

CLAIMS:

1. A suture lock assembly for a delivery system for an implantable medical device, comprising:

a spool configured to receive a suture and including a gear;
a rotatable handle coupled to the spool and configured to rotate the spool and gear;
a pawl configured to engage with teeth of the gear and allow rotation of the gear, spool, and handle in only one direction; and
a directional selector coupled to the pawl and movable between two positions, each of the two positions corresponding to a different direction of rotation of the gear, the directional selector configured to pivot the pawl to adjust an orientation of the pawl relative to the gear and adjust a direction of rotation of the gear.

2. The suture lock assembly of claim 1, wherein the pawl is pivotable between a first orientation which allows rotation of the gear in only a first direction and a second orientation which allows rotation of the gear in only an opposite, second direction.

3. The suture lock assembly of claim 2, wherein the first direction is counterclockwise and the second direction is clockwise.

4. The suture lock assembly of any of claims 2 and 3, wherein the pawl is held in the first orientation and the second orientation by a spring plunger engaged with the pawl at a back side of the pawl and wherein in the first orientation the pawl is arranged on a first side of the spring plunger and in the second orientation the pawl is arranged on a second side of the spring plunger.

5. The suture lock assembly of claim 4, wherein the pawl includes two teeth spaced apart from one another and arranged on a front side of the pawl and wherein the two teeth of the pawl are configured to engage with teeth of the gear.

6. The suture lock assembly of any of the preceding claims, further comprising hard stops arranged within a housing of the suture lock assembly, the gear and pawl arranged within the housing, and wherein the pawl is configured to interface with one of the hard stops

when the gear is rotated in a direction that is opposite a selected direction of rotation set by the directional selector.

7. The suture lock assembly of any of the preceding claims, further comprising a housing including a top housing and a bottom housing coupled to one another, the gear and pawl arranged within a space arranged between the top housing and bottom housing and the rotatable handle and the directional selector extending outward from the top housing, wherein the top housing includes a first icon indicating a slack position of the directional selector and a second icon indicating a tension position of the directional selector, and wherein the directional selector is movable between a first of the two position that points toward the first icon and a second of the two positions that points toward the second icon.

8. The suture lock assembly of any of the preceding claims, further comprising a release bar including a suture cutting location arranged at a distal end of the release bar, the release bar configured to receive a suture through an interior of the release bar and across the suture cutting location, the suture extending from the spool.

9. The suture lock assembly of claim 8, wherein the release bar includes one or more supporting ribs arranged on a center portion of the release bar, the center portion arranged between the distal end and proximal end of the release bar.

10. The suture lock assembly of any of claims 8 and 9, wherein distal end of the release bar is shaped to form a first keyed connection with an adaptor of the delivery system and a proximal end of the release bar is shaped to form a second keyed connection with a bottom housing of the suture lock assembly, wherein the spool is arranged within an interior of the bottom housing.

11. The suture lock assembly of claim 10, further comprising a flushing port coupled to the bottom housing and extending outward from the bottom housing in an opposite direction from a direction which the release bar extends from the bottom housing.

12. The suture lock assembly of any of claims 8-11, further comprising a plurality of annular sealing elements, including a first annular sealing element arranged around a distal end portion of the release bar, proximate to the suture cutting location, and a second annular

sealing element arranged around a proximal end portion of the release bar, the second annular sealing element arranged between, in a radial direction, the release bar and a bottom housing of the suture lock assembly, wherein the spool is arranged within the bottom housing.

13. The suture lock assembly of claim 12, wherein the plurality of annular sealing elements further includes a third annular sealing element arranged around a portion of the spool and arranged between the portion of the spool and the bottom housing.

14. The suture lock assembly of any of claims 8-13, wherein a proximal end of the release bar is bonded to a bottom housing of the suture lock assembly.

15. The suture lock assembly of any of claims 8-14, wherein the release bar includes a divider arranged within the suture cutting location, wherein the divider is configured to separate two lines of a suture extending longitudinally through the release bar and expose only one line of the two lines of the suture to an exterior of the suture lock assembly at the suture cutting location.

16. The suture lock assembly of any of the preceding claims, wherein the spool includes a gap in a flange arranged around a bottom of the spool and wherein the rotatable handle includes an indicator on its outer surface configured to track a number of turns applied to the spool and locate the gap.

17. The suture lock assembly of claim 16, wherein the gap is arranged adjacent to one or more apertures arranged within the spool, the one or more apertures configured to route the suture from inside the spool to an exterior surface of the spool that is configured to receive the suture thereon.

18. The suture lock assembly of any of the preceding claims, wherein the rotatable handle is coupled to the spool via a central screw extending longitudinally through the rotatable handle and the spool, further comprising one or more friction pads arranged around the central screw, adjacent to the central portion of the spool, and a friction nut coupled to the central screw, below a lower friction pad of the one or more friction pads, and wherein the one or more friction pads are configured to increase friction on the central screw

to stop rotation of the central screw and the rotatable handle when a tension in the suture increases above a predetermined threshold.

19. The suture lock assembly of any of claims 1-17, further comprising a pin-based clutch system including a spring plunger extending longitudinally through and coupled to a portion of the rotatable handle, the spring plunger including an end extending into the gear and configured to extend into and mate with a plurality of detents arranged in an outer-facing surface of the gear to allow rotation of the gear by the rotatable handle, and wherein the spring plunger is configured to slip out of the detents in response to a tension in the suture above a predetermined threshold.

~~20. — A delivery system for delivering a docking device to a native valve annulus of a patient's heart, comprising:~~

~~an outer shaft;~~

~~a sleeve shaft at least partially arranged within the outer shaft, the sleeve shaft comprising:~~

~~a distal section configured to cover the docking device, the distal section comprising a flexible material with a lubricous outer surface; and~~

~~a proximal section comprising a rigid material and including a tubular portion and a cut portion, the cut portion having an open, u-shaped cross-section; and~~

~~a pusher shaft at least partially arranged within the outer shaft, the pusher shaft comprising:~~

~~a main tube arranged interior to, in a radial direction that is relative to a central longitudinal axis of the delivery system, the sleeve shaft;~~

~~an annular shell surrounding a proximal end portion of the main tube and spaced away from, in the radial direction, an outer surface of the main tube; and~~

~~a proximal extension connected to and extending proximally from a proximal end of the main tube, proximal to the shell, the proximal extension comprising a flexible material and extending along a portion of an inner surface of the cut portion of the proximal section of the sleeve shaft.~~

~~— 21. — The delivery system of claim 20, wherein the pusher shaft further comprises an annular plug arranged within the annular shell, at a proximal end of the shell, and surrounding the main shaft, wherein the plug includes a crescent-shaped portion extending~~

across and filling a first portion of an annular space arranged between the main tube and the shell.

~~22. The delivery system of claim 21, wherein the annular space includes a second portion that is open and not filled by the plug, wherein the proximal section of the sleeve shaft is configured to slide within the annular space, and wherein the cut portion of the proximal section is configured to slide through the second portion of the annular space.~~

~~23. The delivery system of claim 22, wherein the tubular portion of the proximal section has an end surface at an interface between the tubular portion and the cut portion, the end surface arranged normal to the central longitudinal axis, and wherein the plug is configured to interface with the end surface of the proximal section and stop the sleeve shaft from traveling further in the proximal, axial direction.~~

~~24. The delivery system of any of claims 20-23, wherein the sleeve shaft further includes a middle section arranged between the distal section and the proximal section of the sleeve shaft, the middle section forming a transition between the flexible material of the distal section and the rigid material of the proximal section.~~

~~25. The delivery system of claim 24, wherein the sleeve shaft further includes a flexible polymer jacket forming an outer surface of the distal section and the middle section, the flexible polymer jacket comprising the flexible material, an inner liner forming an inner surface of each of the distal section and the middle section, and a rigid tube including a first section forming an entirety of the proximal section and a second section forming a proximal portion of the middle section.~~

~~26. The delivery system of claim 25, wherein the rigid tube is a metal tube, wherein the second section includes a plurality of apertures arranged around a circumference of the rigid tube, along the second section, and wherein the rigid tube is coupled to the inner liner and the flexible polymer jacket via a bonding connection between the inner liner and the flexible polymer jacket, through the plurality of apertures.~~

~~27. The delivery system of any of any of claims 20-26, further comprising a handle assembly include a handle portion and a hub assembly extending proximally from a~~

proximal end of the handle portion, wherein the outer shaft extends distally from a distal end of the handle portion, and wherein the hub assembly includes an adaptor with a straight section coupled to a suture lock assembly and a branch section coupled to sleeve actuating handle.

—28.— The delivery system of claim 27, wherein the suture lock assembly is the suture lock assembly of any of claims 1-19.

—29.— The delivery system of any of claims 27 and 28, wherein the proximal extension of the pusher shaft extends into and through a portion of the branch section of the adaptor.

—30.— The delivery system of claim 29, further comprising a first flushing port coupled to the branch section of the adaptor and fluidly coupled with an inner lumen of the proximal extension of the pusher shaft.

—31.— The delivery system of claim 30, further comprising a second flushing port coupled to the branch section, distal to the first flushing port, and fluidly coupled with a lumen formed between an outer surface of the proximal extension and an inner surface of the branch section.

—32.— The delivery system of claim 29, further comprising a first flushing port coupled to a proximal end of the suture lock assembly and fluidly coupled with an inner lumen of the proximal extension of the pusher shaft and a second flushing port coupled to the branch section, distal to the first flushing port, and fluidly coupled with a lumen formed between an outer surface of the proximal extension and an inner surface of the branch section.

—33.— The delivery system of any of claims 27-32, wherein the cut portion of the sleeve shaft extends into the straight section of the adaptor and is coupled to the sleeve actuating handle.

—34.— The delivery system of any of claims 20-33, wherein the pusher shaft and the sleeve shaft are coaxial with one another, along the central longitudinal axis of the delivery

system, and wherein each of the sleeve shaft and the pusher shaft are configured to slide axially along the central longitudinal axis, relative to the outer shaft.

~~35. The delivery system of any of any of claims 20-34, wherein a distal section of the main tube of the pusher shaft includes a plurality of cuts therein, spaced apart from one another along a length of the distal section, wherein the plurality of cuts are configured to increase a flexibility of the distal section of the main tube.~~

~~36. The delivery system of claim 35, wherein a spacing between adjacent cuts of the plurality of cuts varies along the length of the distal section and wherein the spacing between adjacent cuts increases from a distal end to a proximal end of the distal section.~~

~~37. A delivery system for delivering a docking device to a native valve annulus of a patient's heart, comprising:~~

~~a handle portion;~~

~~an outer shaft extending distally from a distal end of the handle portion;~~

~~a sleeve shaft extending through an interior of the outer shaft and configured to cover the docking device;~~

~~a pusher shaft including a main tube extending through an interior of the sleeve shaft;~~

~~and~~

~~a hub assembly extending proximally from a proximal end of the handle portion, the hub assembly comprising:~~

~~an adaptor coupled to the handle portion and including a first section and a second section that branches off from the first section, wherein a portion of the pusher shaft extends into the second section and a proximal section of the sleeve shaft extends through the first section;~~

~~a suture lock assembly coupled to a proximal end of the second section and configured to adjust tension in a suture extending from the suture lock assembly, through the pusher shaft, to the docking device;~~

~~a first flushing port coupled to the second section and fluidly coupled to a first fluid flow lumen arranged within an interior of the pusher shaft and to a second fluid flow lumen arranged between the sleeve shaft and the docking device; and~~

~~a second flushing port coupled to the second section and fluidly coupled to a third fluid flow lumen arranged between the outer shaft and the sleeve shaft.~~

~~38. The delivery system of claim 37, further comprising a sleeve actuating handle arranged at a proximal end of the first section and coupled to an end of the proximal section of the sleeve shaft, the sleeve actuating handle configured to adjust an axial position of the sleeve shaft relative to the outer shaft.~~

~~39. The handle assembly of any of claims 37 and 38, wherein the first fluid flow lumen extends through an interior of a proximal extension of the pusher shaft and an interior of the main tube of the pusher shaft, the main tube coupled to the proximal extension and extending through an interior of the outer shaft and the proximal extension extending through a portion of the outer shaft and into the second section.~~

~~40. The handle assembly of claim 39, wherein the first fluid flow lumen extends to a distal end of the pusher shaft, the distal end arranged adjacent to but spaced away from a proximal end of the docking device when the docking device is arranged within the outer shaft.~~

~~41. The handle assembly of any of claims 39 and 40, wherein the second flushing port is fluidly coupled to the third fluid flow lumen via an annular cavity arranged between a shell of the pusher shaft and the main tube of the pusher shaft, and a fourth fluid flow lumen formed between an outer surface of the proximal extension and an inner surface of the second section, the fourth fluid flow lumen fluidly coupled to the annular cavity.~~

~~42. The handle assembly of claim 41, wherein third fluid flow lumen is arranged between an inner surface of the outer shaft and a distal portion of the sleeve shaft, the distal portion configured to cover the docking device while the docking device is arranged inside the outer shaft and being implanted at the native valve annulus.~~

~~43. The handle assembly of any of claims 41 and 42, further comprising a third flushing port coupled to the handle portion and fluidly coupled to the annular cavity.~~

~~44. The handle assembly of any of claims 37-43, further comprising a gasket arranged within and across a diameter of the second section, between where the first flushing port is coupled to the second section and where the second flushing port is coupled to the~~

~~second section, wherein the gasket is configured to fluidly separate the first fluid flow lumen and the third fluid flow lumen from one another.~~

~~45. The handle assembly of any of claims 37-44, wherein the first flushing port and the second flushing port are connected to a single fluid source.~~

~~46. The handle assembly of claim 45, wherein the single fluid source is an infusion pump and wherein the infusion pump is coupled to the first flushing port and the second flushing port via a y-connector.~~

~~47. The handle assembly of any of claims 37-44, wherein the first flushing port and the second flushing port are connected to different fluid sources.~~

~~48. The handle assembly of any of claims 37-47, wherein the first flushing port is directly coupled to the second section of the adaptor, distal to the suture lock assembly and proximal to the second flushing port.~~

~~49. The handle assembly of any of claims 37-47, wherein the first flushing port is part of the suture lock assembly and arranged at a proximal end of the suture lock assembly.~~

~~50. The handle assembly of any of claims 37-49, further comprising a hemostatic seal arranged within the first section of the adaptor, proximate to the sleeve actuating handle, wherein the hemostatic seal includes an opening surrounding a cut portion of the sleeve shaft that extends through the first section, to the sleeve actuating handle, the hemostatic seal configured to seal around the cut portion of the sleeve shaft.~~

~~51. The handle assembly of claim 50, further comprising a locking cap assembly arranged on the first section, around the hemostatic seal, the locking cap assembly configured to apply inward pressure on the hemostatic seal and lock axial translation of the sleeve shaft relative to a remainder of the hub assembly.~~

~~52. The handle assembly of any of claims 37-51, wherein the suture lock assembly is the suture lock assembly of any of claims 1-19.~~

~~53. — The handle assembly of any of claims 37-52, wherein the pusher shaft is configured to deploy the docking device from inside a distal end portion of the outer shaft upon reaching the native valve annulus and wherein a distal end of the sleeve shaft is spaced away from a distal end of the outer shaft, within the outer shaft, while the docking device is arranged within the outer shaft during navigating the delivery system to the native valve annulus.~~

~~54. — The handle assembly of any of claims 37-53, wherein the docking device is configured to receive and secure a prosthetic heart valve at the native valve annulus.~~

~~55. — A method of delivering a docking device to a native valve of a heart, comprising:~~

~~deploying the docking device from a distal end of a delivery system, the docking device covered by a distal section of a sleeve shaft of the delivery system, the docking device comprising a coil extending along a central axis and including a central region including a plurality of turns, a leading turn extending from a first end of the central region, and a stabilization turn extending from an opposite, second end of the central region, wherein a covering extends around and along a top turn of the central region, the top turn arranged at the second end of the central region;~~

~~positioning the covered docking device at the native valve, such that the covering of the top turn of the central region crosses and plugs a medial commissure of the native valve, at least a portion of the leading turn is positioned in a ventricle of the heart, and at least a portion of the stabilization turn is positioned in an atrium of the heart; and~~

~~after positioning the covered docking device, retracting the sleeve shaft, in a proximal direction, to uncover the docking device.~~

~~56. — The method of claim 55, wherein the delivery system is the delivery system of any of claims 20-51, and wherein deploying the docking device from the distal end of the delivery system includes pushing the covered docking device outside of the outer shaft of the delivery system with the pusher shaft of the delivery system.~~

~~57. — The method of claim 56, wherein the delivery system is the delivery system of claim 36 and wherein retracting the sleeve shaft to uncover the docking device includes moving the sleeve actuating handle in the proximal direction.~~

~~58.—The method of any of claims 56 and 57, further comprising maintaining a position of the pusher shaft while retracting the sleeve shaft to uncover the docking device and, after uncovering the docking device, retracting the pusher shaft back into the outer shaft of the delivery system.~~

~~59.—The method of any of claims 56–58, further comprising, during deploying the covered docking device and positioning the covered docking device at the native valve, flushing a plurality of lumens of the delivery system including a first lumen arranged between the distal section of the sleeve shaft and the docking device and a second lumen arranged between an outer shaft of the delivery system and the sleeve shaft.~~

~~60.—The method of claim 59, wherein flushing the first lumen includes providing flush fluid to a pusher shaft lumen extending through the pusher shaft from a proximal end of the pusher shaft arranged within a branch section of a hub assembly, wherein a suture lock is coupled to the branch section, to a distal end of the pusher shaft, the distal end arranged proximate to, but spaced away from, a proximal end of the docking device and flowing the flush fluid through the pusher shaft lumen and into and through the first lumen.~~

~~61.—The method of claim 60, wherein the flush fluid is provided to the pusher shaft lumen via a flush port coupled to the branch section, distal to the suture lock.~~

~~62.—The method of claim 60, wherein the flush fluid is provided to the pusher shaft lumen via a flush port that is part of the suture lock and arranged at a proximal end of the suture lock.~~

~~63.—The method of any of claims 59–62, wherein flushing the second lumen includes providing flush fluid to a first cavity formed between an outer surface of the pusher shaft and an inner surface of a conduit of the branch section, flowing the flush fluid from the first cavity into a second cavity formed between a shell of the pusher shaft and a main tube of the pusher shaft, and flowing the flush fluid from the second cavity to the second lumen.~~

~~64.—The method of any of claims 55–63, further comprising, during the deploying and positioning of the covered docking device, arranging a distal tip of the distal section of~~

~~the sleeve shaft to extend a distance past, in the distal direction, a distal end of the docking device.~~

~~65.—The method of any of claims 55–64, further comprising deploying a prosthetic heart valve within the central region of the docking device.~~

~~66.—A method for providing flush fluid to a delivery system configured to deliver a docking device to a native valve of a heart, comprising:~~

~~flowing flush fluid through an inner, pusher shaft lumen extending through an interior of a pusher shaft of the delivery system to a distal end of the pusher shaft, wherein the pusher shaft is arranged coaxial with and at least partially within a sleeve shaft of the delivery system, the sleeve shaft and pusher shaft arranged within an outer shaft of the delivery system that extends distally from a handle assembly of the delivery system, the sleeve shaft include a distal section that surrounds and covers the docking device within the outer shaft;~~

~~flowing flush fluid from the pusher shaft lumen into a sleeve shaft lumen formed between an outer surface of the docking device and an inner surface of the distal section of the sleeve shaft; and~~

~~flowing flush fluid through a delivery shaft lumen formed between an outer surface of the sleeve shaft and an inner surface of the outer shaft.~~

~~67.—The method of claim 66, wherein flowing flush fluid through the pusher shaft lumen and into the sleeve shaft lumen and flowing fluid through the delivery shaft lumen includes flowing flush fluid continuously, from a common fluid source to the pusher shaft lumen, the sleeve shaft lumen, and the delivery shaft lumen.~~

~~68.—The method of claim 66, wherein flowing flush fluid through the pusher shaft lumen and into the sleeve shaft lumen and flowing fluid through the delivery shaft lumen includes flowing flush fluid continuously from a first fluid source to the pusher shaft lumen and the sleeve shaft lumen and flowing flush fluid continuously from a separate, second fluid source to the delivery shaft lumen.~~

~~69.—The method of any of claims 66–68, wherein the flowing flush fluid through the pusher shaft lumen and into the sleeve shaft lumen and flowing fluid through the delivery shaft lumen occurs during advancing a distal end portion of the delivery system, including the~~

docking device arranged therein, to the native valve and positioning the docking device, while covered by the sleeve shaft, at the native valve.

70. — The method of any of claims 66-69, wherein flowing flush fluid through the pusher shaft lumen and into the sleeve shaft lumen and flowing fluid through the delivery shaft lumen occurs during preparing the delivery device for an implantation procedure, prior to inserting the delivery device into a patient.

71. — The method of any of claims 66-70, wherein flowing the flush fluid through the delivery shaft lumen includes flowing flush fluid from a first flushing port coupled to a conduit of a hub assembly of the delivery system to a first cavity formed between an outer surface of the pusher shaft and an inner surface of the conduit, flowing flush fluid from the first cavity into a second cavity arranged between an inner surface of a shell of the pusher shaft and an outer surface of a main tube of the pusher shaft, and flowing flush fluid from the second cavity to the delivery shaft lumen.

72. — The method of claim 71, wherein flowing the flush fluid through the delivery shaft lumen includes flowing flush fluid from a first flushing port coupled to the conduit and in direct fluid communication with the first cavity, into the first cavity.

73. — The method of claim 72, wherein flowing the flush fluid through the pusher shaft lumen and into the sleeve shaft lumen includes flowing the flush fluid from a second flushing port coupled to the conduit, proximal to where the first flushing port is coupled to the conduit, and in direct fluid communication with the pusher shaft lumen, into the pusher shaft lumen.

74. — The method of claim 73, further comprising maintaining the flush fluid flow from the first flushing port into the first cavity separate from the flush fluid flow from the second flushing port into the pusher shaft lumen.

75. — A docking device for docking a prosthetic valve at a native heart valve, the docking device comprising:

a coil extending along a central axis, including a leading turn, a central region, and a stabilization turn, wherein:

~~the central region possesses a plurality of turns having substantially equal inner diameters;~~
~~the leading turn extends from one end of the central region and has a diameter greater than the diameter of the central region, and~~
~~the stabilization turn has a diameter greater diameter than the diameter of the central region and extends from the opposing end of the central region from the leading turn.~~

~~76. — The docking device of claim 75, wherein the stabilization turn is designed to create three points of contact in a native anatomy.~~

~~77. — The docking device of any of claims 75-76, wherein the stabilization turn is designed to sit lower in free space than the central region thus lifting the central region.~~

~~78. — The docking device of claim 75, wherein the stabilization turn has a diameter larger than an opening of a native mitral valve but smaller enough to rest on the mitral plane.~~

~~79. — The docking device of claim 75, wherein the stabilization turn is configured to create a ring around a deployed prosthetic valve.~~

~~80. — The docking device of any of claims 75-79, wherein the central region possesses at least three full turns.~~

~~81. — The docking device of any of claims 75-80, wherein the stabilization turn possesses a covering to form a seal against a prosthetic valve.~~

~~82. — The docking device of any of claims 75-80, wherein a top turn of the central region, the top turn arranged at the end of the central region from which the stabilization turn extends, includes a covering.~~

~~83. — The docking device of claim 81 or claim 82, wherein the covering is a foam.~~

~~84.—The docking device of claim 83, wherein the foam is selected from the group consisting of: polyethylene terephthalate, polyurethane, and polyurethane polycarbonate matrix.~~

~~85.—The docking device of claim 81 or claim 82, wherein the covering is a braided structure.~~

~~86.—The docking device of claim 85, wherein the braided structure is a shape memory material selected from the group consisting of: shape memory alloy, shape memory metal, and nitinol.~~

~~87.—The docking device of any of claims 81-86, wherein the covering possesses pores sized to be atraumatic to native tissues and allow tissue ingrowth into the covering.~~

~~88.—The docking device of any of claims 75-87, wherein the docking device further comprises a soft covering over the entire length of the coil to reduce friction and maintain retention forces for a prosthetic valve.~~

~~89.—The docking device of claim 88, wherein the soft covering comprises a plurality of layers of ePTFE bonded together.~~

~~90.—The docking device of claim 89, wherein the bonding is intermittent to increase gumminess of the soft covering.~~

~~91.—The docking device of any of claims 75-79 and 81-90, wherein the central region comprises at least 3 turns, including a proximal turn, a distal turn, and at least 1 intermediate turn, wherein the proximal turn is the turn nearest the stabilization turn and the distal turn is the turn nearest the leading turn, and wherein the central region forms a generally hourglass structure, where the distal turn and the proximal turn have a greater diameter than the at least 1 intermediate turn.~~

~~92.—The docking device of any of claims 1-90, wherein the central region comprises at least 3 turns, including a proximal turn, a distal turn, and at least 1 intermediate turn, wherein the proximal turn is the turn nearest the stabilization turn and the distal turn is the turn nearest~~

~~the leading turn, and wherein the central region forms a generally barrel structure, where the at least 1 intermediate turn has a greater diameter than the distal turn and the proximal turn.~~

~~93.—The docking device of any of claims 1-92, wherein the docking device includes a flange created by linking the stabilization turn to the next adjacent turn in the central region using cloth.~~

~~94.—The docking device of any of claims 1-93, wherein the coil incorporates a radiopaque marker.~~

~~95.—The docking device of claim 94, wherein the radiopaque marker is located at one quarter turn around the leading turn.~~

~~96.—An implantable prosthetic heart valve comprising:
an annular frame comprising an inflow end and an outflow end and being radially collapsible and expandable between a radially collapsed configuration and a radially expanded configuration, the frame defining an axial direction extending from the inflow end to the outflow end;
a leaflet structure positioned within the frame and secured thereto; and
a flange attached to the inflow end of the annular frame and designed to extend outwardly therefrom.~~

~~97.—The implantable prosthetic heart valve of claim 96, wherein the flange is constructed of a memory material.~~

~~98.—The implantable prosthetic heart valve of any of claims 96-97, wherein the flange is made of nitinol.~~

~~99.—The implantable prosthetic heart valve of any of claims 96-98, wherein the flange is attached to the annular frame with a cloth intermediary.~~

~~100.—The implantable prosthetic heart valve of any of claims 96-99 further comprising a skirt attached to an outer surface of the annular frame.~~

~~101.—The implantable prosthetic heart valve of claim 100, wherein the skirt is constructed of at least one of foam and cloth.~~

~~102.—The implantable prosthetic heart valve of claim 101, wherein the foam is selected from at least one of the group consisting of polyethylene terephthalate, polyurethane, and polyurethane-polycarbonate matrix.~~

~~103.—The implantable prosthetic heart valve of any of claims 100-102, wherein the skirt is expandable.~~

~~104.—The implantable prosthetic heart valve of any of claims 100-102, wherein the skirt comprises both cloth and foam.~~

~~105.—The implantable prosthetic heart valve of any of claims 100, 101, and 103, wherein the skirt is formed of cloth having a plurality of floats.~~

~~106.—The implantable prosthetic heart valve of claim 105, wherein the plurality of floats are separated by a plurality of bands.~~

~~107.—The implantable prosthetic heart valve of claim 106, wherein the plurality of bands are formed as a leno weave.~~

~~108.—The implantable prosthetic heart valve of any of claims 100-107, wherein the annular frame includes a memory material incorporated with or located under the skirt to aid in expansion of the skirt.~~

~~109.—The implantable prosthetic heart valve of any of claims 100-108, wherein the skirt possesses a larger diameter near the inflow end of the prosthetic valve than near the outflow end of the prosthetic valve.~~

~~110.—The implantable prosthetic heart valve of any of claims 100-109, wherein the skirt possesses a pocket for the placement of an embolic material.~~

~~111.—The implantable prosthetic heart valve of claim 110, wherein the pocket possesses a pore to allow for insertion of the embolic material.~~

~~112.—The implantable prosthetic heart valve of any of claims 110-111, wherein the pocket possesses a permeable or semipermeable covering to allow for the exchange of fluids between the embolic material and native blood.~~

~~113.—The implantable prosthetic heart valve of any of claims 110-112, wherein the embolic material is selected from a hydrogel, an ethylene vinyl alcohol dissolved in dimethyl sulfoxide, and an *n*-butyl cyanoacrylate.~~

~~114.—A system for implanting a docking device at a native valve, comprising:
a delivery catheter;
a docking device of any of claims 75-95, the docking device having an end portion at the end of the stabilization turn located opposite the central region;
a pusher shaft disposed in the delivery catheter and including a distal end arranged proximate to the end portion of the docking device; and
a sleeve shaft coaxially located with the pusher shaft and disposed between the delivery catheter and the pusher shaft;
wherein the system is configured such that the pusher shaft and sleeve shaft to operate in parallel.~~

~~115.—The system of claim 114, wherein the sleeve shaft comprises a distal section, a middle section, and a proximal section, wherein the distal section forms a lubricous sleeve covering the docking device, and the proximal section is used to actuate the position of the lubricous sleeve.~~

~~116.—The system of claim 115, wherein the lubricous sleeve is a low friction material.~~

~~117.—The system of any of claims 114-116, wherein the lubricous sleeve possesses a hydrophilic coating.~~

~~118.—The system of any of claims 115-117, wherein the lubricous sleeve possesses a hydrogel coating.~~

~~119.—The system of any of claims 115–118, wherein the proximal section is rigid and possesses a cut portion to allow access to the pusher shaft.~~

~~120.—The system of any of claims 115–119, wherein the distal section and the middle section are flexible and are each constructed of a polymer and braid structure.~~

~~121.—The system of claim 120, wherein the polymer is a polyether amide block copolymer or a blend of two or more polyether amide block copolymers.~~

~~122.—The system of any of claims 120–121, wherein the braid is stainless steel.~~

~~123.—The system of any of claims 119–122, wherein the distal section possesses a high density braid.~~

~~124.—The system of any of claims 119–123, wherein the middle section possesses a lower density braid than the distal section.~~

~~125.—The system of any of claims 114–124, wherein the pusher shaft comprises:
a main hypo tube having a distal end arranged proximate to the docking device and a proximal end opposite the distal end;~~

~~a shell;~~

~~a plug; and~~

~~a proximal extension;~~

~~wherein the shell runs coaxially to the main hypo tube and sleeve shaft, is welded to the proximal end of the main hypo tube using the plug, and is disposed between the catheter and the sleeve shaft; and~~

~~wherein the proximal extension extends from the proximal end of the main hypo tube.~~

~~126.—The system of claim 125, wherein the proximal extension is constructed of a flexible material.~~

~~127.—The system of any of claims 125-126, wherein the shell and the plug are welded to the main hypo tube and wherein the cut portion of the sleeve shaft is arranged and configured to slide within a cavity formed between the main hypo tube and the shell.~~

~~128.—The system of any of claims 114-127, further comprising a handle assembly.~~

~~129.—The system of claim 128, wherein the handle assembly comprises a general Y-shape connector.~~

~~130.—The system of claim 129, wherein the Y-shaped connector possesses a straight section and a branch, wherein the sleeve shaft extends to the end of the straight section, and the proximal extension extends to the end of the branch.~~

~~131. The system of any of claims 128-130, wherein the handle assembly further comprises a flushing port.~~

~~132.—The system of claim 131, wherein the flushing port is configured such that a plurality of lumens formed between the catheter, the sleeve shaft, and the pusher shaft are simultaneously flushable from a single port.~~

~~133.—The system of any of claims 130-132, wherein the handle assembly includes a hemostatic seal located in the straight section formed and possessing a first end located proximal to an opening in the shape of the sleeve shaft.~~

~~134.—The system of claim 133, wherein the sleeve shaft possesses a laser cut portion forming a general U shape structure, and the opening possesses a U shape.~~

~~135.—The system of any of claims 133-134, wherein the handle assembly further includes a first rigid washer located on one end of the hemostatic seal and a second rigid washer on the second end of the hemostatic seal.~~

~~136.—The system of claim 135, wherein the first and second rigid washers place inward pressure on the hemostatic seal to form a seal between the hemostatic seal and the sleeve shaft.~~

~~137.—The system of any of claims 135-136, wherein the handle assembly further comprises a locking cap assembly.~~

~~138.—The system of claim 137, wherein the locking cap assembly allows adjustment of inward pressure between the first and second rigid washers and the hemostatic seal to immobilize the sleeve shaft.~~

~~139.—The system of any of claims 114-138, further comprising a suture lock attached to the handle assembly.~~

~~140.—The system of any of claims 139, wherein the suture lock is a ratcheting suture lock~~

~~141.—The system of claim 140, wherein the ratcheting suture lock comprises a rotator to adjust tension on a suture.~~

~~142.—The system of claim 141, wherein the suture lock further comprises a directional selector.~~

~~143.—The system of claim 142, wherein the ratcheting mechanism comprises a gear with teeth attached to the rotator and a pawl with teeth attached to the directional selector, and a spring plunger, wherein the spring plunger holds the pawl in a selected direction, and wherein the teeth of the pawl interact with the teeth of the gear to allow unidirectional rotation of the gear.~~

~~144.—The system of claim 141, wherein the ratcheting mechanism comprises a central screw with a friction control nut and at least one friction pad, wherein the rotator is attached to the central screw, the friction control nut is attached to the central screw distal from the rotator, and the at least one friction pad is introduced on the central screw, where rotating the rotator too far in one direction increase friction on the central screw, such that further rotation of the rotator is prevented.~~

~~145.—The system of claim 141, wherein the ratcheting mechanism comprises a spring plunger and a gear comprising a plurality of detents, wherein the spring plunger transfers torque from the rotator and rests in a detent on the gear, where rotation of the rotator beyond a certain point causes retraction of the spring plunger and prevents additional rotation of the rotator.~~

~~146.—A method of delivering an implant to a native valve of a heart, the implant comprising a docking device of any of claims 75-95, the method comprising:~~

~~positioning the docking device at the native valve of the heart, such that at least a portion of the leading turn of the docking device is positioned in a ventricle of the heart and around one or more valve leaflets of the native valve.~~

~~147.—The method of claim 146, wherein:~~

~~the implant further comprises an implantable prosthetic heart valve of any of claims 96-113; and~~

~~the method further comprises:~~

~~positioning the implantable prosthetic heart valve in the radially collapsed configuration within the docking device; and~~

~~expanding the implantable prosthetic heart valve from the radially collapsed configuration to the radially expanded configuration, such that a radially outward pressure is applied by the frame of the implantable prosthetic heart valve on at least a portion of the central region of the docking device.~~

~~148.—The method of any of claims 146-147, wherein the positioning of the docking device is performed with a system of any of claims 114-145, wherein the positioning the docking device step comprises pushing the docking device out of the catheter with the pusher shaft.~~

~~149.—The method of claim 148, wherein the positioning the docking device step further comprises retracting the sleeve shaft after pushing the docking device out of the catheter with the pusher shaft.~~

~~150.—The method of claim 149, wherein:~~

~~the implant comprises a docking device of any of claims 83-87; and~~

~~the positioning the docking device step further comprises:~~

~~reinserting the sleeve shaft to push the covering into an expanded form; and
retracting the sleeve shaft.~~

~~151. The method of claim 150, wherein:~~

~~the covering is positioned on a top turn of the central region, the top turn arranged at
the end of the central region from which the stabilization turn extends; and
the positioning the docking device step further comprises:~~

~~positioning the docking device such that the covering extends from a first radial angular
location in the left ventricle, through the PC and into the left atrium, and to a second
radial angular location in the left atrium.~~

~~152. The method of claim 151, wherein the first radial angular location is at a point
representing a percentage of the circumferential distance from the PC to the AC of
about 10%, about 20%, about 30%, about 40%, about 50%, about 60%, about 70%,
about 80%, about 90%, or about 100%.~~

~~153. The method of any of claims 151-152, wherein the second radial angular location
is at a point representing a percentage of the circumferential distance from the PC
to the AC of about 10%, about 20%, about 30%, about 40%, about 50%, about 60%,
about 70%, about 80%, about 90%, or about 100%.~~

~~154. The method of any of claims 151-153, wherein the first radial angular location is
underneath the A2 region of the AL.~~

~~155. The method of any of claims 151-154, wherein the first radial angular location is
at about the AC.~~

~~156. The method of any of claims 151-155, wherein the second radial angular location
is at about the AC.~~

~~157. The method of any of claims 151-155, wherein the second radial angular location
is at about middle of P2 at about the point intersected by minor axis of the mitral
valve annulus.~~