments have a second width less than the first width such that when the frame is in the radially compressed configuration the inflow end portion has a first diameter smaller than a second diameter of the outflow end portion.