

CLAIMS:

1. — A prosthetic heart valve, comprising:
an annular frame comprising a plurality of angled strut members, the frame being radially collapsible to a collapsed configuration and radially expandable to an expanded configuration, the frame having an inflow end and an outflow end;
a leaflet structure positioned at least partially within the frame, the leaflet structure comprising a plurality of leaflets arranged to form a plurality of commissures; and
a plurality of commissure support elements, each commissure support element being positioned at one of the commissures, each of the commissure support elements comprising a coupling portion coupled to the frame and first and second members coupled to the coupling portion and extending in a direction toward the inflow end of the frame or toward the outflow end of the frame, the leaflets of each commissure being received between the first and second members of the respective commissure support element.

2. — The prosthetic heart valve of claim 1, wherein the coupling portion comprises an annular collar portion.

3. — The prosthetic heart valve of claim 2, further comprising a plurality of axially extending posts coupled to an inner surface of the frame and wherein the collar portion of the commissure support element at each commissure is disposed around the post at the commissure.

4. — The prosthetic heart valve of claim 3, wherein the first and second members are coupled together distally of the collar portion and define a leaflet receiving space through which leaflets are received.

5. — The prosthetic heart valve of claim 4, wherein the first and second members are coupled together radially inwardly of the post.

6. — The prosthetic heart valve of claim 5, wherein:
the first and second members are spaced radially inwardly from the post; and

~~leaflets of the commissures are sutured to the first and second members of the respective commissure support elements in a space between the post and the first and second members.~~

~~7. — The prosthetic heart valve of claim 5 or claim 6, wherein the first and second members are coupled to the collar portion by curved members that curve in a direction of the outflow end of the frame.~~

~~8. — The prosthetic heart valve of any of claims 5-7, wherein the collar portion comprises at least one protrusion configured to engage a corresponding recess in the post.~~

~~9. — The prosthetic heart valve of any of claims 5-8, wherein each of the first and second members comprise at least one opening.~~

~~10. — The prosthetic heart valve of any of claims 5-9, wherein the posts comprise recesses configured to receive the collar portions of the commissure support elements.~~

~~11. — The prosthetic heart valve of any preceding claim, wherein the coupling portion is rectangular.~~

~~12. — The prosthetic heart valve of claim 4, wherein:
the collar portion is a first collar portion; and
the first and second members are coupled together radially outwardly of the post to form a second collar portion longitudinally spaced apart from the first collar portion.~~

~~13. — The prosthetic heart valve of claim 12, wherein the first and second members of each commissure support element are clamping members rotatable away from the post to receive a leaflet.~~

~~14. — The prosthetic heart valve of claim 12 or claim 13, wherein the posts comprise grooves configured to receive the first and second collar portions of the commissure support elements.~~

~~15.—The prosthetic heart valve of any of claims 12-14, wherein the first and second collar portions are angled toward each other.~~

~~16.—The prosthetic heart valve of any of claims 12-15, wherein each leaflet is folded to form a cuff that is circumferentially offset from the respective clamping member that clamps the leaflet against the frame.~~

~~17.—The prosthetic heart valve of claim 16, wherein the cuff of each leaflet is configured to contact the frame to prevent rotation of the leaflet about the respective clamping member by which it is clamped against the frame during operation of the prosthetic heart valve.~~

~~18.—The prosthetic heart valve of claim 16 or claim 17, wherein the cuffs comprise folded edges oriented radially inward toward a center of the prosthetic heart valve.~~

~~19.—The prosthetic heart valve of any of claims 12-17, wherein the first and second collar portions of the commissure support element have a shape that conforms to a shape of the posts.~~

~~20.—The prosthetic heart valve of claim 1, wherein the coupling portion comprises a first coupling member and a second coupling member configured to engage the frame.~~

~~21.—The prosthetic heart valve of claim 20, further comprising a plurality of axially extending posts coupled to an inner surface of the frame and wherein the first coupling member and the second coupling member are received in the post at the commissure.~~

~~22.—The prosthetic heart valve of claim 21, wherein the post defines channels configured to receive the first coupling member and the second coupling member.~~

~~23.—The prosthetic heart valve of claim 21 or claim 22, wherein the first and second members extend in a direction toward the outflow end of the frame.~~

~~24. — The prosthetic heart valve of any of claims 21-23, wherein the first and second coupling members comprise projections configured to engage the post.~~

~~25. — The prosthetic heart valve of any of claims 1-24, wherein the first member comprises a clasp configured to engage a clasp of the second member.~~

~~26. — The prosthetic heart valve of any of claims 1-25, further comprising suture extending between the first and second members to clamp the leaflets between the first and second members.~~

~~27. — The prosthetic heart valve of any of claims 1-26, wherein the first and second members of the commissure support elements each comprise flexible tab portions resiliently engaging the leaflets at each respective commissure.~~

~~28. — The prosthetic heart valve of any of claims 1-27, wherein the first and second members of the commissure support elements comprise projections that engage the leaflets of the respective commissure.~~

~~29. — The prosthetic heart valve of any of claims 3-19 and 21, wherein:
the frame is a mechanically expandable frame and the posts comprise components of actuators configured to radially expand and collapse the frame; and
the collar portion of the commissure support element at each commissure is disposed around the actuator component at the commissure.~~

130. A prosthetic heart valve, comprising:

an annular frame including a plurality of angled strut members, the frame being radially collapsible to a collapsed configuration and radially expandable to an expanded configuration;

a leaflet structure positioned at least partially within the frame, the leaflet structure comprising a plurality of leaflets arranged to form a plurality of commissures; and

a plurality of commissure clamps, each commissure clamp being positioned at one of the commissures, each of the commissure clamps comprising a wire form member curved to

form a first collar portion and a second collar portion, the first and second collar portions being spaced apart from each other along a longitudinal axis of the prosthetic heart valve and interconnected by first and second clamping members formed by the wire form member and extending between the first and second collar portions;

wherein at each respective commissure, one leaflet of the commissure is clamped against the frame by the first clamping member, and the other leaflet of the commissure is clamped against the frame by the second clamping member.

231. The prosthetic heart valve of claim 130, further comprising a plurality of axially extending posts coupled to an inner surface of the frame and wherein the first and second collar portions of the commissure clamp at each commissure are disposed around the post at the commissure.

32. The prosthetic heart valve of claim 231, wherein:
the frame is a mechanically expandable frame and the posts comprise components of actuators configured to radially expand and compress the frame; and
the first and second collar portions of the commissure clamp at each commissure are disposed around the actuator component at the commissure.

433. The prosthetic heart valve of any of claims 1 to 330-32, wherein the first and second clamping members of each commissure clamp are rotatable away from the actuator component to receive a leaflet.

534. The prosthetic heart valve of any of claims 2 to 431-33, wherein the posts comprise grooves configured to receive the first and second collar portions of the commissure clamps.

635. The prosthetic heart valve of any of claims 1 to 530-34, wherein the first and second collar portions are angled toward each other.

736. The prosthetic heart valve of any of claims 1 to 630-35, wherein each leaflet is folded to form a cuff that is circumferentially offset from the respective clamping member that clamps the leaflet against the frame.

837. The prosthetic heart valve of claim 736, wherein the cuff of each leaflet is configured to contact the frame to prevent rotation of the leaflet about the respective clamping member by which it is clamped against the frame during operation of the prosthetic heart valve.

938. The prosthetic heart valve of claim 736 or claim 837, wherein the cuffs comprise folded edges oriented radially inward toward a center of the prosthetic heart valve.

1039. The prosthetic heart valve of any of claims 231, 332 and 534, wherein the collar portions of the commissure clamps have a shape that conforms to a shape of the posts.

~~40. A prosthetic heart valve, comprising:~~

~~an annular mechanically expandable frame comprising a plurality of angled strut members, the frame comprising a plurality of actuator components configured to radially collapse the frame to a collapsed configuration and radially expand the frame to an expanded configuration, the frame having an inflow end and an outflow end;~~

~~a leaflet structure positioned at least partially within the frame, the leaflet structure comprising a plurality of leaflets arranged to form a plurality of commissures; and~~

~~a plurality of commissure support elements, each commissure support element being positioned at one of the commissures, each of the commissure support elements comprising a coupling portion coupled to an actuator of the frame and first and second members coupled to the coupling portion and extending in a direction along the longitudinal axis of the frame, the leaflets of each commissure being received between the first and second members of the respective commissure support element;~~

~~wherein the first and second members are spaced apart along at least a portion of their length and define a leaflet receiving space through which leaflets are received; and~~

~~wherein the first and second members are coupled together at a location spaced apart from the collar portion in a direction toward the inflow end of the frame or toward the outflow end of the frame.~~

~~41. — The prosthetic heart valve of claim 40, wherein the first and second members are coupled together radially inwardly of the actuator.~~

~~42. — The prosthetic heart valve of claim 40, wherein:
the coupling portion is a first coupling portion; and
the first and second members are coupled together radially outwardly of the post to form a second collar portion longitudinally spaced apart from the first collar portion.~~