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Inventor(s)	Lopes; Fernando et al.

Enhanced medical device for use in bodily cavities, for example an atrium

Abstract

Systems, methods, and devices allow intravascular or percutaneous mapping, orientation and/or ablation, in bodily cavities or lumens. A device includes elongate members, moveable between an unexpanded configuration and an expanded or fanned configuration. The elongate members form a stack in the unexpanded configuration to fit through a catheter sheath. The elongate members follow respective arcuate or curvilinear paths as advanced from the sheath into the bent or coiled stack configuration, adopting volute, scroll or rho shapes, and may be nested. The elongated members are fanned or radially spaced circumferentially with respect to one another into the expanded or fanned configuration. Transducer elements carried by elongate members sense various physiological characteristics of or proximate tissue, and/or may apply energy to or proximate tissue. The elongate members are rotatable in groups or as a group in the expanded configuration. The device is retractable.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of U.S. patent application Ser. No. 18/951,919, filed Nov. 19, 2024, which is a continuation of U.S. patent application Ser. No. 17/182,732, filed Feb. 23, 2021, now U.S. Pat. No. 12,178,490, issued Dec. 31, 2024, which is a continuation of U.S. patent application Ser. No. 15/299,640, filed Oct. 21, 2016, now U.S. Pat. No. 11,399,881, issued Aug. 2, 2022, which is a continuation of U.S. patent application Ser. No. 13/782,903, filed Mar. 1, 2013, now U.S. Pat. No. 9,492,228, issued Nov. 15, 2016, which is a continuation-in-part of International Application PCT/US2012/022061, filed Jan. 20, 2012, which claims the benefit of each of: (1) U.S. Provisional Application No. 61/515,141, filed Aug. 4, 2011, (2) U.S. Provisional Application No. 61/488,639, filed May 20, 2011, (3) U.S. Provisional Application No. 61/485,987, filed May 13, 2011, and (4) U.S. Provisional Application No. 61/435,213, filed Jan. 21, 2011, the entire disclosures of each of the applications identified in this cross-reference to related applications section are hereby incorporated herein by reference.

BACKGROUND
Technical Field
(1) This disclosure is generally related to surgery, and more particularly to intravascularly or percutaneously deployed medical devices suitable for determining locations of cardiac features or ablating regions of cardiac tissue, or both.
Description of the Related Art
(2) Cardiac surgery was initially undertaken using highly invasive open procedures. A sternotomy, which is a type of incision in the center of the chest that separates the sternum (chest bone) was typically employed to allow access to the heart. In the past several decades, more and more cardiac operations are performed using intravascular or percutaneous techniques, where access to inner organs or other tissue is gained via a catheter.
(3) Intravascular or percutaneous surgeries benefit patients by reducing surgery risk, complications and recovery time. However, the use of intravascular or percutaneous technologies also raises some particular challenges. Medical devices used in intravascular or percutaneous surgery need to be deployed via catheter systems which significantly increase the complexity of the device structure. As well, doctors do not have direct visual contact with the medical devices once the devices are positioned within the body. Positioning these devices correctly and operating the devices successfully can often be very challenging.
(4) One example of where percutaneous medical techniques have been employed is in the treatment of a heart disorder called atrial fibrillation. Atrial fibrillation is a disorder in which spurious electrical signals cause an irregular heartbeat. Atrial fibrillation has been treated with open heart methods using a technique known as the “Cox-Maze procedure.” During this procedure, physicians

create lesions in a specific pattern in the left and right atria which block various paths taken by the spurious electrical signals. Such lesions were originally created using incisions, but are now typically created by ablating the tissue with various techniques including radio frequency (RF) energy, microwave energy, laser energy and cryogenic techniques. The procedure is performed with a high success rate under the direct vision that is provided in open procedures, but is relatively complex to perform intravascularly or percutaneously because of the difficulty in creating the lesions in the correct locations. Various problems, potentially leading to severe adverse results, may occur if the lesions are placed incorrectly.
(5) Key factors which are needed to dramatically improve the intravascular or percutaneous treatment of atrial fibrillation are enhanced methods for deployment, positioning and operation of the treatment device. It is particularly important to know the position of the elements which will be creating the lesions relative to cardiac features such as the pulmonary veins and mitral valve. The continuity and transmurality characteristics of the lesion patterns that are formed can impact the ability to block paths taken within the heart by spurious electrical signals.
(6) Several methods have been previously developed for positioning intravascularly or percutaneously deployed medical devices within the heart. For example, commonly assigned U.S. Patent Application Publication 2009/0131930 A1, which is herein incorporated by reference in its entirety, describes a device that is percutaneously guided to a cavity of bodily organ (e.g., a heart). The device can discriminate between fluid within the cavity (e.g., blood) and tissue that forms an inner or interior surface of the cavity (i.e., surface tissue) to provide information or mapping indicative of a position or orientation, or both of the device in the cavity. Discrimination may be based on flow or some other characteristic, for example electrical permittivity or force. The device can selectively ablate portions of the surface tissue based on the information or the mapping. In some cases, the device may detect characteristics (e.g., electrical potentials) indicative of whether ablation was successful. The device includes a plurality of transducer elements that are percutaneously guided in an unexpanded configuration and positioned at least proximate the surface tissue in an expanded configuration. Various expansion mechanisms that include a helical member or an inflatable member are described.
(7) The desire to employ intravascular or percutaneous techniques that employ devices that can fit through catheter sheaths of ever smaller sizes (e.g., on the order of approximately 20-24 French in some cases, 18-20 French in other cases and 16-18 French or less in yet other cases) has increased. In some instances, devices deliverable via larger or smaller sized catheter sheets may be employed. Additional challenges therefore exist in creating a device that can assume an unexpanded configuration for passage through these smaller sheaths and yet, can also assume an expanded configuration suitable for positioning a portion of the device proximate to a tissue surface within the cavity.
(8) The treatment of atrial fibrillation is but one example of a cardiac surgery that requires improved configurable devices. There are many others that require similar improved devices, such as mitral valve repair.
(9) There is a need for enhanced methods and apparatus that allow a portion of a configurable device to assume a delivery or unexpanded configuration suitable for passage though a small bodily opening leading to a bodily cavity, and a deployed or expanded configuration suitable for positioning the portion of the device at least proximate to a tissue that forms an interior surface of the cavity.
(10) There is a need for enhanced methods and apparatus that allow a portion of a configurable device to assume a delivery or unexpanded configuration suitable for passage though a small bodily opening leading to a bodily cavity, and a deployed or expanded configuration suitable for positioning the portion of the device at least proximate to a tissue that forms an interior surface of the cavity, the enhanced methods and apparatus being further suitable for the determination of the relative position of anatomical features within the cavity such as pulmonary veins and a mitral

valve with respect to the configurable medical device.

(11) There is a further need for enhanced methods and apparatus that allow a portion of a configurable device to assume a delivery or unexpanded configuration suitable for passage though a small bodily opening leading to a bodily cavity, and a deployed or expanded configuration suitable for positioning the portion of the device at least proximate to a tissue that forms an interior tissue surface of the cavity, the enhanced methods and apparatus being further suitable for treatment of the interior tissue surface. Treatment may include the formation of lesions in a specified position relative to anatomical features within the cavity such as pulmonary veins and a mitral valve.

(12) There is a further need for enhanced methods and apparatus that allow a portion of a configurable device to assume a delivery or unexpanded configuration suitable for passage though a small bodily opening leading to a bodily cavity, and a deployed or expanded configuration suitable for positioning a plurality of transducer elements over a region extending across a majority of an interior tissue surface of the cavity. In particular, there is a need for enhanced methods and apparatus to arrange a plurality of transducer elements in a two- or three-dimensional grid or array capable of mapping, ablating, and or stimulating an inside surface of a bodily cavity or lumen without requiring mechanical scanning.

BRIEF SUMMARY

(13) The present design of a medical device with enhanced capabilities for deployment, positioning and ablating within a bodily cavity such as an intra-cardiac cavity is disclosed. In particular, the device is configurable from a first or unexpanded configuration in which a portion of the device is sized for delivery to a bodily cavity via a catheter sheath to a second or expanded configuration in which the portion of the device is expanded to position various transducer elements at least proximate a tissue surface within the bodily cavity. The device may employ a method for distinguishing tissue from blood and may be used to deliver positional information of the device relative to ports in the atrium, such as the pulmonary veins and mitral valve. The device may employ characteristics such as blood flow detection, impedance change detection or deflection force detection to discriminate between blood and tissue. The device may also improve ablation positioning and performance by ablating using the same elements used for discriminating between blood and tissue. Other advantages will become apparent from the teaching herein to those of skill in the art.

(14) A medical system may be summarized as including a device that includes a plurality of elongate members, each elongate member in the plurality of elongate members including a first end and a second end, an intermediate portion positioned between the first end and the second end, and a respective length between the first end and the second end. A portion of the device is selectively moveable between an unexpanded configuration in which at least the respective intermediate portions of the elongate members of the plurality of elongate members are arranged successively with respect to one another along a first direction in a stacked arrangement, the stacked arrangement sized to be delivered through a bodily opening leading to a bodily cavity, and an expanded configuration in which each of at least some of the plurality of elongate members are fanned about each of one or more axes. When the portion of the device is in the expanded configuration, at least one elongate member of the plurality of elongate members is arranged such that the one or more axes pass through the at least one elongate member of the plurality of elongate members at two or more locations, each location of the two or more locations spaced from another location of the two or more locations along the respective length of the at least one elongate member of the plurality of elongate members.

(15) The one or more axes may include two or more axes, and the at least one elongate member of the plurality of elongate members may be arranged such that each axis of the two or more axes passes through a respective one of the two or more locations when the portion of the device is in the expanded configuration. At least a first axis of the two or more axes may be collinear with a

second axis of the two or more axes when the portion of the device is in the expanded configuration. Each elongate member of the at least some of the plurality of elongate members may cross the at least one elongate member of the plurality of elongate members in an X configuration about at least one axis of the one or more axes when the portion of the device is in the expanded configuration.

(16) The device may include at least one coupler arranged to physically couple each elongate member of the at least some of the plurality of elongate members together with the at least one elongate member of the plurality of elongate members. The at least one coupler may include a plurality of the couplers, each coupler of the plurality of the couplers spaced from at least one other one of the plurality of the couplers along the respective length of the at least one elongate member of the plurality of elongate members. The at least one coupler may include a flexible line arranged to be received in at least one opening provided in the at least one elongate member of the plurality of elongate members.

(17) The at least one elongate member of the plurality of elongate members may be twisted about a twist axis extending along a portion of the respective length of the at least one elongate member of the plurality of elongate members. The two or more locations may include at least three locations.

(18) Various systems may include combinations and subsets of those summarized above.

(19) A medical system may be summarized as including a structure that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, an intermediate portion positioned between the proximal end and the distal end, and a thickness. Each intermediate portion includes a front surface and a back surface opposite across the thickness of the elongate member from the front surface. The structure is selectively moveable between an unexpanded configuration in which at least the respective intermediate portions of the elongate members of the plurality of elongate members are arranged with respect to one another front surface-toward-back surface in a stacked array sized for delivery through a bodily opening leading to a bodily cavity, and an expanded configuration in which the respective intermediate portions of at least some of the plurality of elongate members are angularly spaced with respect to one another about a first axis. Each of the at least some of the plurality of elongate members further includes a curved portion arranged to extend along at least a portion of a respective curved path that intersects the first axis at each of a respective at least two spaced apart locations along the first axis when the structure is in the expanded configuration.

(20) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the proximal end and the distal end, and at least a first elongate member of the at least some of the plurality of elongate members crosses a second elongate member of the at least some of the plurality of elongate members at a location along the respective length of the second elongate member of the at least some of the plurality of elongate members when the structure is in the expanded configuration. At least a first elongate member of the at least some of the plurality of elongate members may cross a second elongate member of the at least some of the plurality of elongate members in an X configuration at each of at least one of the respective at least two spaced apart locations along the first axis intersected by the at least a portion of the respective curved path extended along by the curved portion of the second elongate member of the at least some of the plurality of elongate members when the structure is in the expanded configuration.

(21) The device may include at least one coupler arranged to physically couple each elongate member of the at least some of the plurality of elongate members together with at least one other elongate member of the plurality of elongate members. In some embodiments each elongate member of the plurality of elongate members includes a respective length between the proximal end and the distal end, and the at least one coupler includes a plurality of couplers, each coupler of the plurality of couplers spaced from another coupler of the plurality of couplers along the respective length of the at least one other elongate member of the plurality of elongate members. At least one of the respective at least two spaced apart locations along the first axis intersected by at

least the portion of the respective curved path extended along by the curved portion of at least a first elongate member of the at least some of the plurality of elongate members may be positioned between a first coupler of the plurality of couplers and at least a second coupler of the plurality of couplers when the structure is in the expanded configuration.

(22) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the proximal end and the distal end, and at least one elongate member of the plurality of elongate members is twisted about a twist axis extending along a portion of the respective length of the at least one elongate member of the plurality of elongate members. The respective at least two spaced apart locations along the first axis intersected by at least the portion of the respective curved path extended along by the curved portion of at least a first one of the at least some of the plurality of elongate members when the structure is in the expanded configuration may include at least three spaced apart locations along the first axis.

(23) Various systems may include combinations and subsets of those summarized above.

(24) A medical system may be summarized as including a device that includes a plurality of elongate members and at least a first coupler arranged to physically couple each elongate member of the plurality of elongate members together with each other of the elongate members of the plurality of elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, an intermediate portion positioned between the proximal end and the distal end, a respective length between the proximal end and the distal end, and a thickness. Each intermediate portion includes a front surface and a back surface opposite across the thickness of the elongate member from the front surface. A portion of the device is selectively moveable between an unexpanded configuration in which at least the respective intermediate portions of the elongate members of the plurality of elongate members are arranged with respect to each other front surface-toward-back surface in a stacked array sized for delivery through a bodily opening leading to a bodily cavity, each elongate member of the plurality of elongate members arranged to be advanced distal end first into the bodily cavity, and an expanded configuration in which at least a first elongate member of the plurality of elongate members is positioned to cross a second elongate member of the plurality of elongate members in an X configuration at a first location spaced along the respective length of the second elongate member from a location of at least the first coupler. The first location may be positioned between at least the first coupler and the respective distal end of the second elongate member. The first location may be spaced from the respective distal end of the second elongate member.

(25) At least the first elongate member of the plurality of elongate members may be positioned to cross the second elongate member of the plurality of elongate members in an X configuration at a second location spaced from the first location along the respective length of the second elongate member of the plurality of elongate members when the portion of the device is in the expanded configuration. The medical system may further include a second coupler arranged to physically couple each elongate member of the plurality of elongate members together with each other of the elongate members of the plurality of elongate members. The first location may be spaced along the respective length of the second elongate member from a location of the second coupler and the first location may be positioned between at least the first coupler and the second coupler when the portion of the device is in the expanded configuration.

(26) The respective intermediate portions of each of at least some of the plurality of elongate members may be angularly spaced, like lines of longitude, with respect to one another about a first axis extending through the first location when the portion of the device is in the expanded configuration. At least one elongate member of the plurality of elongate members may be twisted about an axis extending along a portion of the respective length of the at least one elongate member of the plurality of elongate members.

(27) Various systems may include combinations and subsets of those summarized above.

(28) A medical system may be summarized as including a structure that includes a plurality of

elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, an intermediate portion positioned between the proximal end and the distal end, a respective length between the proximal end and the distal end, and a thickness. Each intermediate portion includes a front surface and a back surface opposite across the thickness of the elongate member from the front surface. Each intermediate portion further includes a respective pair of side edges that define a portion of a periphery of at least one of the front surface and the back surface, the side edges of each pair of side edges opposed to one another across at least a portion of the length of the respective elongate member. The structure is selectively moveable between an unexpanded configuration in which at least the respective intermediate portions of the elongate members of the plurality of elongate members are arranged with respect to one another front surface-toward-back surface in a stacked array sized for delivery through a bodily opening leading to a bodily cavity, and an expanded configuration in which the structure is sized too large for delivery through the bodily opening leading to the bodily cavity. At least a first elongate member of the plurality of elongate members is positioned such that one of the side edges of the pair of side edges of the first elongate member crosses one of the side edges of the pair of side edges of a second elongate member of the plurality of elongate members at each of a plurality of spaced apart locations along the respective length of the second elongate member as viewed normally to each of a respective one of a plurality of portions of the front surface of the respective intermediate portion of the second elongate member over which each of the plurality of spaced apart locations along the respective length of the second elongate member is positioned when the structure is in the expanded configuration.
(29) The respective intermediate portions of at least some of the plurality of elongate members may be fanned with respect to one another about an axis when the structure is in the expanded configuration. At least some of the plurality of elongate members may be fanned with respect to the second elongate member about one or more axes when the structure is in the expanded configuration, the second elongate member arranged such that the one or more axes passes through the second elongate member at each of two or more locations, each location of the two or more locations spaced from another location of the two or more locations along the respective length of the second elongate member. The plurality of spaced apart locations along the respective length of the second elongate member may include at least three spaced apart locations along the respective length of the second elongate member.
(30) The device may further include at least one coupler arranged to physically couple at least some of the plurality of elongate members together with the second elongate member, the at least one coupler spaced along the respective length of the second elongate member from at least one of the plurality of spaced apart locations along the respective length of the second elongate member when the structure is in the expanded configuration. The at least one coupler may be positioned along the respective length of the second elongate member relatively closer to one of the respective proximal end and the respective distal end of the second elongate member than each of at least two of the plurality of spaced apart locations along the respective length of the second elongate member when the structure is in the expanded configuration. Each elongate member of the plurality of elongate members may be arranged to be advanced distal end first into the bodily cavity when the structure is in the unexpanded configuration, and the at least one coupler may be positioned along the respective length of the second elongate member relatively closer to the respective distal end of the second elongate member than at least one of the plurality of spaced apart locations along the respective length of the second elongate member when the structure is in the expanded configuration.
(31) At least one elongate member of the plurality of elongate members may be twisted about an axis extending along a portion of the respective length of the at least one elongate member of the plurality of elongate members. The back surface of the respective intermediate portion of at least the first elongate member may, or may not be separated from the front surface of the respective

intermediate portion of the second elongate member at each of at least one of the plurality of spaced apart locations along the respective length of the second elongate member when the structure is in the expanded configuration.

(32) The one of the side edges of the pair of side edges of the first elongate member may be opposed to the one of the side edges of the pair of side edges of the second elongate member in the stacked array when the structure is in the unexpanded configuration. The first elongate member of the plurality of elongate members may be positioned such that the other one of the side edges of the pair of side edges of the first elongate member crosses the other one of the side edges of the pair of side edges of the second elongate member at each of one or more locations along the respective length of the second elongate member as viewed normally to each of a respective one of one or more portions of the front surface of the respective intermediate portion of the second elongate member over which each of the one or more locations along the respective length of the second elongate member is positioned when the structure is in the expanded configuration.

(33) Various systems may include combinations and subsets of those summarized above.

(34) A medical system may be summarized as including a structure that includes a plurality of elongate members and at least one coupler arranged to physically couple at least a first elongate member of the plurality of elongate members together with a second elongate member of the plurality of elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, an intermediate portion positioned between the proximal end and the distal end, and a thickness. Each intermediate portion includes a front surface and a back surface opposite across the thickness of the elongate member from the front surface, a respective geodesic extending along a portion of each of the elongate members between a location at least proximate the proximal end and another location at least proximate the distal end of the elongate member. Each geodesic is located at least on the front surface of the respective intermediate portion of the elongate member. The structure is selectively moveable between an unexpanded configuration in which at least the respective intermediate portions of the elongate members of the plurality of elongate members are arranged with respect to one another front surface-toward-back surface in a stacked array sized for delivery through a bodily opening leading to a bodily cavity, each elongate member of the plurality of elongate members arranged to be advanced distal end first into the bodily cavity, and an expanded configuration in which the structure is sized too large for delivery through the bodily opening to the bodily cavity. At least the first elongate member is positioned such that the respective geodesic of the first elongate member crosses the respective geodesic of the second elongate member at a first location along the geodesic of the second elongate member as viewed normally to a respective portion of the front surface of the intermediate portion of the second elongate member over which the first location along the respective geodesic of the second elongate member is positioned. The first location is spaced from a location of the at least one coupler along the second elongate member, and the first location may be positioned between the at least one coupler and the respective distal end of the second elongate member when the structure is in the expanded configuration.

(35) The respective intermediate portions of at least some of the plurality of elongate members may be fanned with respect to one another about an axis when the structure is in the expanded configuration. At least some of the plurality of elongate members may be fanned with respect to the second elongate member about one or more axes when the structure is in the expanded configuration, the second elongate member curved such that the one or more axes pass through the second elongate member at each of two or more locations, each location of the two or more locations spaced from each other between the respective proximal and distal ends of the second elongate member. The respective intermediate portions of at least some of the plurality of elongate members may be angularly spaced with respect to one another about a first axis, like lines of longitude, when the structure is in the expanded configuration, each of the least some of the plurality of elongate members including a curved portion arranged to extend along at least a portion

of a respective curved path that intersects the first axis at each of a respective at least two spaced apart locations along the first axis.
(36) At least one elongate member of the plurality of elongate members may be twisted about an axis extending along a portion of the at least one elongate member of the plurality of elongate members located between the respective proximal and distal ends of the at least one elongate member of the plurality of elongate members.
(37) The structure may include at least one other coupler arranged to physically couple at least the first elongate member together with the second elongate member, the at least one other coupler positioned relatively closer to the respective distal end of the second elongate member than the at least one coupler, and the first location may be positioned between the at least one coupler and the at least one other coupler along the second elongate member when the structure is in the expanded configuration.
(38) The structure may include at least one other coupler arranged to physically couple at least the first elongate member together with the second elongate member, the at least one other coupler spaced from the at least one coupler along the second elongate member, and the first location may be positioned along the second elongate member relatively closer to the respective distal end of the second elongate member than each of the at least one coupler and the at least one other coupler when the structure is in the expanded configuration.
(39) The at least one coupler may include a flexible line arranged to pass through an opening provided in each of at least one of the first elongate member and the second elongate member. The back surface of the respective intermediate portion of at least the first elongate member may contact the front surface of the respective intermediate portion of the second elongate member at the first location when the structure is in the expanded configuration. The back surface of the respective intermediate portion of at least the first elongate member may be separated from the front surface of the respective intermediate portion of the second elongate member at the first location when the structure is in the expanded configuration.
(40) Various systems may include combinations and subsets of those summarized above.
(41) A medical system may be summarized as including a structure that includes a plurality of elongate members, each elongate member of the plurality of elongate members including a proximal end, a distal end, and a respective intermediate portion positioned between the proximal end and the distal end. The structure is selectively moveable between a delivery configuration in which the structure is suitably sized to allow the structure to be intravascularly or percutaneously delivered to a bodily cavity, and a deployed configuration in which the structure is expanded to have a size too large to allow the structure to be intravascularly or percutaneously delivered to the bodily cavity. The plurality of elongate members include a first set of the elongate members and a second set of the elongate members, at least the respective intermediate portions of the elongate members in each of the first and the second sets of the elongate members pivoting about at least one axis when the structure is moved into the deployed configuration, each of the respective intermediate portions of the elongate members in the first set of the elongate members pivoting along a first angular direction and each of the respective intermediate portions of the elongate members in the second set of the elongate members pivoting along a second angular direction opposite to the first angular direction. At least the respective intermediate portion of at least one of the elongate members in the first set of the elongate members is positioned between the respective intermediate portions of at least two of the elongate members in the second set of the elongate members when the structure is in the delivery configuration.
(42) In some embodiments each elongate member of the plurality of elongate members includes a thickness, and the respective intermediate portion of each elongate member of the plurality of elongate members includes a front surface and a back surface opposite across the thickness of the elongate member from the front surface. At least one portion of the respective front surface of each elongate member of the plurality of elongate members may be positioned to directly face an

interior tissue surface of the bodily cavity when the structure is moved into the deployed configuration within the bodily cavity, and the respective front surface of the at least one of the elongate members in the first set of the elongate members may be positioned to directly face the respective back surface of one of the at least two of the elongate members in the second set of the elongate members when the structure is in the delivery configuration. The respective intermediate portions of the elongate members of the plurality of elongate members may be arranged with respect to one another front surface-toward-back surface in a stacked array when the structure is in the delivery configuration. At least the respective intermediate portions of the elongate members in the first set of the elongate members may be interleaved with at least the respective intermediate portions of the elongate members in the second set of the elongate members in a stacked array when the structure is in the delivery configuration.
(43) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective proximal and distal ends of the elongate member, and at least a first elongate member of the plurality of elongate members crosses a second elongate member of the plurality of elongate members in an X configuration at each of at least one location along the respective length of the second elongate member of the plurality of elongate members when the structure is in the deployed configuration.
(44) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective proximal and distal ends of the elongate member, and at least one elongate member of the plurality of elongate members is arranged such that the at least one axis passes through the at least one elongate member of the plurality of elongate members at each of two or more locations, each location of the two or more locations spaced from another location of the two or more locations along the respective length of the at least one elongate member of the plurality of elongate members when the structure is in the deployed configuration. The two or more locations may include at least three spaced apart locations along the respective length of the at least one elongate member of the plurality of elongate members.
(45) Various systems may include combinations and subsets of those summarized above.
(46) A medical system may be summarized as including at least one transducer controller; and a device that includes a plurality of transducer elements and a plurality of flexible circuit structures. Each of the flexible circuit structures includes at least one flexible substrate and a set of one or more electrical conductors carried by the at least one flexible substrate, at least some the electrical conductors in the set of one or more electrical conductors providing at least a portion of a signal path between the at least one transducer controller and at least some of the transducer elements. At least one portion of each of the plurality of flexible circuit structures is positionable within a bodily cavity. A portion of the device is selectively moveable between an unexpanded configuration in which at least the respective at least one portions of the plurality of flexible circuit structures are arranged successively along a first direction in a stacked arrangement, the stacked arrangement sized to be intravascularly or percutaneously delivered through a bodily opening leading to the bodily cavity, and an expanded configuration in which the respective at least one portions of the plurality of flexible circuit structures are angularly spaced with respect to one another about at least one axis. The respective at least one portion of each of at least some of the flexible circuit structures may pivot about the least one axis when the portion of the device is moved between the unexpanded configuration and the expanded configuration.
(47) At least one of the plurality of flexible circuit structures may be arranged such that the at least one axis passes through the at least one of the plurality of flexible circuit structures at each of two or more spaced apart locations when the portion of the device is in the expanded configuration. The two or more spaced apart locations may include at least three spaced apart locations. At least a first one of the plurality of flexible circuit structures may cross a second one of the plurality of flexible circuit structures in an X configuration when the portion of the device is in the expanded configuration.

(48) The respective at least one flexible substrate of each of at least some of the plurality of flexible circuit structures may include a plurality of material layers, at least one of the material layers bonded to at least one other of the material layers with an adhesive. The respective at least one portion of at least one of the plurality of flexible circuit structures may include a different number of material layers than at least another portion of the at least one of the plurality of flexible circuit structures. At least one of the plurality of transducer elements may be carried by the respective at least one portion of each of the at least some of the plurality of flexible circuit structures. Each of the plurality of flexible circuit structures may be a printed flexible circuit structure. At least one of the plurality of flexible circuit structures includes a twist about a twist axis.
(49) Various systems may include combinations and subsets of those summarized above.
(50) A medical system may be summarized as including a device that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a first end, a second end, an intermediate portion positioned between the first end and the second end, and a thickness. Each intermediate portion includes a front surface and a back surface opposite across the thickness of the elongate member from the front surface. A portion of the device is selectively moveable between a delivery configuration in which at least the respective intermediate portions of the elongate members of the plurality of elongate members are arranged with respect to one another front surface-toward-back surface in a stacked array sized for delivery through a bodily opening leading to a bodily cavity, and a deployed configuration in which at least the respective intermediate portion of each elongate member of at least some of the plurality of elongate members is arranged within the bodily cavity to position a first portion of the front surface of the respective intermediate portion of the elongate member of the at least some of the plurality of elongate members to face a first portion of an interior tissue surface within the bodily cavity and to position a second portion of the front surface of the respective intermediate portion of the elongate member of the at least some of the plurality of elongate members to face a second portion of the interior tissue surface, where the second portion of the interior tissue surface is opposed across the bodily cavity from the first portion of the interior tissue surface.
(51) The at least some of the plurality of elongate members may be bent about a bending axis into an arcuate stacked array when the portion of the device is in the deployed configuration.
(52) At least the respective intermediate portions of the elongate members of the at least some of the plurality of elongate members may be fanned with respect to at least one elongate member of the plurality of elongate members about each of one or more axes when the portion of the device is in the deployed configuration. In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective first end and the respective second end of the elongate member, and the one or more axes pass through the at least one elongate member of the plurality of elongate members at two or more locations when the portion of the device is in the deployed configuration, each location of the two or more locations spaced from another location of the two or more locations along the respective length of the at least one elongate member of the plurality of elongate members. The two or more locations may include at least three spaced apart locations along the respective length of the at least one elongate member of the plurality of elongate members.
(53) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective first end and the respective second end of the elongate member, and at least a first elongate member of the at least some of the plurality of elongate members crosses a second elongate member of the at least some of the plurality of elongate members in an X configuration at each of one or more locations along the respective length of the second elongate member of the at least some of the plurality of elongate members when the portion of the device is in the deployed configuration. At least one location of the one or more locations may be spaced along the respective length of the second elongate member of the at least some of the plurality of elongate members from each of the respective first end and the respective second

end of the second elongate member. The at least one location of the one or more locations may be located along the respective length of the second elongate member of the at least some of the plurality of elongate members between the respective first and second portions of the front surface of the respective intermediate portion of the second elongate member of the at least some of the plurality of elongate members. The one or more locations along the respective length of the second elongate member of the at least some of the plurality of elongate members may include at least two spaced apart locations along the respective length of the second elongate member of the at least some of the plurality of elongate members. The device may further include at least one coupler that physically couples at least the first and the second elongate members of the at least some of the plurality of elongate members together. The at least one location of the one or more locations may be spaced along the respective length of the second elongate member of the at least some of the plurality of elongate members from a location of the at least one coupler when the portion of the device is in the deployed configuration. The device may further include a plurality of couplers which each physically couples at least the second elongate member of the at least some of the plurality of elongate members together with at least one other elongate member of the plurality of elongate members, each coupler of the plurality of couplers spaced from another of the plurality of couplers along the respective length of the second elongate member of the at least some of the plurality of elongate members. The at least one location of the one or more locations may be located along the respective length of the second elongate member of the at least some of the plurality of elongate members between the respective locations of at least two of the plurality of couplers when the portion of the device is in the deployed configuration. The at least one location of the one or more locations may be located along the respective length of the second elongate member of the at least some of the plurality of elongate members relatively closer to the respective first end of the second elongate member than a respective location of each of at least two of the plurality of couplers when the portion of the device is in the deployed configuration, the respective first end of each elongate member of the plurality of elongate members arranged to be advanced into the bodily cavity before the respective second end of the elongate member of the plurality of elongate members when the portion of the device is in the delivery configuration.

(54) Each elongate member of the at least some of the plurality of elongate members may have a volute shape profile when the portion of the device is in the deployed configuration.

(55) Each of the first and the second portions of the front surface of the respective intermediate portion of the elongate member of the at least some of the plurality of elongate members may include respective ones of one or more transducers which face a respective one of a pair of diametrically opposed portions of the interior tissue surface within the bodily cavity when the portion of the device is in the deployed configuration in use.

(56) Various systems may include combinations and subsets of those summarized above.

(57) A medical system may be summarized as including a structure that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, and a respective intermediate portion positioned between the proximal end and the distal end. The structure is selectively moveable between a delivery configuration in which the structure is suitably sized to be intravascularly or percutaneously delivered to a bodily cavity, and a deployed configuration in which the structure has a size too large to be intravascularly or percutaneously delivered to the bodily cavity. The respective intermediate portions of at least two of the plurality of elongate members are angularly spaced with respect to one another about a first axis, similar to lines of longitude, and each of the at least two of the plurality of elongate members includes a curved portion that extends along at least a portion of a respective curved path that intersects the first axis at each of a respective at least two spaced apart locations along the first axis when the structure is in the deployed configuration. The medical system further includes a handle portion, and a shaft member. A portion of the shaft member sized and arranged to deliver the structure intravascularly or percutaneously to the bodily cavity. The shaft member includes a first

end positioned at least proximate to the handle portion and a second end physically coupled to the structure at one or more locations on the structure. Each of the one or more locations on the structure to which the second end is physically coupled is positioned to one side of at least one spatial plane coincident with the first axis when the structure is in the deployed configuration.
(58) At least one of the one or more locations on the structure to which the second end is physically coupled may be at least proximate to the respective proximal ends of at least some of the plurality of elongate members. Each of the at least two of the plurality of elongate members may extend tangentially from the second end of the shaft member when the structure is in the deployed configuration. Each of the proximal ends of the elongate members of the plurality of elongate members may be positioned to one side of the at least one spatial plane coincident with the first axis when the structure is in the deployed configuration. Each of the distal ends of the elongate members of the plurality of elongate members may be positioned to one side of the at least one spatial plane coincident with the first axis when the structure is in the deployed configuration. The shaft member may be arranged to avoid intersection by the first axis when the structure is in the deployed configuration. The shaft member may be arranged to avoid intersection of the second end of the shaft member by the first axis when the structure is in the deployed configuration.
(59) The respective intermediate portion of each elongate member of the plurality of elongate members may include a front surface and a back surface opposite across a thickness of the elongate member from the front surface, and at least the respective intermediate portions of the elongate members of the plurality of elongate members may be arranged with respect to one another front surface-toward-back surface in a stacked array when the structure is in the delivery configuration.
(60) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective proximal end and the respective distal end of the elongate member, and the first axis passes through each of at least one elongate member of the plurality of elongate members at two or more locations when the structure is in the deployed configuration, each location of the two or more locations spaced from another location of the two or more locations along the respective length of the at least one elongate member of the plurality of elongate members. The two or more locations may include at least three locations spaced along the respective length of the at least one elongate member of the plurality of elongate members.
(61) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective proximal end and the respective distal end of the elongate member, and at least a first elongate member of the plurality of elongate members crosses a second elongate member of the plurality of elongate member in an X configuration at a location along the respective length of the second elongate member spaced from each of the respective proximal end and the respective distal end of the second elongate member when the structure is in the deployed configuration. Each elongate member of at least some of the plurality of elongate members may have a volute shape profile when the structure is in the deployed configuration.
(62) Various systems may include combinations and subsets of those summarized above.
(63) A medical system may be summarized as including a device that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, an intermediate portion positioned between the proximal end and the distal end, and a thickness. Each intermediate portion includes a front surface and a back surface opposite across the thickness of the elongate member from the front surface. A portion of the device is selectively moveable between a delivery configuration in which at least the respective intermediate portions of the elongate members of the plurality of elongate members are arranged with respect to one another front surface-toward-back surface in a stacked array sized for delivery through a bodily opening leading to a bodily cavity, and a deployed configuration in which the respective intermediate portion of each elongate member of at least some of the plurality of elongate members has a volute shape profile.
(64) At least the respective intermediate portions of the elongate members of the at least some of

the plurality of elongate members may be fanned with respect to at least one elongate member of the plurality of elongate members about at least one axis when the portion of the device is in the deployed configuration. In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective proximal end and the respective distal end of the elongate member, and the at least one axis passes through the at least one elongate member of the plurality of elongate members at two or more locations when the portion of the device is in the deployed configuration, each location of the two or more locations spaced from another location of the two or more locations along the respective length of the at least one elongate member of the plurality of elongate members. The two or more locations may include at least three spaced apart locations along the respective length of the at least one elongate member of the plurality of elongate members.
(65) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective proximal end and the respective distal end of the elongate member, and at least a first elongate member of the plurality of elongate members crosses a second elongate member of the plurality of elongate member in an X configuration at each of one or more locations along the respective length of the second elongate member spaced from each of the respective proximal end and the respective distal end of the second elongate member when the portion of the device is in the deployed configuration. The device may further include a plurality of couplers which each physically couples at least the second elongate member of the plurality of elongate members together with at least one other elongate member of the plurality of elongate members, each coupler of the plurality of couplers spaced from another of the plurality of couplers along the respective length of the second elongate member of the plurality of elongate members. At least one location of the one or more locations may be located along the respective length of the second elongate member of the plurality of elongate members between the respective locations of at least two of the plurality of couplers when the portion of the device is in the deployed configuration. Each elongate member of the plurality of elongate members in the stacked array may be arranged to be advanced distal end first into the bodily cavity when the portion of the device is in the delivery configuration, and at least one location of the one or more locations may be located along the respective length of the second elongate member of the plurality of elongate members relatively closer to the respective distal end of the second elongate member than a respective location of each of at least two of the plurality of couplers when the portion of the device is in the deployed configuration.
(66) Various systems may include combinations and subsets of those summarized above.
(67) A medical system may be summarized as including a catheter sheath that includes a first end, a second end and a lumen therebetween. The medical system further includes a device that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, an intermediate portion positioned between the proximal end and the distal end, and a thickness. Each intermediate portion includes a front surface and a back surface opposite across the thickness of the elongate member from the front surface. A portion of the device is selectively moveable between a first configuration in which at least the respective intermediate portions of the elongate members of the plurality of elongate members are arranged with respect to one another front surface-toward-back surface in a stacked array sized for delivery through the lumen of the catheter sheath, each elongate member of the plurality of elongate members arranged to be advanced distal end first out from the lumen of the catheter sheath, and a second configuration in which the respective distal end of each of at least some of the plurality of elongate members moves along a respective coiled path as the elongate members advance out of the lumen of the catheter sheath, the respective intermediate portions of each elongate member of the at least some of the plurality of elongate members bent about a respective bending axis into an arcuate stacked array sized too large for delivery though the lumen of the catheter sheath.
(68) At least part of the coiled path may extend along a volute path. At least the respective

intermediate portion of each elongate member of the at least some of the plurality of elongate members may have a volute shape profile when the portion of the device is in the second configuration.
(69) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective proximal end and the respective distal end of the elongate member, and the portion of the device is further selectively moveable between at least the second configuration and a third configuration in which at least the respective intermediate portions of the elongate members of the at least some of the plurality of elongate members are fanned with respect to at least one elongate member of the plurality of elongate members about each of one or more axes. The one or more axes may pass through the at least one elongate member of the plurality of elongate members at two or more locations when the portion of the device is in the third configuration, each location of the two or more locations spaced from another location of the two or more locations along the respective length of the at least one elongate member of the plurality of elongate members. The two or more locations may include at least three spaced apart locations along the respective length of the at least one elongate member of the plurality of elongate members.
(70) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective proximal end and the respective distal end of the elongate member, and the portion of the device is further selectively moveable between at least the second configuration and a third configuration in which at least a first elongate member of the plurality of elongate members crosses a second elongate member of the plurality of elongate members in an X configuration at each of one or more locations along the respective length of the second elongate member spaced from each of the respective proximal end and the respective distal end of the second elongate member. The device may further include a plurality of couplers which each physically couples at least the second elongate member of the plurality of elongate members together with at least one other elongate member of the plurality of elongate members, each coupler of the plurality of couplers spaced from another of the plurality of couplers along the respective length of the second elongate member. At least one location of the one or more locations may be located along the respective length of the second elongate member between the respective locations of at least two of the plurality of couplers when the portion of the device is in the third configuration. At least one location of the one or more locations may be located along the respective length of the second elongate member relatively closer to the respective distal end of the second elongate member than a respective location of each of at least two of the plurality of couplers when the portion of the device is in the third configuration.
(71) At least one elongate member of the at least some of the plurality of elongate members may have an annular shape profile in the second configuration, the annular profile interrupted by a separation. The respective intermediate portion of each elongate member of the at least some of the plurality of elongate members may be preformed to autonomously bend about the respective bending axis of the elongate member of the at least some of the plurality of elongate members as the respective intermediate portion is advanced out from the lumen of the catheter sheath. The medical system may further include a bending unit that acts on at least one of the plurality of elongate members to bend the respective intermediate portion of each elongate member of the at least some of the plurality of elongate members about the respective bending axis of the elongate member of the at least some of the plurality of elongate members when the portion of the device is moved between the first configuration and the second configuration.
(72) Various systems may include combinations and subsets of those summarized above.
(73) A medical system may be summarized as including a device that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a first end and a second end, an intermediate portion between the first end and the second end, and a respective length between the first end and the second end. The device further includes a plurality

of couplers that includes a proximal coupler, a distal coupler and at least one intermediate coupler. Each coupler of the plurality of couplers is spaced from another of the plurality of couplers along the respective length of at least a first elongate member of the plurality of elongate members with the at least one intermediate coupler positioned between the proximal coupler and the distal coupler. Each coupler of the plurality of couplers is arranged to couple at least the first elongate member together with least one other elongate member of the plurality of elongate members. A portion of the device is selectively moveable between an unexpanded configuration in which at least the respective intermediate portions of the elongate members of the plurality of elongate members are sized and arranged to be delivered through a bodily opening leading to a bodily cavity within a body, the bodily cavity having an interior tissue surface interrupted by a port of the bodily opening, and the plurality of couplers arranged to be advanced distal coupler first into the bodily cavity, and an expanded configuration in which at least the respective intermediate portions of at least some of the plurality of elongate members are arranged such that at least the distal coupler is located within the bodily cavity at a respective location positioned relatively closer to the port of the bodily opening than a respective location of the at least one intermediate coupler within the bodily cavity.

(74) When the portion of the device is in the expanded configuration, the proximal coupler may be positioned relatively closer to the port of the bodily opening than the distal coupler within the bodily cavity. When the portion of the device is in the expanded configuration, the distal coupler may be positioned relatively closer to the port of the bodily opening than the proximal coupler. At least the respective intermediate portions of the at least some of the plurality of elongate members may be arranged such that the proximal coupler is located within the body at a location outside of the bodily cavity when the portion of the device is in the expanded configuration.

(75) At least the respective intermediate portions of the elongate members of the plurality of elongate members may be arranged successively with respect to one another along a first direction in a stacked arrangement when the portion of the device is in the unexpanded configuration.

(76) The respective intermediate portion of each elongate member of the plurality of elongate members may include a thickness, a front surface and a back surface opposite across the thickness from the front surface. At least the respective intermediate portions of the elongate members of the plurality of elongate members may be arranged with respect to one another front surface-toward-back surface in a stacked array sized for delivery through the bodily opening leading to the bodily cavity when the portion of the device is in the unexpanded configuration, and the respective intermediate portion of each elongate member of the at least some of the plurality of elongate members may be bent about a respective bending axis when the portion of the device is in the expanded configuration. The respective intermediate portion of each elongate member of the at least some of the plurality of elongate members may be preformed to autonomously bend about the respective bending axis of the elongate member of the at least some of the plurality of elongate members when the respective intermediate portion of the elongate member of the at least some of the plurality of elongate members is advanced into the bodily cavity.

(77) At least the respective intermediate portions of the elongate members of the at least some of the plurality of elongate members may be fanned with respect to at least one elongate member of the plurality of elongate members about each of one or more axes, and the one or more axes may pass through the at least one elongate member of the plurality of elongate members at two or more locations when the portion of the device is in the expanded configuration. Each location of the two or more locations may be spaced from another location of the two or more locations along the respective length of the at least one elongate member of the plurality of elongate members. The two or more locations may include at least three spaced apart locations along the respective length of the at least one elongate member of the plurality of elongate members. At least a second elongate member of the plurality of elongate members may cross the first elongate member at a location along the respective length of the first elongate member spaced from each of the proximal coupler

and the distal coupler when the portion of the device is in the expanded configuration.

(78) Various systems may include combinations and subsets of those summarized above.

(79) A medical system may be summarized as including a device that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, an intermediate portion positioned between the proximal end and the distal end, and a thickness. Each intermediate portion includes a front surface and a back surface opposite across the thickness of the elongate member from the front surface. A respective geodesic defined for each elongate member extends along the respective elongate member between a first location at least proximate the proximal end and a second location at least proximate the distal end of the elongate member, each geodesic defined at least on the front surface of the respective intermediate portion of the elongate member. A portion of the device is selectively moveable between an unexpanded configuration in which at least the respective intermediate portions of the elongate members of the plurality of elongate members are arranged front surface-toward-back surface in a stacked array sized to be delivered through a bodily opening leading to a bodily cavity having an interior tissue surface interrupted by a port of the bodily opening, each elongate member of the plurality of elongate members arranged to be advanced distal end first into the bodily cavity, and an expanded configuration in which at least a first elongate member of the plurality of elongate members is positioned to cross a second elongate member of the plurality of elongate members at each of one or more crossing locations within the bodily cavity. Each of the one or more crossing locations is located on the front surface of the second elongate member at a respective one of one or more locations along the respective geodesic of the second elongate member that is crossed by the respective geodesic of the first elongate member as viewed normally to a respective one of one or more portions of the front surface of the second elongate member over which each respective one of the one or more locations along the respective geodesic of the second elongate member is located. The elongate members of the plurality of elongate members are arranged such that the respective distal end of each elongate member of at least some of the plurality of elongate members is positioned within the bodily cavity at a respective location located relatively closer to the port of the bodily opening than at least one crossing location of the one or more crossing locations within the bodily cavity when the portion of the device is in the expanded configuration.

(80) The one or more crossing locations within the bodily cavity may include at least one other crossing location, the least one other crossing location located within the bodily cavity relatively closer to the port of the bodily opening than the respective location within the bodily cavity of the respective distal end of each elongate member of the at least some of the plurality of elongate members when the portion of the device is moved between the unexpanded configuration and the expanded configuration.

(81) The respective intermediate portion of each elongate member of the at least some of the plurality of elongate members may be arranged within the bodily cavity to position a first portion of the front surface of the respective intermediate portion of the elongate member of the at least some of the plurality of elongate members to face a first portion of an interior tissue surface within the bodily cavity and to position a second portion of the front surface of the respective intermediate portion of the elongate member of the at least some of the plurality of elongate members to face a second portion of the interior tissue surface when the portion of the device is in the expanded configuration, the second portion of the interior tissue surface positioned diametrically opposite to the first portion of the interior tissue surface.

(82) The device may further include a plurality of couplers which each physically couples at least the second elongate member together with at least one other elongate member of the plurality of elongate members, each coupler of the plurality of couplers spaced from another coupler of the plurality of couplers along the second elongate member. The location of the at least one crossing location along the respective geodesic of the second elongate member may be positioned along the second elongate member between the respective locations of two of the plurality of couplers when

the portion of the device is in the expanded configuration. The location of the at least one crossing location along the respective geodesic of the second elongate member may be located along the second elongate member relatively closer to the respective distal end of the second elongate member than a respective location of each of at least two of the plurality of couplers when the portion of the device is in the expanded configuration.

(83) The respective intermediate portion of each elongate member of the at least some of the plurality of elongate members may be preformed to autonomously bend about a respective bending axis as the respective intermediate portion of the elongate member of the at least some of the plurality of elongate members is advanced into the bodily cavity. The medical system may further include a bending unit that acts on at least one of the plurality of elongate members to bend each elongate member of the at least some of the plurality of elongate members about a respective bending axis within the bodily cavity when the portion of the device is moved between the unexpanded configuration and the expanded configuration.

(84) Various systems may include combinations and subsets of those summarized above.

(85) A medical system may be summarized as including a catheter sheath that includes a first end, a second end and a lumen therebetween. The medical system further includes a structure that includes a plurality of elongate members, each elongate member of the plurality of elongate members including a proximal end, a distal end, and an intermediate portion positioned between the proximal and the distal ends. The structure is selectively moveable between an unexpanded configuration in which the elongate members of the plurality of elongate members are arranged successively with respect to one another along a first direction in a stacked arrangement, the stacked arrangement sized to be delivered through the lumen of the catheter sheath from the first end of the catheter sheath towards the second end of the catheter sheath, a portion of at least one elongate member of the plurality of elongate members in the stacked arrangement positioned to be advanced from the second end of the catheter sheath prior to each of the other elongate members of the plurality of elongate members in the stacked arrangement as the stacked arrangement is delivered through the lumen of the catheter sheath from the first end of the catheter sheath towards the second end of the catheter sheath, and an expanded configuration in which the structure is expanded to have a size too large to be delivered through the lumen of the catheter sheath.

(86) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the proximal and the distal ends of the elongate member, and the respective length of the at least one elongate member of the plurality of elongate members is longer than each of the respective lengths of the other elongate members of the plurality of elongate members. The portion of the at least one elongate member of the plurality of elongate members may be cantilevered from the stacked arrangement when the structure is in the unexpanded configuration. The at least one elongate member of the plurality of elongate members may include an outermost elongate member in the stacked arrangement when the structure is in the unexpanded configuration. The at least one elongate member of the plurality of elongate members may include an elongate member located between two outermost elongate members in the stacked arrangement when the structure is in the unexpanded configuration. The at least one elongate member of the plurality of elongate members may include at least two elongate members of the plurality of elongate members.

(87) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the proximal and the distal ends of the elongate member, and at least a first elongate member of the plurality of elongate members crosses a second elongate member of the plurality of elongate members in an X configuration at each of one or more locations along the respective length of the second elongate member when the structure is in the expanded configuration, each of the one or more locations spaced from each of the respective proximal end and the respective distal end of the second elongate member.

(88) The respective intermediate portion of each elongate member of at least some of the plurality

of elongate members may be preformed to autonomously bend about a respective bending axis as the respective intermediate portion of the elongate member of the at least some of the plurality of elongate members is advanced from the second end of the catheter sheath as the stacked arrangement is delivered through the lumen of the catheter sheath from the first end of the catheter sheath towards the second end of the catheter sheath. The medical system may further include a bending unit that acts on at least one of the plurality of elongate members to bend each elongate member of at least some of the plurality of elongate members about a respective bending axis when the respective intermediate portion of the elongate member of the at least some of the plurality of elongate members is advanced from the second end of the catheter sheath.
(89) Each elongate member of the plurality of elongate members may be arranged to be advanced distal end first as the stacked arrangement is delivered through the lumen of the catheter sheath from the first end of the catheter sheath towards the second end of the catheter sheath.
(90) Various systems may include combinations and subsets of those summarized above.
(91) A medical system may be summarized as including a structure that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, a respective intermediate portion positioned between the proximal end and the distal end, and a respective length between the proximal and the distal ends. A method employing the medical system may be summarized as including intravascularly or percutaneously delivering at least a portion of the structure to a location within an intra-cardiac cavity formed at least in part by a tissue wall having an interior tissue surface, each elongate member of the plurality of elongate members introduced distal end first into the intra-cardiac cavity and the distal end of each elongate member of the plurality of elongate members curling away from the interior tissue surface as the distal end of the elongate member of the plurality of elongate members is advanced along a respective path within the intra-cardiac cavity during the intravascular or percutaneous delivery. The method further includes fanning at least some of the plurality of elongate members with respect to at least one elongate member of the plurality of elongate members about each of one or more axes within the intra-cardiac cavity. The one or more axes pass through the at least one elongate member of the plurality of elongate members at two or more locations, each location of the two or more locations spaced from another location of the two or more locations along the respective length of the at least one elongate member of the plurality of elongate members.
(92) In some embodiments the respective intermediate portion of each elongate member of the plurality of elongate members includes a front surface and a back surface opposite across a thickness of the elongate member from the front surface, and the method further includes positioning a first portion of the front surface of the respective intermediate portion of at least a first elongate member of the plurality of elongate members to face a first portion of the interior tissue surface and positioning a second portion of the front surface of the respective intermediate portion of at least the first elongate member of the plurality of elongate members to face a second portion of the interior tissue surface, the second portion of the interior tissue surface positioned diametrically opposite to the first portion of the interior tissue surface.
(93) In some embodiments, the respective intermediate portion of each elongate member of the plurality of elongate members may include a front surface and a back surface opposite across a thickness of the elongate member from the front surface, and at least the respective intermediate portions of the elongate members of the plurality of elongate members may be arranged with respect to one another front surface-toward-back surface in a stacked array when intravascularly or percutaneously delivering at least the portion of the structure to the location within the intra-cardiac cavity.
(94) The method may further include crossing a second elongate member of the plurality of elongate members with a first elongate member of the plurality of elongate members in an X configuration at each of one or more locations along the respective length of the second elongate member, each of the one or more locations spaced from each of the respective proximal end and the

respective distal end of the second elongate member.
(95) Various methods may include combinations and subsets of those summarized above.
(96) A medical system may be summarized as including a structure that includes a plurality of elongate members. Each elongate member includes a first end, a second end, and an intermediate portion positioned between the first and the second ends. Each intermediate portion includes a thickness, a front surface and a back surface opposite across the thickness from the front surface. The structure further includes a proximal portion and a distal portion, each of the proximal and the distal portions of the structure including a respective part of each of at least some of the plurality of elongate members. The structure is selectively moveable between a delivery configuration in which the structure is sized for delivery through a bodily opening leading to a bodily cavity, at least the respective intermediate portions of the elongate members of the plurality of elongate members arranged front surface-toward-back surface in a stacked array when the structure is in the delivery configuration, and a deployed configuration in which the structure is sized too large for delivery through the bodily opening leading to the bodily cavity, the proximal portion of the structure forming a first domed shape and the distal portion of the structure forming a second domed shape when the structure is in the deployed configuration.
(97) At least one of the first domed shape and the second domed shape may have a first radius of curvature in a first spatial plane and a second radius of curvature in a second spatial plane that intersects the first spatial plane, a magnitude of the second radius of curvature different than a magnitude of the first radius of curvature.
(98) Each elongate member of the at least some of the plurality of elongate members may cross at least one other elongate member of the plurality of elongate members at least at one location between the proximal and the distal portions of the structure when the structure is in the deployed configuration.
(99) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the first end and the second end of the elongate member, and each elongate member of the at least some of the plurality of elongate members crosses at least one other elongate member of the plurality of elongate members at each of a plurality of spaced apart locations along the respective length of at least the one other elongate member of the plurality of elongate members when the structure is in the deployed configuration. At least some of the plurality of elongate members may be fanned with respect to at least one of the plurality of elongate members about an axis passing through a location between the proximal and the distal portions of the structure when the structure is in the deployed configuration.
(100) In some embodiments, the medical system further includes at least one flexible line arranged to physically couple the proximal and the distal portions of the structure together, the at least one flexible line manipulable to vary a distance between the proximal and the distal portions of the structure when the structure is in the deployed configuration.
(101) Various systems may include combinations and subsets of those summarized above.
(102) A medical system may be summarized as including a structure that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, and a respective intermediate portion positioned between the proximal end and the distal end. The structure is selectively moveable between a delivery configuration in which the structure is suitably sized to be intravascularly or percutaneously delivered to a bodily cavity, and a deployed configuration in which the structure is expanded to have a size too large to be intravascularly or percutaneously delivered to the bodily cavity. The respective intermediate portions of at least some of the plurality of elongate members are angularly spaced with respect to one another about a first axis, similar to lines of longitude, when the structure is in the deployed configuration. The medical system further includes a handle portion and a shaft member, a portion of the shaft member sized and arranged to deliver the structure intravascularly or percutaneously to the bodily cavity. The shaft member includes a first end positioned at least proximate to the handle

portion and a second end physically coupled to the structure. In the deployed configuration the structure and the shaft member have a projected outline in the shape of the Greek letter rho, where a point where a loop of the letter would intersect a tail of the letter may be open or not closed. Such outline may be either without, or with, an opening defined by a loop portion of the letter represented.

(103) Each of the at least some of the plurality of elongate members may include a curved portion that extends along at least a portion of a respective curved path that intersects the first axis at each of a respective at least two spaced apart locations along the first axis when the structure is in the deployed configuration.

(104) In some embodiments the respective intermediate portion of each elongate member of the plurality of elongate members includes a front surface and a back surface opposite across a thickness of the elongate member, and at least the respective intermediate portions of the elongate members of the plurality of elongate members are arranged with respect to one another front surface-toward-back surface in a stacked array when the structure is in the delivery configuration.

(105) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective proximal end and the respective distal end of the elongate member, and the first axis passes through each of at least one elongate member of the plurality of elongate members at two or more locations when the structure is in the deployed configuration, each location of the two or more locations spaced from another location of the two or more locations along the respective length of the at least one elongate member of the plurality of elongate members. The two or more locations may include at least three locations spaced along the respective length of the at least one elongate member of the plurality of elongate members.

(106) In some embodiments each elongate member of the plurality of elongate members includes a respective length between the respective proximal end and the respective distal end of the elongate member, and at least a first elongate member of the plurality of elongate members crosses a second elongate member of the plurality of elongate member in an X configuration at each of one or more locations along the respective length of the second elongate member spaced from each of the respective proximal end and the respective distal end of the second elongate member when the structure is in the deployed configuration. The medical system may further include a plurality of couplers which each physically couples at least the second elongate member of the plurality of elongate members together with at least one other elongate member of the plurality of elongate members, each coupler of the plurality of couplers spaced from another of the plurality of couplers along the respective length of the second elongate member of the plurality of elongate members. At least one location of the one or more locations may be located along the respective length of the second elongate member of the plurality of elongate members between the respective locations of at least two of the plurality of couplers when the structure is in the deployed configuration. Each elongate member of the plurality of elongate members may be arranged to be advanced distal end first into the bodily cavity when the structure is in the delivery configuration, and at least one location of the one or more locations may be located along the respective length of the second elongate member of the plurality of elongate members relatively closer to the respective distal end of the second elongate member than a respective location of each of at least two of the plurality of couplers when the structure is in the deployed configuration.

(107) Various systems may include combinations and subsets of those summarized above.

(108) A medical system may be summarized as including a structure that includes a proximal portion and a distal portion. The structure is selectively movable between a delivery configuration in which the structure is sized for delivery through a bodily opening leading to a bodily cavity, the structure arranged to be advanced distal portion first into the bodily cavity, and a deployed configuration in which the structure is sized too large for delivery through the bodily opening leading to the bodily cavity. The proximal portion of the structure forms a first domed shape and the distal portion of the structure forms a second domed shape when the structure is in the deployed

configuration. The proximal and the distal portions of the structure are arranged in a clam shell configuration when the structure is in the deployed configuration.
(109) At least one of the first domed shape and the second domed shape may have a first radius of curvature in a first spatial plane and a second radius of curvature in a second spatial plane that intersects the first spatial plane. A magnitude of the second radius of curvature may be different than a magnitude of the first radius of curvature. The proximal and the distal portions of the structure may be physically coupled together to pivot with respect to one another when the structure is in the deployed configuration. The proximal and the distal portions of the structure may be pivotably coupled together by a flexure portion of the structure when the structure is in the deployed configuration.
(110) The medical system may further include at least one actuator operably coupled to the structure to selectively pivot the proximal and the distal portions of the structure with respect to one another when the structure is in the deployed configuration. In some embodiments, the medical system further includes at least one flexible line arranged to physically couple the proximal and the distal portions of the structure together, the at least one flexible line manipulable to vary a distance between the proximal and the distal portions of the structure when the structure is in the deployed configuration.
(111) The medical system may further include at least one actuator selectively operable to act on at least one of the proximal and the distal portions of the structure to distort a respective one of the first domed shape and the second domed shape when the structure is in the deployed configuration. Each of the first domed shape and the second domed shape may have a respective volume therein, and the medical system may further include at least one actuator selectively operable to act on the structure to vary the respective volume of at least one of the first domed shape and the second domed shape when the structure is in the deployed configuration. The medical system may further include at least one actuator selectively operable to act on at least one of the proximal and the distal portions of the structure to vary a difference between the respective volumes of the first and the second domed shapes when the structure is in the deployed configuration.
(112) Each of the proximal and the distal portions of the structure may be arranged to pivot with respect to one another about a pivot location when the structure is in the deployed configuration. Each of the first domed shape and the second domed shape may include a respective apex and a respective height extending normally from a respective spatial plane to the respective apex, each respective spatial plane positioned to intersect the pivot location. The medical system may further include at least one actuator selectively operable to act on at least one of the proximal and the distal portions of the structure to vary at least one of a magnitude of the respective height of the first domed shape and a magnitude of the respective height of the second domed shape when the structure is in the deployed configuration.
(113) The structure may further include a plurality of elongate members, each of the proximal and the distal portions of the structure comprising a respective portion of each elongate member of the plurality of elongate members. Each elongate member of at least some of the plurality of elongate members may cross at least one other elongate member of the plurality of elongate members at least at one location between the proximal and the distal portions of the structure when the structure is in the deployed configuration. Each elongate member of the plurality of elongate members may include a first end, a second end, and a respective length between the first end and the second end. Each elongate member of at least some of the plurality of elongate members may cross at least one other elongate member of the plurality of elongate members at each of a plurality of spaced apart locations along the respective length of at least the one other elongate member of the plurality of elongate members when the structure is in the deployed configuration. The plurality of spaced apart locations along the respective length of at least the one other elongate member of the plurality of elongate members may include at least one location between the respective portion of the one other elongate member of the plurality of elongate members comprised by the proximal portion of the

structure and the respective portion of the one other elongate member of the plurality of elongate members comprised by the distal portion of the structure. At least some of the plurality of elongate members may be fanned with respect to one another about an axis that passes through a location between the proximal and the distal portions of the structure when the structure is in the deployed configuration.

(114) Each elongate member of the plurality of elongate members may include a first end, a second end, an intermediate portion positioned between the first end and the second end, and a thickness, the respective intermediate portion of each elongate member including a front surface and a back surface opposite across the thickness from the front surface. The respective intermediate portions of the plurality of elongate members may be arranged front surface-toward-back surface in a stacked array when the structure is in the delivery configuration. The respective intermediate portion of each elongate member of at least some of the plurality of elongate members may include a slotted opening between the respective first and the second ends of the elongate member, at least two of the slotted openings arranged to cross one another when the structure is in the deployed configuration. The medical system may further include at least one actuator selectively operable to act on the structure to change a location where the at least two slotted openings cross one another when the structure is in the deployed configuration.

(115) Various systems may include combinations and subsets of those summarized above.

(116) A medical system may be summarized as including a structure that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a plurality of ends including a proximal end and a distal end. Each elongate member of the plurality of elongate members further includes a respective intermediate portion positioned between the proximal and the distal ends of the elongate member, and a respective length between the proximal and the distal ends of the elongate member. The structure further includes a plurality of couplers arranged to physically couple each elongate member of the plurality of elongate members together with at least one other elongate member of the plurality of elongate members at each of at least two spaced apart locations along the respective length of the elongate member of the plurality of elongate members. A method employing the medical system may be summarized as including providing a catheter sheath that includes a first end, a second end and a lumen extending therebetween, and arranging the structure to have a size suitable for delivery though the lumen of the catheter sheath, each of the elongate members in the structure arranged to be advanced distal end first out from the lumen of the catheter sheath. The method includes expanding the structure to have a size too large for delivery through the lumen of the catheter sheath. The method includes providing at least one of a) relative movement between at least some of the ends in a first set of the proximal ends of the elongate members of the plurality of elongate members to reduce an end-to-end distance between the at least some of the ends in the first set during the expanding or b) relative movement between at least some of the ends in a second set of the distal ends of the elongate members of the plurality of elongate members to reduce an end-to-end distance between the at least some of the ends in the second set during the expanding.

(117) The method may further include providing the relative movement between the at least some of the ends in the first set or between the at least some of the ends in the second set while restraining relative movement between at least some of the ends in the other of the first set and the second set along at least one direction during the expanding. The method may further include providing the relative movement between the at least some of the ends in the first set or between the at least some of the ends in the second set while restraining relative movement between the respective intermediate portions of at least some of the plurality of elongate members along at least one direction during the expanding.

(118) The method may further include providing the relative movement between the at least some of the ends in the first set or between the at least some of the ends in the second set while decreasing a distance between the respective distal end and the respective proximal end of each of

at least some of the plurality of elongate members during the expanding.
(119) The method may further include arranging the respective intermediate portions of at least some of the plurality of elongate members to cross one another at a crossing location, and varying a respective distance between the crossing location and each of the at least some of the ends in the first set or each of the at least some of the ends in the second set. The method may further include arranging the respective intermediate portions of at least some of the plurality of elongate members to cross one another at a crossing location, and providing the relative movement between the at least some of the ends in the first set while varying a respective distance between the crossing location and each of the at least some of the ends in the first set or providing the relative movement between the at least some of the ends in the second set while varying a respective distance between the crossing location and each of the at least some of the ends in the second set. The method may further include arranging the respective intermediate portions of at least some of the plurality of elongate members to cross one another at a crossing location; varying a respective distance between the crossing location and at least a first one of the ends of the respective at least some of the ends in one of the first set and the second set by a first amount; and varying a respective distance between the crossing location and at least a second one of the ends of the respective at least some of the ends in the one of the first set and the second set by a second amount different from the first amount.
(120) The method may further include arranging at least the respective intermediate portions of at least some of the plurality of elongate members to be angularly spaced with respect to one another about a first axis. The respective intermediate portion of each elongate member of the plurality of elongate members may include a thickness, a front surface and a back surface opposite across the thickness from the front surface, and arranging the structure to have the size suitable for delivery through the lumen of the catheter sheath may include arranging the respective intermediate portions of the elongate members with respect to one another front surface-toward-back surface in a stacked array.
(121) Various methods may include combinations and subsets of those summarized above.
(122) A medical system may be summarized as including a structure that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a proximal end, a distal end, a respective intermediate portion positioned between the proximal and the distal ends, and a respective length between the proximal and the distal ends. The structure is selectively moveable between a delivery configuration in which the structure is sized to be delivered through a bodily opening leading to a bodily cavity, and a deployed configuration in which the structure is expanded to have a size too large to be delivered through the bodily opening leading to the bodily cavity. The respective intermediate portions of at least some of the plurality of elongate members are angularly spaced with respect to one another about a first axis and each of the at least some of the plurality of elongate members further includes a curved portion arranged to extend along at least a portion of a respective curved path that intersects the first axis at each of a respective at least two spaced apart locations along the first axis when the structure is in the deployed configuration. A portion of the structure is radially spaced from the first axis by a first dimension when the structure is in the deployed configuration. The medical system further includes at least one actuator operably coupled to the structure to selectively reduce a curvature of the respective curved portion of at least one of the at least some of the plurality of elongate members to increase the first dimension when the structure is in the deployed configuration.
(123) The structure may include a second dimension along the first axis when the structure is in the deployed configuration, and the at least one actuator may be operably coupled to the structure to selectively reduce the curvature of the respective curved portion of the at least one of the at least some of the plurality of elongate members to increase the second dimension when the structure is in the deployed configuration. The at least one actuator may be operably coupled to the structure to selectively reduce the curvature of the respective curved portion of the at least one of the at least

some of the plurality of elongate members to concurrently increase each of the first and the second dimensions. The second dimension may be an overall dimension of the structure along the first axis when the structure is in the deployed configuration. The first axis may pass through the at least one of the at least some of the plurality of elongate members at each of a first location and a second location spaced along the respective length of the at least one of the at least some of the plurality of elongate members from the first location when the structure is in the deployed configuration. The second dimension may be a dimension between the first location and the second location along the first axis.

(124) The portion of the structure may include the respective curved portion of the at least one of the at least some of the plurality of elongate members when the structure is in the deployed configuration. The first axis may pass through the at least one of the at least some of the plurality of elongate members at a first location spaced along the respective length of the at least one of the at least some of the plurality of elongate members from one of the respective proximal end and the respective distal end of the at least one of the at least some of the plurality of elongate members, and the at least one actuator may be operably coupled to the structure to selectively reduce the curvature of the respective curved portion of the at least one of the at least some of the plurality of elongate members to reduce a distance between the first location and the one of the respective proximal end and the respective distal end of the at least one of the at least some of the plurality of elongate members when the structure is in the deployed configuration.

(125) The respective intermediate portion of each elongate member of the plurality of elongate members may include a front surface and a back surface opposite across a thickness of the elongate member. At least the respective intermediate portions of the elongate members of the plurality of elongate members may be arranged with respect to one another front surface-toward-back surface in a stacked array when the structure is in the delivery configuration.

(126) The first axis may pass through at least a first elongate member of the plurality of elongate members at two or more locations when the structure is in the deployed configuration. Each location of the two or more locations may be spaced from another location of the two or more locations along the respective length of at least the first elongate member of the plurality of elongate members. The two or more locations may include at least three locations spaced with respect to one another along the respective length of the first elongate member of the plurality of elongate members.

(127) At least a first elongate member of the plurality of elongate members may cross a second elongate member of the plurality of elongate members in an X configuration at one or more locations along the respective length of the second elongate member spaced from each of the respective proximal end and the respective distal end of the second elongate member when the structure is in the deployed configuration. The structure may further include a plurality of couplers, each coupler of the plurality of couplers arranged to physically couple at least the second elongate member of the plurality of elongate members together with at least one other elongate member of the plurality of elongate members, each coupler of the plurality of couplers spaced from another of the plurality of couplers along the respective length of the second elongate member of the plurality of elongate members. At least one location of the one or more locations may be located along the respective length of the second elongate member of the plurality of elongate members between the respective locations of at least two of the plurality of couplers when the structure is in the deployed configuration. Each elongate member of the plurality of elongate members may be arranged to be advanced distal end first into the bodily cavity when the structure is in the delivery configuration, and at least one location of the one or more locations may be located along the respective length of the second elongate member of the plurality of elongate members relatively closer to the respective distal end of the second elongate member than a respective location of each of at least two of the plurality of couplers when the structure is in the deployed configuration.

(128) Various systems may include combinations and subsets of those summarized above.

(129) A medical system may be summarized as including a device that includes a plurality of elongate members. Each elongate member of the plurality of elongate members includes a first end, a second end, a respective length between the first end and the second end, a thickness, a respective front surface and a respective back surface opposite across the thickness. The plurality of elongate members include at least one elongate member that has a unitary or single piece structure having a plurality of portions arranged between the respective first end and the respective second end of the at least one elongate member. The plurality of portions include at least a first portion, a second portion and a third portion positioned between the first portion and the second portion. Each of the plurality of portions further includes a respective pair of side edges that form a portion of a periphery of at least one of the respective front surface and the respective back surface of the at least one elongate member. The third portion of the at least one elongate member includes a twist about a twist axis extending across at least part of the third portion of the at least one elongate member. The twist in the third portion of the at least one elongate member angularly offsets the second portion of the at least one elongate member from the first portion of the at least one elongate member about the twist axis. In the absence of the twist in the third portion of the at least one elongate member, the plurality of portions of the at least one elongate member are arranged such that the second portion of the at least one elongate member is laterally offset from the first portion of the at least one elongate member across at least a portion of the respective length of the at least one elongate member. At least part of the device is selectively moveable between a delivery configuration in which the elongate members of the plurality of elongate members are arranged in a first arrangement sized for intravascular or percutaneous delivery to a bodily cavity, and a deployed configuration in which the elongate members of the plurality of elongate members are arranged in a second arrangement sized too large for intravascular or percutaneous delivery to the bodily cavity.
(130) The first portion of the at least one elongate member may be bent about a first axis having a directional component extending transversely across at least one of the respective pair of side edges of the first portion of the at least one elongate member when the at least part of the device is in the deployed configuration. The second portion of the at least one elongate member may be bent about a second axis having a directional component extending transversely across at least one of the respective pair of side edges of the second portion of the at least one elongate member when the at least part of the device is in the deployed configuration.
(131) The twist in the third portion of the at least one elongate member may bias the at least one elongate member to autonomously fan with respect to at least one other elongate member of the plurality of elongate members when the plurality of elongate members are advanced into the bodily cavity. The first portion of the at least one elongate member may be preformed to autonomously bend about a first axis to urge the at least one elongate member to fan with respect to at least one other elongate member of the plurality of elongate members when the plurality of elongate members are advanced into the bodily cavity. The second portion of the at least one elongate member may be preformed to autonomously bend about a second axis when the plurality of elongate members are advanced into the bodily cavity. The first axis and the second axis may be non-parallel axes.
(132) In use a first portion of the respective front surface of the at least one elongate member may face towards a first portion of an interior tissue surface within the bodily cavity and a second portion of the respective front surface of the at least one elongate member may face towards a second portion of the interior tissue surface within the bodily cavity when the at least part of the device is moved into the deployed configuration within the bodily cavity, the second portion of the interior tissue surface positioned diametrically opposite to the first portion of the interior tissue surface within the bodily cavity.
(133) At least the second portion of the at least one elongate member may include a volute shape profile when the at least part of the device is in the deployed configuration. The at least one elongate member may include at least a first elongate member and a second elongate member. The

respective second portion of the first elongate member may be laterally offset from the respective first portion of the first elongate member by a first distance across at least the portion of the respective length of the first elongate member in the absence of the twist in the respective third portion of the first elongate member, and the respective second portion of the second elongate member may be laterally offset from the respective first portion of the second elongate member by a second distance across at least the portion of the respective length of the second elongate member in the absence of the twist in the respective third portion of the second elongate member. The second distance may be different from the first distance.
(134) The at least one elongate member may include multiple elongate members of the plurality of elongate members. The respective first portions of the elongate members of the multiple elongate members may be arranged front surface-toward-back surface along a first direction in a first stacked array when the at least part of the device is in the delivery configuration. The respective second portions of the elongate members of the multiple elongate members may be arranged front surface-toward-back surface along a second direction in a second stacked array when the at least part of the device is in the delivery configuration. The first direction and the second direction may be non-parallel directions.
(135) The respective pair of side edges of each portion of the plurality of portions of the at least one elongate member may include a respective first side edge portion arranged on a first side of the at least one elongate member and a respective second side edge portion arranged on a second side of the at least one elongate member, the second side opposite to the first side. At least one of the first side edge portion and the second side edge portion of the second portion of the at least one elongate member may be laterally offset from the corresponding one of the first side edge portion and the second side edge portion of the first portion of the at least one elongate member across at least the portion of the respective length of the at least one elongate member in the absence of the twist in the third portion of the at least one elongate member. The respective first side edge of one of the first portion and the second portion of the at least one elongate member may converge with the respective first side edge of the third portion of the at least one elongate member to enclose an obtuse angle therebetween in the absence of the twist in the third portion of the at least one elongate member. The obtuse angle may extend across the at least one of the respective front surface and the respective back surface of the at least one elongate member towards the respective second side edge of at least one portion of the plurality of portions of the at least one elongate member.
(136) The at least one elongate member may include a flexible circuit structure that includes at least one base layer and at least one electrically conductive layer patterned to provide at least one electrically conductive trace supported directly or indirectly by the at least one base layer, the at least one electrically conductive trace extending along a path across each of at least the first, the third and the second portions of the at least one elongate member. The at least one electrically conductive trace may include at least one jogged portion as viewed perpendicularly to a portion of the surface of the at least one base layer located at least proximate to a location on the surface of the at least one base layer where the path extends across the third portion of the at least one elongate member.
(137) Various systems may include combinations and subsets of those summarized above.
(138) A method for forming a portion of a medical system may be summarized as including providing a plurality of elongate members, each elongate member of the plurality of elongate members including a first end, a second end, a respective length between the first end and the second end, a thickness, a respective front surface and a respective back surface opposite across the thickness. Each elongate member of the plurality of elongate members further includes a plurality of portions arranged between the respective first end and the respective second end of the elongate member. The plurality of portions includes at least a first portion, a second portion and a third portion positioned between the first portion and the second portion. Each of the plurality of

portions further includes a respective pair of side edges that form a portion of a periphery of at least one of the respective front surface and the respective back surface of the elongate member. The respective second portion of each elongate member of at least some of the plurality of elongate members is laterally offset from the respective first portion of the elongate member of the at least some of the plurality of elongate members across at least a portion of the respective length of the elongate member of the at least some of the plurality of elongate members. The method includes for each elongate member in the provided plurality of elongate members, distorting the respective third portion of the elongate member to rotationally offset the respective second portion of the elongate member from the respective first portion of the elongate member along the respective length of the elongate member. The method includes arranging each elongate member in the provided plurality of elongate members into an arrangement, the arrangement configurable to a size suitable for intravascular or percutaneous delivery through an opening in a tissue wall leading to a bodily cavity.

(139) Distorting the respective third portion of the elongate member to rotationally offset the respective second portion of the elongate member from the respective first portion of the elongate member along the respective length of the elongate member may cause the respective third portion of the elongate member to have a twisted shape. Distorting the respective third portion of the elongate member to rotationally offset the respective second portion of the elongate member from the respective first portion of the elongate member along the respective length of the elongate member may include forming at least one twist in the respective third portion of the elongate member about a respective twist axis extending across at least part of the respective third portion of the elongate member.

(140) The at least some of the plurality of elongate members that are provided may include at least a first elongate member and a second elongate member, and the method may further include forming at least one twist in the respective third portion of each of the provided first elongate member and the provided second elongate member about the respective twist axis of each of the provided first elongate member and the provided second elongate member to rotationally offset the respective second portion of the provided first elongate member from the respective first portion of the provided first elongate member along the respective length of the provided first elongate member by a first angular amount and to rotationally offset the respective second portion of the provided second elongate member from the respective first portion of the provided second elongate member along the respective length of the provided second elongate member by a second angular amount. The second angular amount may be different from the first angular amount.

(141) The at least some of the plurality of elongate members that are provided may include at least a first elongate member and a second elongate member, the respective second portion of the provided first elongate member laterally offset from the respective first portion of the provided first elongate member by a first distance across at least the portion of the respective length of the provided first elongate member, and the respective second portion of the provided second elongate member laterally offset from the respective first portion of the provided second elongate member by a second distance across at least the portion of the respective length of the provided second elongate member. The second distance may be different from the first distance.

(142) The method may further include selecting a set of the elongate members from the provided plurality of elongate members and forming at least one twist in the respective third portion of each elongate member in the set of the elongate members to at least in part cause at least the respective second portions of the elongate members in the set of the elongate members to be fanned with respect to one another when at least the respective first portions of each elongate member in the provided plurality of elongate members are arranged into the arrangement. The method may further include selecting a set of the elongate members from the provided plurality of elongate members and bending the respective first portion of each elongate member in the set of the elongate members about a respective bending axis to at least in part cause at least the respective second

portions of the elongate members in the set of the elongate members to be fanned with respect to one another when at least the respective first portions of each elongate member in the provided plurality of elongate members are arranged into the arrangement. Each respective bending axis may be skewed with respect to at least one of the pair of side edges of the respective first portion of the associated elongate member in the set of the elongate members.

(143) The method may further include selecting a set of the elongate members from the provided plurality of elongate members and bending the respective second portion of each elongate member in the set of the elongate members about a respective bending axis such that a first portion of the respective back surface of each elongate member of the set of the elongate members is positioned diametrically opposite to a second portion of the respective back surface of the elongate member in the set of the elongate members.

(144) Arranging each elongate member in the provided plurality of elongate members in the arrangement may include arranging the respective first portions of each elongate member in the provided plurality of elongate members front surface-toward-back surface in a stacked array. The method may further include physically coupling the respective first portions of at least two of the elongate members in the provided plurality of elongate members together and physically coupling the respective second portions of the at least two of the elongate members in the provided plurality of elongate members together. The method may include providing a plurality of flexible circuit structures, each flexible circuit structure of the plurality of flexible circuit structures including at least one base layer and at least one patterned electrically conductive layer. The method may further include interleaving a portion of each flexible circuit structure of the provided plurality of flexible circuit structures with the respective first portions of each elongate member in the provided plurality of elongate members in the array. The respective at least one patterned electrically conductive layer of at least one of the provided plurality of flexible circuits may include at least one electrically conductive trace having at least one jogged portion formed by a patterning process. The method may further include securing each of the at least one of the provided plurality of flexible circuits to a respective one of the provided plurality of elongate members such that the at least one electrically conductive trace extends along a path across each of the first, the third and the second portions of the respective one of the provided plurality of elongate members with the at least one jogged portion of the at least one electrically conductive trace positioned at least proximate to the third portion of the respective one of the provided plurality of elongate members.

(145) The respective pair of side edges of each portion of the plurality of portions of at least one elongate member of the plurality of elongate members may include a respective first side edge arranged on a first side of the at least one elongate member of the plurality of elongate members and a respective second side edge arranged on a second side of the at least one elongate member of the plurality of elongate members, the second side opposite to the first side. Providing the plurality of elongate members may include providing the plurality of elongate members such that at least one of the first side edge and the second side edge of the second portion of the at least one elongate member of the plurality of elongate members is laterally offset from the corresponding one of the first side edge and the second side edge of the first portion of the at least one elongate member of the plurality of elongate members. Providing the plurality of elongate members may include providing the plurality of elongate members such that the at least one elongate member of the plurality of elongate members includes at least one corner formed by a convergence of the respective first side edge of one of the first portion and the second portion of the at least one elongate member of the plurality of elongate members with the respective first side edge of the third portion of the at least one elongate member of the plurality of elongate members. The at least one corner may enclose an angle extending across the at least one of the respective front surface and the respective back surface of the at least one elongate member of the plurality of elongate members towards the respective second edge of at least one portion of the plurality of portions of the at least one elongate member of the plurality of elongate members.

(146) Various methods may include combinations and subsets of those summarized above.
(147) A medical system may be summarized as including a device that includes a plurality of transducer element sets and a plurality of flexible circuit structures. Each transducer element set includes one or more transducer elements. Each flexible circuit structure includes a respective at least one base layer, each at least one base layer including a first end, a second end, a respective length between the first end and the second end, a thickness, a respective front surface and a respective back surface opposite across the thickness, and a respective plurality of portions arranged between the first end and the second end. Each portion of the plurality of portions further includes a respective pair of side edges that form a portion of a periphery of at least one of the respective front surface and the respective back surface of the at least one base layer. Each respective plurality of portions further includes at least a first portion, a second portion and a third portion positioned between the first portion and the second portion. The respective third portion of each at least one base layer further includes a twist arranged to rotationally offset the second portion of the at least one base layer from the first portion of the at least one base layer along the respective length of the at least one base layer. Each flexible circuit structure further includes a respective at least one patterned electrically conductive layer. Each at least one patterned electrically conductive layer is arranged to provide at least one electrically conductive trace supported at least indirectly by the respective at least one base layer of the flexible circuit structure. Each at least one electrically conductive trace is electrically connected to a respective one of the plurality of transducer element sets, and each at least one electrically conductive trace extends along a path across each of the first, the third and the second portions of the respective at least one base layer of the flexible circuit structure. For each of at least some of the plurality of flexible circuit structures, the respective at least one electrically conductive trace includes at least one jogged portion as viewed normally to a portion of the front surface of the respective at least one base layer located at least proximate to a location on the front surface of the respective at least one base layer where the path extends across the respective third portion of the respective at least one base layer. At least part of the device is selectively moveable between an unexpanded configuration in which the flexible circuit structures of the plurality of flexible circuit structures are arranged in a first arrangement sized for delivery through a bodily opening leading to a bodily cavity, and an expanded configuration in which the flexible circuit structures of the plurality of flexible circuit structures are arranged in a second arrangement sized too large for delivery through the bodily opening leading to the bodily cavity.
(148) The flexible circuit structures in the plurality of flexible circuit structures may be arranged such that the respective first portions of each at least one base layer are arranged front surface-toward-back surface in a first stacked array and the respective second portions of each at least one base layer are arranged front surface-toward-back surface in a second stacked array when the at least part of the device is in the unexpanded configuration. The flexible circuit structures in the plurality of flexible circuit structures may be arranged such that at least the respective second portions of each at least one base layer are arranged in a fanned array when the at least part of the device is in the expanded configuration. The twist in the respective third portion of the at least one base layer of each flexible circuit structure of the at least some of the plurality of flexible circuits may bias the respective second portion of the at least one base layer of the flexible circuit structure of the at least some of the plurality of flexible circuit structures into the fanned array as the plurality of flexible circuit structures are advanced into the bodily cavity.
(149) The respective first portion of the at least one base layer of each flexible circuit structure of the at least some of the plurality of flexible circuit structures may be preformed to bend about a respective bending axis to bias the respective second portion of the at least one base layer of the flexible circuit structure of the at least some of the plurality of flexible circuit structures into the fanned array as the plurality of flexible circuit structures are advanced into the bodily cavity.
(150) The respective second end of the at least one base layer of each of the at least some of the

plurality of flexible circuit structures may move along a curved path that bends back on itself when the at least part of the device is selectively moved from the unexpanded configuration to the expanded configuration. At least part of the curved path may be a volute path. The respective second portion of the at least one base layer of each flexible circuit structure of the at least some of the plurality of flexible circuit structures may include a volute shape profile when the at least part of the device is in the expanded configuration. A first portion of the respective front surface of the at least one base layer of at least one of the plurality of flexible circuit structures may face towards a first portion of an interior tissue surface within the bodily cavity and a second portion of the respective front surface of the at least one base layer of the at least one of the plurality of flexible circuit structures may face towards a second portion of the interior tissue surface within the bodily cavity when the at least part of the device is moved into the expanded configuration within the bodily cavity, the second portion of the interior tissue surface positioned diametrically opposite to the first portion of the interior tissue surface within the bodily cavity.

(151) Various systems may include combinations and subsets of those summarized above.

(152) A medical system may be summarized as including a structure including a plurality of elongate members, each elongate member of the plurality of elongate members including a proximal end, a distal end and a respective intermediate portion positioned between the proximal and the distal ends, the structure selectively moveable between an unexpanded configuration in which the structure is suitably sized to be percutaneously delivered to a bodily cavity and an expanded configuration in which the structure has a size too large to be percutaneously delivered to the bodily cavity, each of the respective intermediate portions of the plurality of elongate members radially arranged with respect to one another about a first axis when the structure is in the expanded configuration, and each of the respective intermediate portions of the plurality of elongate members radially spaced from the first axis when the structure is in the expanded configuration; a flexible shaft member, a portion of the flexible shaft member sized to be percutaneously delivered to the bodily cavity, the flexible shaft member including a first end portion and a second end portion spaced from the first end portion across an elongated portion of the flexible shaft member, the structure physically coupled to the flexible shaft member at least proximate the second end portion of the flexible shaft member; and at least one actuator selectively operable to concurrently rotate the intermediate portions of all of the plurality of elongate members at least partially about at least the first axis when the structure is in the expanded configuration, the intermediate portions of all of the plurality of elongate members moved relative to at least the second end portion of the flexible shaft member by the at least one actuator when the structure is in the expanded configuration.

(153) One of the respective proximal and distal ends of each of the elongate members may be fixedly coupled to the flexible shaft member. The respective proximal end, the respective distal end, or each of the respective proximal and distal ends of each of the elongate members may be fixedly coupled to the flexible shaft member. The structure may be rotationally coupled to the second end portion of the flexible shaft member. The second end portion of the flexible shaft member may include a surface, a portion of the surface positioned at an end of the flexible shaft member, the portion of the surface circumferentially arranged about a second axis, and wherein the intermediate portions of all of the plurality of elongate members may be concurrently rotated at least partially about the second axis by the at least one actuator when the structure is in the expanded configuration. The second end portion of the flexible shaft member may include a surface, a portion of the surface positioned at an end of the flexible shaft member, the portion of the surface circumferentially arranged about a second axis, and wherein the intermediate portions of all of the plurality of elongate members are not rotated, even partially, about the second axis by the at least one actuator when the structure is in the expanded configuration. The second end portion of the flexible shaft member may include a surface, a portion of the surface positioned at an end of the flexible shaft member, the portion of the surface circumferentially arranged about a second axis, the second axis parallel to the first axis when the structure is in the expanded configuration. The

second end portion of the flexible shaft member may include a surface, a portion of the surface positioned at an end of the flexible shaft member, the portion of the surface circumferentially arranged about a second axis, the second axis not parallel to the first axis when the structure is in the expanded configuration. The medical system may further include a biasing device that opposes rotation of the intermediate portions of all of the plurality of elongate members about at least the first axis when the structure is in the expanded configuration. The biasing device may be provided at least in part by a respective resilient portion of each of at least some of the elongate members. Each of at least some of the plurality of elongate members may include a respective length between the respective proximal and distal ends, and a plurality of portions arranged between the respective proximal and distal ends, each respective plurality of portions further including at least a first elongate member portion, a second elongate member portion and a twisted elongate member portion positioned between the first elongate member portion and the second elongate member portion, the respective twisted elongate member portion of each elongate member of the at least some of the plurality of elongate members arranged to rotationally offset the second elongate member portion from the first elongate member portion along the respective length of the elongate member of the at least some of the plurality of elongate members. Each first elongate member portion may be adjacent the corresponding twisted elongate member portion, and the medical system may further include a biasing device that opposes rotation of the intermediate portions of all of the plurality of elongate members about at least the first axis when the structure is in the expanded configuration, wherein the biasing device is provided at least in part by the respective first elongate member portion of each elongate member of the at least some of the plurality of elongate members. The medical system may further include a biasing device that opposes rotation of the intermediate portions of all of the plurality of elongate members about at least the first axis when the structure is in the expanded configuration, wherein the biasing device is provided at least in part by the respective twisted elongate member portion of each elongate member of the at least some of the plurality of elongate members. The expanded configuration may be a first expanded configuration in which the respective intermediate portion of each of at least some of the plurality of elongate members is radially spaced from the first axis by a respective first radial distance, the structure further selectively moveable between the first expanded configuration and a second expanded configuration in which the respective intermediate portion of each of the at least some of the plurality of elongate members is radially spaced from the first axis by a respective second radial distance, each second radial distance having a greater magnitude than a magnitude of the corresponding first radial distance. The intermediate portions of the plurality of elongate members may be circumferentially arranged about the first axis when the structure is in the expanded configuration. Each location on the structure to which the flexible shaft member is physically coupled to may be positioned to a same side of at least one plane when the structure is in the expanded configuration, and each plane of the at least one plane may be coincident with the first axis. The medical system may further include a plurality of transducer elements, at least some of the plurality of transducer elements located on each of at least some of the plurality of elongate members. Each of the plurality of transducer elements may include an electrode, wherein energy is selectively transmittable from each electrode, the energy sufficient for tissue ablation. At least a portion of the flexible shaft member may be directly manipulable by a user to percutaneously deliver the structure to the bodily cavity when the structure is in the unexpanded configuration. The at least a portion of the flexible shaft member may include at least part of the elongated portion of the flexible shaft member. At least part of the flexible shaft member may be moved through a lumen of a catheter sheath when the structure is percutaneously delivered to the bodily cavity, a surface of the flexible shaft member arranged to contact a surface of the lumen during at least part of the percutaneous delivery of the structure. The respective intermediate portion of each elongate member of the plurality of elongate members may include a thickness, a front surface, and a back surface opposite across the thickness from the front surface, and wherein the respective intermediate portions of the plurality of elongate members may be arranged front surface-toward-back surface in a stacked array when the structure is in the unexpanded configuration. The structure may further include a proximal portion and a distal portion, each of the proximal and the distal portions including a respective part of each of the plurality of elongate members, the proximal portion of the structure forming a first domed shape and the distal portion of the structure forming a second domed shape when the structure is in the deployed configuration. The structure may include a proximal portion and a distal portion, the structure arranged to be advanced distal portion first into the bodily cavity in the unexpanded configuration, the proximal portion of the structure forming a first domed shape and the distal portion of the structure forming a second domed shape when the structure is in the expanded configuration, and the proximal and the distal portions of the structure arranged in a clam shell configuration when the structure is in the expanded configuration. The plurality of elongate members may include a first set of the elongate members and a second set of the elongate members, the second set of the elongate members different than the first set of the elongate members, and wherein when the structure is moved between the unexpanded configuration and the expanded configuration, the respective intermediate portion of each elongate member in the first set of the elongate members is rotated in a first rotational direction and the respective intermediate portion of each elongate member in the second set of the elongate members is rotated in a second rotational direction, the second rotational direction opposite to the first rotational direction. The at least one actuator may be selectively operable to rotate the intermediate portions of all of the plurality of elongate members about at least the first axis in at least one of the first or the second rotational directions when the structure is in the expanded configuration.

(154) Various systems may include combinations and subsets of those summarized above.

(155) A medical system may be summarized as including a structure including a plurality of elongate members including a first set of the elongate members and a second set of the elongate members, the second set of the elongate members different than the first set of the elongate members, each elongate member of the plurality of elongate members including a proximal end, a distal end and a respective intermediate portion positioned between the proximal and the distal ends, the structure selectively moveable between: an unexpanded configuration in which the structure is sized to be percutaneously delivered to a bodily cavity, and an expanded configuration in which the structure has a size too large to be percutaneously delivered to the bodily cavity, each of the respective intermediate portions of the plurality of elongate members radially arranged with respect to one another about a first axis and each of the respective intermediate portions of the plurality of elongate members radially spaced from the first axis when the structure is in the expanded configuration, at least one elongate member of the plurality of elongate members further including a respective curved portion arranged to extend along at least a portion of a respective curved path that intersects the first axis at each of a respective at least two spaced apart locations along the first axis when the structure is in the expanded configuration, wherein: when the structure is moved between the unexpanded configuration and the expanded configuration, the respective intermediate portion of each elongate member in the first set of the elongate members is rotated in a first rotational direction and the respective intermediate portion of each elongate member in the second set of the elongate members is rotated in a second rotational direction, the second rotational direction opposite to the first rotational direction.

(156) The structure may be moved between the unexpanded configuration and the expanded configuration, the respective intermediate portion of each elongate member in the first set of the elongate members may be rotated at least partially about the first axis in the first rotational direction and the respective intermediate portion of each elongate member in the second set of the elongate members may be rotated at least partially about the first axis in the second rotational direction. The medical system may further include at least one actuator selectively operable to rotate the intermediate portion of each of at least some of the plurality of elongate members about

at least the first axis in at least one of the first rotational direction or the second rotational direction when the structure is in the expanded configuration, the at least some of the plurality of elongate members including each elongate member in the first set of the elongate members and each elongate member in the second set of the elongate members. The medical system may further include at least one actuator selectively operable to rotate the intermediate portion of each of at least some of the plurality of elongate members about at least the first axis between two modes when the structure is in the expanded configuration, the two modes including a first mode in which the intermediate portion of each elongate member of the at least some of the plurality of elongate members is rotated about at least the first axis in the first rotational direction, and a second mode in which the intermediate portion of each of at least some of the plurality of elongate members is rotated about at least the first axis in the second rotational direction, the at least some of the plurality of elongate members including each elongate member in the first set of the elongate members and each elongate member in the second set of the elongate members. The medical system may further include a flexible shaft member, a portion of the flexible shaft member sized to be percutaneously delivered to the bodily cavity, the flexible shaft member including a first end portion and a second end portion spaced from the first end portion across an elongated portion of the flexible shaft member, the structure physically coupled to the flexible shaft member at least proximate the second end portion of the flexible shaft member, the second end portion of the flexible shaft member including a surface, a portion of the surface positioned at an end of the flexible shaft member, the portion of the surface circumferentially arranged about a second axis, wherein when the structure is moved between the unexpanded configuration and the expanded configuration, the respective intermediate portion of each elongate member in the first set of the elongate members is moved away from the second axis in a first direction and the respective intermediate portion of each elongate member in the second set of the elongate members is moved away from the second axis in a second direction, the second direction opposite to the first direction. The second axis may not be parallel to the first axis when the structure is in the expanded configuration. The first direction may include a first rotational direction component and the second direction may include a second rotational direction component opposite to the first rotational direction component, and the medical system may further include at least one actuator selectively operable to rotate the intermediate portion of each of at least some of the plurality of elongate members about at least the first axis in at least one of the first rotational direction component or the second rotational direction component when the structure is in the expanded configuration, the at least some of the plurality of elongate members including each elongate member in the first set of the elongate members and each elongate member in the second set of the elongate members. The first direction may include a first rotational direction component and the second direction may include a second rotational direction component opposite to the first rotational direction component, and the at least one actuator may be selectively operable to rotate the intermediate portion of each of at least some of the plurality of elongate members about at least the first axis between two modes when the structure is in the expanded configuration, the two modes including a first mode in which the intermediate portion of each of the at least some of the plurality of elongate members is rotated about at least the first axis in the first rotational direction component, and a second mode in which the intermediate portion of each of the at least some of the plurality of elongate members is rotated about at least the first axis in the second rotational direction component, the at least some of the plurality of elongate members including each elongate member in the first set of the elongate members and each elongate member in the second set of the elongate members. The intermediate portions of the plurality of elongate members may be circumferentially arranged about the first axis when the structure is in the expanded configuration. The at least one elongate member of the plurality of elongate members may include all of the plurality of elongate members, the respective curved portions of the plurality of elongate members circumferentially arranged about the first axis when the structure is in the expanded configuration. The at least one

elongate member of the plurality of elongate members may include at least two of the plurality of elongate members, at least some of the respective curved portions of the at least two of the plurality of elongate members arranged on each side of a plane when the structure is in the expanded configuration, the plane coincident with the first axis.
(157) Various systems may include combinations and subsets of those summarized above.
(158) A medical system may be summarized as including a structure including a plurality of elongate members, each elongate member of the plurality of elongate members including a proximal end, a distal end and a respective intermediate portion positioned between the proximal and the distal ends, the structure selectively moveable between an unexpanded configuration in which the structure is suitably sized to be percutaneously delivered to a bodily cavity and an expanded configuration in which the structure has a size too large to be percutaneously delivered to the bodily cavity, each of the respective intermediate portions of the plurality of elongate members radially arranged with respect to one another about a first axis when the structure is in the expanded configuration, and each of the respective intermediate portions of the plurality of elongate members radially spaced from the first axis when the structure is in the expanded configuration; a flexible shaft member, a portion of the flexible shaft member sized to be percutaneously delivered to the bodily cavity, the flexible shaft member including a first end portion and a second end portion spaced from the first end portion across an elongated portion of the flexible shaft member, the structure physically coupled to the flexible shaft member at least proximate the second end portion of the flexible shaft, the second end portion of the flexible shaft member including a surface positioned at an end of the flexible shaft member, the portion of the surface circumferentially arranged about a second axis; and at least one actuator selectively operable to rotate the intermediate portion of each of at least some of the plurality of elongate members about at least the first axis when the structure is in the expanded configuration, the intermediate portion of each of the at least some of the plurality of elongate members rotating about each of the first axis and the second axis by different respective angular amounts when the at least one actuator rotates the intermediate portion of each of the at least some of the plurality of elongate members about at least the first axis when the structure is in the expanded configuration.
(159) The intermediate portion of each of the at least some of the plurality of elongate members may be rotated about the first axis by a respective first angular amount and may be rotated about the second axis by a respective second angular amount when the at least one actuator rotates the intermediate portion of each of the at least some of the plurality of elongate members about at least the first axis when the structure is in the expanded configuration, each first angular amount being greater than the corresponding second angular amount. The intermediate portion of each of the at least some of the plurality of elongate members may not be rotated about the second axis when the at least one actuator rotates the intermediate portion of each of the at least some of the plurality of elongate members about at least the first axis when the structure is in the expanded configuration. The second axis may not be parallel to the first axis when the structure is in the expanded configuration. The second axis may not be collinear with the first axis when the structure is in the expanded configuration. The at least some of the plurality of elongate members may include all of the plurality of elongate members.
(160) Various systems and methods may include combinations and subsets of all those summarized above.
(161) In any of the above systems, at least some of the elongate members may each include respective ones of one or more transducers.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) In the drawings, identical reference numbers identify similar elements or acts. The sizes and relative positions of elements in the drawings are not necessarily drawn to scale. For example, the shapes of various elements and angles are not drawn to scale, and some of these elements are arbitrarily enlarged and positioned to improve drawing legibility. Further, the particular shapes of the elements as drawn are not intended to convey any information regarding the actual shape of the particular elements, and have been solely selected for ease of recognition in the drawings.

(2) FIG. **1** is a cutaway diagram of a heart showing a medical device according to one illustrated embodiment percutaneously placed in a left atrium of the heart.

(3) FIG. **2** is a partially schematic diagram of a medical system according to one illustrated embodiment, including a control unit, a display and a medical device having an expandable frame and an assembly of elements.

(4) FIG. **3**A is an isometric view of a frame in a first or unexpanded configuration according to one illustrated embodiment.

(5) FIG. **3**B is an isometric view of an example of the frame of FIG. **3**A in a second or bent configuration.

(6) FIG. **3**C is an isometric view of an example of the frame of FIG. **3**A in a third or expanded configuration.

(7) FIG. **3**D is an exploded isometric view of an elongate member including a flexible circuit structure employed in the frame of FIG. **3**A.

(8) FIG. **3**E is a cross-sectional view of the frame of FIG. **3**A in a catheter sheath.

(9) FIGS. **4**A, **4**B, **4**C, **4**D and **4**E are sequential elevation views of a portion of a device positioned within a bodily cavity at five successive intervals of time according to an illustrated embodiment, including a control unit illustrated in FIGS. **4**B-**4**E.

(10) FIG. **4**F is a partially exploded isometric view of an elongate member of FIGS. **4**A, **4**B, **4**C, **4**D and **4**E including a flexible circuit structure.

(11) FIG. **4**G is a cross-section view of a first set and a second set of various ones of the elongate members of FIGS. **4**A, **4**B, **4**C, **4**D and **4**E arranged in a second or bent configuration.

(12) FIG. **4**H is a cross-section view of the first set and the second set of the elongate members of FIG. **4**G arranged in a third or expanded configuration.

(13) FIG. **5**A is an isometric view of a portion of a device that includes an arrangement of elongate members in a first/unexpanded configuration received via a catheter sheath, according to one example embodiment.

(14) FIG. **5**B is an isometric view of an elongate member of the device of FIG. **5**A.

(15) FIG. **5**C is an isometric view of the portion of the device of FIG. **5**A extending from the catheter sheath positioned in a second/bent configuration.

(16) FIGS. **5**D and **5**E are isometric views of the portion of the device of FIG. **5**A extending from the catheter sheath in a third/expanded or fanned configuration.

(17) FIGS. **5**F and **5**G are respective top plan views of the isometric views of a portion of the device extending from the catheter sheath shown in the configurations of FIGS. **5**D and **5**E, respectively.

(18) FIG. **5**H is a schematic representation of an elongate member of the device of FIG. **5**A crossed by various portions of another elongate member in the third/expanded or fanned configuration.

(19) FIG. **6**A is a side elevation view a portion of a device that includes a number of elongate members extending from a catheter sheath and in an initial configuration according to another example embodiment.

(20) FIG. **6**B is an isometric view of a representative one of the elongate members of the device of FIG. **6**A, and a projection of that elongate member.

(21) FIGS. **6**C, **6**D, **6**E, and **6**F are various side elevation views of a portion of the device in FIG.

6A positioned within a bodily cavity at four successive intervals of time according to an example embodiment.

(22) FIGS. **6**G and **6**H are various perspective views of the elongate members of the device of FIG. **6**A extending from the catheter sheath, the elongate members arranged in a first expanded or fanned array.

(23) FIG. **6**I is a sectioned side elevation view of the elongate members of the device of FIG. **6**A extending from the catheter sheath, the elongate members arranged in a first expanded or fanned array.

(24) FIG. **6**J is a partially sectioned end elevation view of the elongate members of the device of FIG. **6**A extending from the catheter sheath, the elongate members arranged in a first expanded or fanned array.

(25) FIGS. **6**K and **6**L are various isometric views of the elongate members of the device of FIG. **6**A extending from the catheter sheath, the elongate members arranged in a second expanded or fanned array.

(26) FIG. **6**M is a sectioned side elevation view of the elongate members of the device of FIG. **6**A extending from the catheter sheath, the elongate members arranged in a second expanded or fanned array.

(27) FIG. **6**N is a schematic representation of an elongate member of the device of FIG. **6**A crossed by various portions of another elongate member in a first expanded or fanned array.

(28) FIG. **6**O is a schematic representation of an elongate member of the device of FIG. **6**A crossed by various portions of another elongate member in a second expanded or fanned array.

(29) FIG. **7**A is an isometric view of a portion of a device that includes a number of elongate members extending from a catheter sheath in an initial configuration according to another example embodiment.

(30) FIG. **7**B is an isometric view of a representative one of the elongate members of the device of FIG. **7**A.

(31) FIGS. **7**C, **7**D, **7**E, and **7**F are various isometric views of the portion of the device of FIG. **7**A extending at least partially from the catheter sheath and positioned at four successive intervals of time according to an example embodiment.

(32) FIG. **7**G is a plan view of various elongate members that are provided to form at least a portion of respective ones of the elongate members employed by the device of FIG. **7**A.

(33) FIG. **7**H is an isometric view of a representative flexible circuit structure provided to form at least a portion of a respective one of the elongate members employed by the device of FIG. **7**A.

(34) FIG. **7**I is an isometric view of one of the provided elongate members of FIG. **7**G distorted by a first distorting process according to an example embodiment.

(35) FIG. **7**J is an isometric view of an assemblage of a portion of a flexible circuit structure and the provided elongate member of FIG. **7**I.

(36) FIG. **7**K is an isometric view of the assemblage of the flexible circuit structure and the provided elongate member of FIG. **7**J distorted by a second distorting process according to an example embodiment.

(37) FIG. **7**L is a side view of a portion of an arrangement of elongate members as per an example embodiment.

(38) FIGS. **7**L (A-A), **7**L (B-B) and **7**L (C-C) are various cross-sectional views of the arrangement of elongate members of FIG. **7**L taken along section lines A-A, B-B and C-C, respectively.

(39) FIG. **7**M are respective side and end elevation views of each elongate member of the arrangement of elongate members of FIG. **7**L.

(40) FIG. **8** is a flow diagram representing a method according to one example embodiment.

(41) FIG. **9**A is an isometric view of a portion of a device that includes a number of elongate members extending from a catheter sheath in a deployed configuration according to another example embodiment.

(42) FIG. **9**B is a partially sectioned plan view of the portion of the device of FIG. **9**A.
(43) FIG. **9**C is an isometric view of the portion of device of FIG. **9**A extending from the catheter sheath after undergoing an additional manipulation in the deployed configuration.
(44) FIG. **9**D is a partially sectioned plan view of the portion of the device of FIG. **9**C.
(45) FIG. **10**A is a view of a structure in an unexpanded configuration according to various embodiments.
(46) FIG. **10**B is a view of an example of the structure of FIG. **10**A in an expanded configuration according to various embodiments.
(47) FIG. **11**A is a partially schematic isometric view of a structure that includes a plurality of elongate members, the structure in an unexpanded configuration according to various embodiments.
(48) FIG. **11**B is an isometric view of an example of the structure of FIG. **11**A in an expanded configuration according to various embodiments.
(49) FIG. **11**C is a plan view of the structure of FIG. **11**B in the expanded configuration.
(50) FIG. **11**D is a plan view of the structure of FIG. **11**C, an intermediate portion of each of a number of the plurality of elongate members rotated in a first rotational direction according to various embodiments.
(51) FIG. **11**E is a plan view of the structure of FIG. **11**C, an intermediate portion of each of a number of the plurality of elongate members rotated in a second rotational direction opposite the first rotational direction according to various embodiments.

DETAILED DESCRIPTION

(52) In the following description, certain specific details are set forth in order to provide a thorough understanding of various embodiments of the invention. However, one skilled in the art will understand that the invention may be practiced without these details. In other instances, well-known structures associated with Radio Frequency (RF) ablation and electronic controls such as multiplexers have not been shown or described in detail to avoid unnecessarily obscuring descriptions of the embodiments of the invention.
(53) The word “ablation” should be understood to mean any disruption to certain properties of the tissue. Most commonly, the disruption is to the electrical conductivity and is achieved by heating, which can be generated with resistive or of Radio Frequencies (RF) techniques for example. Other properties, such as mechanical or chemical, and other means of disruption, such as optical, are included when the term “ablation” is used.
(54) The word “fluid” should be understood to mean any fluid that can be contained within a bodily cavity or can flow into or out, or both into and out of a bodily cavity via one or more bodily openings positioned in fluid communication with the bodily cavity. In the case of cardiac applications, fluid such as blood will flow into and out of various intra-cardiac cavities (e.g., the left atrium and the right atrium).
(55) The words “bodily opening” should be understood to be a naturally occurring bodily opening or channel or lumen; a bodily opening or channel or lumen formed by an instrument or tool using techniques that can include, but are not limited to, mechanical, thermal, electrical, chemical, and exposure or illumination techniques; a bodily opening or channel or lumen formed by trauma to a body; or various combinations of one or more of the above. Various elements having respective openings, lumens or channels and positioned within the bodily opening (e.g., a catheter sheath) may be present in various embodiments. These elements may provide a passageway through a bodily opening for various devices employed in various embodiments.
(56) The word “tissue” should be understood to mean any tissue that is used to form a surface within a bodily cavity, a surface of a feature within a bodily cavity or a surface of a feature associated with a bodily opening positioned in fluid communication with the bodily cavity. The tissue can include part or all of a tissue wall or membrane that includes a surface that defines a surface of the bodily cavity. In this regard, the tissue can form an interior surface of the cavity that

surrounds a fluid within the cavity. In the case of cardiac applications, tissue can include tissue used to form an interior surface of an intra-cardiac cavity such as a left atrium or right atrium.
(57) The term “transducer element” in this disclosure should be interpreted broadly as any device capable of distinguishing between fluid and tissue, sensing temperature, creating heat, ablating tissue and measuring electrical activity of a tissue surface, or any combination thereof. A transducer element can convert input energy of one form into output energy of another form. Without limitation, a transducer element can include an electrode or a sensing device. A transducer element may be constructed from several parts, which may be discrete components or may be integrally formed.
(58) Reference throughout this specification to “one embodiment” or “an embodiment” or “an example embodiment” or “an illustrated embodiment” means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearances of the phrases “in one embodiment” or “in an embodiment” or “in an example embodiment” or “in this illustrated embodiment” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner in one or more embodiments.
(59) Various embodiments of percutaneously or intravascularly deployed medical devices are described herein. Many of the described devices are moveable between a delivery or unexpanded configuration in which a portion of the device is sized for passage though a bodily opening leading to cavity within a body, and a deployed or expanded configuration in which the portion of the device has a size too large for passage through the bodily opening leading to the cavity. In some example embodiments, the device senses characteristics (e.g., convective cooling, permittivity, force) that distinguish between fluid (e.g., blood) and tissue forming an interior surface of the bodily cavity. Such sensed characteristics allow a medical system to map the cavity, for example using positions of openings or ports into and out of the cavity to determine a position or orientation (i.e., pose), or both a position and orientation of the portion of the device in the bodily cavity. In some example embodiments, the devices are capable of ablating tissue in a desired pattern within the bodily cavity. In some example embodiments, the devices are capable of sensing characteristics (e.g., electrical activity) indicative of whether an ablation has been successful. In some example embodiments, the devices are capable of providing stimulation (e.g., electrical stimulation) to tissue within the bodily cavity. Electrical stimulation may include pacing.
(60) An example of the mapping performed by devices according to various embodiments would be to locate the position of various bodily openings leading to the pulmonary veins as well as the mitral valve on the interior surface of the left atrium. In some example embodiments, the mapping is based at least on locating such bodily openings by differentiating between fluid and tissue. There are many ways to differentiate tissue from a fluid such as blood or to differentiate tissue from a bodily opening in case a fluid is not present. By the way of example, three approaches may include: 1. The use of convective cooling of heated transducer elements by the blood. A slightly heated arrangement of transducer elements that is positioned adjacent to the tissue that forms the interior surface(s) of the atrium and across the ports of the atrium will be cooler at the areas which are spanning the ports carrying blood flow. For example, commonly assigned U.S. Patent Application Publication 2008/0004534 A1, which is herein incorporated by reference in its entirety, describes a heart chamber mapping system based on the convective cooling effect of blood flow. 2. The use of the differing change in dielectric constant as a function of frequency between blood and tissue. An arrangement of transducer elements positioned around the tissue that forms the interior surface(s) of the atrium and across the ports of the atrium monitors the ratio of the dielectric constant from 1 KHz to 100 KHz. Such can be used to determine which of those transducer elements are not proximate to tissue, which is indicative of the locations of the ports. 3. The use of transducer elements that sense force (i.e., force sensors). A set of force detection transducer elements

positioned around the tissue that forms the interior surface of the atrium and across the ports of the atrium can be used to determine which of the transducer elements are not in contact with the tissue, which is indicative of the locations of the ports.

(61) FIG. **1** shows a device **100** useful in investigating or treating, or both investigating and treating a bodily organ, for example a heart **102**, according to one illustrated embodiment.

(62) Device **100** can be percutaneously or intravascularly inserted into a portion of the heart **102**, such as an intra-cardiac cavity like left atrium **104**. In this example, the device **100** is part of a catheter **106** inserted via the inferior vena cava **108** and penetrating through a bodily opening in transatrial septum **110** from right atrium **112**. In other embodiments, other paths may be taken.

(63) Catheter **106** includes an elongated flexible rod or shaft member appropriately sized to be delivered percutaneously or intravascularly. Catheter **106** may include one or more lumens (not shown). The lumen(s) may carry one or more communications or power paths, or both communications and power paths, for example one or more electrical conductors **116**. Electrical conductors **116** provide electrical connections to device **100** that are accessible externally from a patient in which device **100** is inserted.

(64) As discussed in more detail herein, device **100** includes a structure or frame **118** which assumes an unexpanded configuration for delivery to left atrium **104**. Frame **118** is expanded (i.e., shown in an expanded configuration in FIG. **1**) upon delivery to left atrium **104** to position a plurality of transducer elements **120** (only three called out in FIG. **1**) proximate the interior surface formed by tissue **122** of left atrium **104**. In this example embodiment, at least some of the transducer elements **120** are used to sense a physical characteristic of a fluid (i.e., blood) or tissue **122**, or both, that may be used to determine a position or orientation (i.e., pose), or both of a portion of a device **100** within, or within respect to left atrium **104**. For example, transducer elements **120** may be used to determine a location of pulmonary vein ostia (not shown) and/or a mitral valve **126**. In this example embodiment, at least some of the transducer elements **120** may be used to selectively ablate portions of the tissue **122**. For example, some of the elements may be used to ablate a pattern around the bodily openings, ports or pulmonary vein ostia, for instance to reduce or eliminate the occurrence of atrial fibrillation.

(65) FIG. **2** schematically shows a system that includes a device **200** according to one illustrated embodiment. Device **200** includes a plurality of flexible strips **204** (three called out in FIG. **2**) and a plurality of transducer elements **206** (three called out in FIG. **2**) arranged to form a two- or three-dimensional grid or array capable of mapping, ablating, stimulating, or combinations thereof, an inside surface of a bodily cavity or lumen without requiring mechanical scanning. The flexible strips **204** are arranged in a framed structure **208** that is selectively movable between an unexpanded configuration and an expanded configuration that may be used to force flexible strips **204** against a tissue surface within the bodily cavity or position the flexible strips in the vicinity of the tissue surface. The flexible strips **204** can form part of a flexible circuit structure (i.e., also known as a flexible printed circuit board (PCB) circuit). The flexible strips **204** can include a plurality of different material layers. The expandable frame **208** can include one or more resilient members. The expandable frame **208** can include one or more elongate members. Each of the one or more elongate members can include a plurality of different material layers. Expandable frame **208** can include a shape memory material, for instance Nitinol. Expandable frame **208** can include a metallic material, for instance stainless steel, or non-metallic material, for instance polyimide, or both a metallic and non metallic material by way of non-limiting example. The incorporation of a specific material into expandable frame **208** may be motivated by various factors including the specific requirements of each of the unexpanded configuration and expanded configuration, the required position or orientation (i.e., pose), or both of expandable frame **208** in the bodily cavity or the requirements for successful ablation of a desired pattern.

(66) Expandable frame **208**, as well as flexible strips **204** can be delivered and retrieved via a catheter member, for example a catheter sheath introducer **210**, which in some embodiments may

have a diameter of about 24 French or smaller while in other embodiments may have a diameter of 16 French or smaller. In some instances, devices deliverable via larger or smaller sized catheter sheets may be employed. Flexible strips **204** may include one or more material layers. Flexible strips **204** may include one or more thin layers of Kapton® (polyimide), for instance 0.1 mm thick. Transducer elements (e.g., electrodes or sensors, or both) **206** may be built on the flexible strips **204** using conventional printed circuit board processes. An overlay of a thin electrical insulation layer (e.g., polyimide about 10-20 microns thick) may be used to provide electrical insulation, except in areas needing electrical contact to blood and tissue. In some embodiments, flexible strips **204** can form a portion of an elongated cable **216** of control leads **218**, for example by stacking multiple layers, and terminating at a connector **220**. In some example embodiments, flexible strips **204** are formed from flexible substrates onto which electrically conductive elements (e.g., conductive lines or traces) are provided. In some example embodiments flexible strips **204** form flexible circuit structures. In some example embodiments, a portion of device **200** is typically disposable.

(67) Device **200** can communicate with, receive power from or be controlled by a control system **222**, or combinations thereof. The control system **222** may include a controller **224** having one or more processors **226** and one or more non-transitory storage mediums **228** that store instructions that are executable by the processors **226** to process information received from device **200** or to control operation of device **200**, or both. For example, controller **224** can control activating selected transducer elements **206** to ablate tissue. Controller **224** may include one or more controllers. Control system **222** may include an ablation source **230**. The ablation source **230** may, for example, provide electrical current or power, light or low temperature fluid to the selected transducer elements **206** to cause ablation. The ablation source may include an electrical current source or an electrical power source. Control system **222** may also include one or more user interface or input/output (I/O) devices, for example one or more displays **232**, speakers **234**, keyboards, mice, joysticks, track pads, touch screens or other transducers to transfer information to and from a user, for example a care provider such as a physician or technician. For example, output from the mapping process may be displayed on a display **232**.

(68) In some embodiments, a frame provides expansion and contraction capabilities for a portion of the medical device (e.g., arrangement or array of transducer elements) used to distinguish between blood and tissue. The transducer elements used to sense a parameter or characteristic to distinguish between a fluid such as blood and tissue may be mounted or otherwise carried on a frame, or may form an integral component of the frame itself. The frame may be flexible enough to slide within a catheter sheath in order to be deployed percutaneously or intravascularly. FIG. **2**, discussed previously, showed one embodiment of such a frame.

(69) FIGS. **3**A, **3**B and **3**C show a portion of the medical device **1400** in various configurations. Specifically, FIG. **3**A shows that the portion of the device **1400** includes a structure or frame **1402** made from a plurality of elongate members **1404***a*, **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f* (collectively **1404**). The elongate members **1404** can be selectively arranged in one of a plurality of different arrangements. The elongate members **1404** can be selectively moved between various different configurations. The portion of the device **1400** (i.e., including frame **1402**) is shown in a first, or an unexpanded configuration suitably sized for delivery within a catheter sheath **1406** of a catheter system **1408** in FIG. **3**A. In some embodiments, employed catheter sheaths may be steerable devices with a portion thereof deflected by an actuator contained in a control portion (e.g., a handle portion). Various levers, knobs, wheels, pulleys, sheathes, etcetera may be employed to steer a deflectable portion of a catheter sheath. Catheter system **1408** is employed to percutaneously or intravascularly deliver a portion of device **1400** through a bodily opening leading to a bodily cavity such as an intra-cardiac cavity (not shown) by way of non-limiting example. FIG. **3**B shows the portion of device **1400** including frame **1402** in a second or bent or expanded and unfanned configuration. In this embodiment, the second/bent configuration is assumed as various

portions of frame **1402** are advanced from catheter sheath **1406**. FIG. **3**C shows the portion of device **1400** including frame **1402** in a third, or expanded configuration. In this illustrated embodiment, the third or expanded or fanned configuration is also alternatively referred to in this application as a fanned configuration, expanded configuration or expanded fanned configuration. The portion of device **1400** including frame **1402** can assume either of the second/bent or the third/expanded or fanned configuration when positioned within the bodily cavity (not shown) by way of example. In this illustrated embodiment, the first configuration is an example of a delivery configuration in which a portion of frame **1402** is suitably sized for delivery through a bodily opening leading to a bodily cavity. In this illustrated embodiment, each of the second and the third configurations is an example of a deployed configuration in which various portions of frame **1402** are manipulated to have a size too large for delivery through the opening leading to the bodily cavity. The portion of device **1400** including frame **1402** is moved into the third/expanded or fanned configuration from the second/bent configuration in this embodiment. In this illustrated embodiment, frame **1402** is sized too large for delivery through catheter sheath **1406** when frame **1402** is in either of the second/bent configuration or the third/expanded or fanned configuration.
(70) In a manner similar to that described in some previous embodiments, various transducer elements may be carried into a bodily cavity by various ones of elongate members **1404**. In some embodiments, various transducer elements can be provided on, or by, various flexible circuit structures made up of various flexible substrates which can include by way of non-limiting example, elongate member **1404** itself. FIG. **3**D shows an exploded view of an elongate member **1404** and a flexible circuit structure **1480**. Flexible circuit structure **1480** can include one or more flexible substrates **1482** (i.e., two in this illustrated embodiment) and at least one electrically conductive layer **1484**. In this example embodiment, the at least one conductive layer **1484** has been patterned to form a plurality of transducer elements **1490** (three called out). In this embodiment, the at least one conductive layer **1484** has been patterned to form a plurality of electrodes. Various ones of the at least one conductive layers can be patterned to form other features and elements including conductive traces or lines by way of non-limiting example. For clarity, various transducer elements **1490** associated with device **1400** are not shown in FIGS. **3**A, **3**B and **3**C. For clarity, various flexible circuit structures **1480** associated with device **1400** are not shown in FIGS. **3**A, **3**B and **3**C.
(71) The elongate members **1404** may be transported by a transporter through catheter sheath **1406**. In this embodiment, the elongate members **1404** are transported by shaft member **1410** through catheter sheath **1406**. Shaft member **1410** is typically sized to extend along a path that leads from a location outside the body to a destination at least proximate to the cavity within the body. Shaft member **1410** is typically a flexible member. Shaft member **1410** can include various lumens and passageways (not shown) some of which can be employed as conduits for various control lines, actuators, force transmitters, irrigation channels, suction channels, etcetera. In this embodiment, wrist coupler **1412** articulably couples the frame **1402** to shaft member **1410**. In other example embodiments, other articulated or non-articulated couplers can be employed to couple the frame **1402** to shaft member **1410**. In some example embodiments, a handle (not shown) can be provided at an end of shaft member **1410** opposite to wrist coupler **1412**. The handle may be employed by a care provider to help manipulate the shaft member **1410** through catheter sheath **1406** in some embodiments. The handle may include various controls or actuators, or both, employed for manipulation of various portions of device **1400**. In some embodiments, shaft member **1410** may be a steerable device with a portion thereof deflected by an actuator contained in a control portion (e.g., a handle portion). Various levers, wheels, pulleys, sheathes may be employed to steer a deflectable portion of shaft member **1410**.
(72) While six (6) elongate members **1404** are shown in this illustrated embodiment, some embodiments may employ a greater or a fewer number of elongate members **1404**. The present inventors have built devices having fewer than six (6) elongate members (e.g., three (3) elongate

members) in some embodiments and more than six (6) elongate members (e.g., eleven (11) elongate members) in other embodiments by way of non-limiting example.

(73) As best shown in FIG. **3**D, each of the elongate members **1404** includes a respective distal or first end **1405**, a respective proximal or second end **1407**, a respective intermediate portion **1409** positioned between the first end **1405** and the second end **1407**, and respective length **1411** between the first end **1405** and the second end **1407**. In this embodiment, various ones of the elongate members **1404** has a different respective length **1411** than the respective length **1411** of another of the elongate members **1404**. In other embodiments, two or more of the elongate members **1404** may have substantially equal lengths **1411**. In this embodiment, each of the elongate members **1404** is compliant about at least one axis. Various embodiments can include elongate members **1404** that are pliable, flexible or resilient elongate members. Various embodiments can include elongate members **1404** that have a different bending stiffness when bent about each of a plurality of differently oriented axes.

(74) As shown in FIG. **3**A, the elongate members **1404** are arranged successively with respect to one another in a stacked arrangement **1415** when the portion of device **1400** is in the first/unexpanded configuration. In this embodiment, the arrangement of the elongate members **1404** in the stacked arrangement **1415** is an orderly one with each of the elongate members arranged successively with respect to one another along a first direction (i.e., a stacking direction) represented by arrow **1416**. It is understood that the first direction need not be a vertical or “up-down” direction but can also include other orientations. For instance in some embodiments, elongate members **1404** which are successively adjacent one another along the first direction **1416** may be stepped with respect to one another in one or more other directions. Thus, the set of elongate members **1404** may be arranged in a non-stepped stacked arrangement fitting in a rectangular parallelepiped or may be arranged in a stepped stacked arrangement for instance fitting in a non-rectangular parallelepiped.

(75) In the illustrated example embodiment, each of the elongate members **1404** is a strip-like member. In this example embodiment, the intermediate portion **1409** of each of the elongate members **1404** includes a set of two opposing surfaces or major faces **1418** made up of a first surface **1418***a* (i.e., also referred to as front surface **1418***a*) (one called out in FIG. **3**A) and a second surface **1418***b* (i.e., also referred to as back surface **1418***b*) (three called out in FIG. **3**A). In this example embodiment, the two opposing surfaces **1418** are separated from one another across a thickness **1417** (only one called out in FIG. **3**A) of the elongate member **1404**. In this illustrated example, the two opposing surfaces **1418** are joined by a set of two opposing edge surfaces **1420***a* and **1420***b* (collectively **1420**) (only one set called out in FIG. **3**A) and hence spaced from each other by the thickness of the edge surfaces **1420***a*, **1420***b*. In this illustrated embodiment, the surfaces **1418** are arranged successively with respect to one another in the stacked arrangement **1415**. In this embodiment, the elongate members **1404** are successively arranged in an arrayed arrangement sized to be delivered through a lumen of catheter sheath **1406**, with each elongate member **1404** positioned in the arrayed arrangement such that the first surface **1418***a* of the elongate member **1404** is towards the second surface **1418***b* of an additional elongate member **1404** in the arrayed arrangement, or the second surface **1418***b* of the elongate member **1404** is towards the first surface **1418***a* of the additional elongate member **1404** in the arrayed arrangement, or both. For example, one of the outermost elongate members in the arrayed arrangement (i.e., elongate member **1404***a*) is positioned in the arrayed arrangement such that its first surface **1418***a* is towards the second surface **1418***b* of elongate member **1404***b*. Outermost elongate member **1404***f* is positioned in the arrayed arrangement such that its second surface **1418***b* is towards the first surface **1418***a* (not called out) of elongate member **1404***e*. An inboard elongate member in the arrayed arrangement such as elongate member **1404***d* is positioned such that its first surface **1418***a* (not called out) is positioned towards the second surface **1418***b* (not called out) of elongate member **1404***e* and the second surface **1418***b* (not called out) of elongate member **1404***d* is towards the first

surface **1418***a* (not called out) of elongate member **1404***c*. In this example embodiment, the first and the second surfaces **1418***a*, **1418***b* of the elongate members **1404** are interleaved in the stacked arrangement **1415**.
(76) In various embodiments, each of the elongate members **1404** has at least one surface that has a common characteristic with, or corresponds to, at least one surface of each of the other elongate members **1404**, and the elongate members **1404** are arranged in an arrayed arrangement or stacked arrangement such that the at least one surfaces of the elongate members **1404** are successively arranged along the first direction of stacked arrangement **1415**. In this respect, it is noted that the stacked arrangement does not require that the individual elongated members **1404** actually rest on one another. In many instances of the stacked arrangement, the elongated members or portions thereof may be separated from successively adjacent elongate members, for instance by space, such as in an embodiment of an interleaved arrangement. In some of these various embodiments, each at least one surface is a first surface that is positionable adjacent to a tissue surface in the bodily cavity when the portion of device **1400** is in the third/expanded configuration within the bodily cavity. In some of these various embodiments, each at least one surface is a first surface that is positionable to face or contact a tissue surface in the bodily cavity when the portion of device **1400** is moved into the third/expanded configuration within the bodily cavity. In some of these various embodiments, each at least one surface is a first surface that includes, or supports (i.e., directly or indirectly) one or more transducer elements. In some of these various embodiments, each at least one surface is a first surface that includes, or supports (i.e., directly or indirectly) one or more transducer elements (e.g., an electrode) that are positionable adjacent to a tissue surface in the bodily cavity when the portion of device **1400** is in the third/expanded configuration within the bodily cavity. In some of these various embodiments, each at least one surface is a first surface that includes, or supports (i.e., directly or indirectly) a flexible circuit structure. In some of these various embodiments, each at least one surface is a second surface that is positionable to face away from a tissue surface in the bodily cavity when the portion of device **1400** is in the third/expanded configuration within the bodily cavity. In some of these various embodiments, each at least one surface is arranged to face away from an axis about which the elongate members **1404** are angularly spaced when the portion of device **1400** is in the third/expanded configuration.
(77) In some embodiments, the elongate members **1404** are arranged successively adjacent to one another. In some embodiments, partial or full separations or gaps can be present between two elongate members **1404** of various ones of the successive pairs of elongate members **1404** in stacked arrangement **1415**. Substantially uniform separations or varying sized separations between the two elongate members **1404** of each successive pair of the elongate members **1404** in the stacked arrangement **1415** can be present. In some example embodiments, various other elements may be disposed between two elongate members **1404** of various ones of the successive pairs of the elongate members **1404** in the stacked arrangement **1415**. For example, various transducer elements may be positioned between two elongate members **1404** of various ones of the successive pairs of the elongate members **1404** in the stacked arrangement **1415**. The elongate members **1404** can be linearly arrayed along the first direction (i.e., as represented by arrow **1416**) in the stacked arrangement **1415**. In some embodiments, at least three elongate members **1404** are linearly arrayed along a first direction (i.e., as represented by arrow **1416**) in an arrayed arrangement. In some embodiments, at least three elongate members **1404** are successively arranged with respect to one another along a first direction (i.e., as represented by arrow **1416**) in the stacked arrangement **1415**.
(78) Elongate members **1404** may be substantially planar members or may have some initial curvature when the portion of device **1400** is in the first/unexpanded configuration. At least one of surfaces **1418***a* and **1418***b* need not be a flat surface. In this example embodiment, elongate members **1404** have a shape that allows them to be successively stacked in stacked arrangement **1415**. FIG. **3**E shows a cross-section view of stacked arrangement **1415** in a lumen **1403** of catheter

sheath **1406** as viewed through lumen **1403**. Stacked arrangement **1415** advantageously allows elongate members **1404** to be arranged in a substantially spatially efficient manner to allow for delivery through catheter sheaths **1406**, enabling a reduced dimension (e.g., a diameter dimension) of catheter sheath **1406**. FIG. **3**E shows that additional space **1414** within lumen **1403** is also advantageously provided for control lines, actuators and force transmission members (all not shown). Various conventional “basket-type” catheter systems that include resilient members that “spring” outwardly when they are advanced from a catheter sheath into a bodily typically are arranged in a relatively bulky and random or quasi-random arrangement when they are delivered within a catheter sheath which can disadvantageously require the use of larger catheter sheaths. Larger catheter sheaths can also be required for conventional “basket-type” catheter systems that employ buckling mechanisms that outwardly buckle an arrangement of members. Larger catheter sheaths can also be required for conventional ablator systems that employ a substrate that is required to fold upon itself for delivery though the catheter sheath as is the case with various conventional inflatable balloon or bladder based catheter systems.
(79) Advantageously, the strip-like elongate members **1404** in this embodiment additionally allows for a reduced bending stiffness about a bending axis arranged perpendicularly to the first or stacking direction of the elongate members **1404** in stacked arrangement **1415**, especially when the elongate members are allowed to slide relatively with respect to one another during the bending. A reduced bending stiffness can facilitate the delivery of the stacked arrangement **1415** through catheter sheath **1406** especially when catheter sheath **1406** extends along a tortuous path to a bodily cavity. The members in many conventional basket-type catheter systems are coupled together in a manner that typically disadvantageously limits sliding movement between the members in a manner that can adversely impact delivery through a catheter sheath. As shown in FIG. **3**A, a portion of elongate member **1404***a* is cantilevered from stacked arrangement **1415** in this embodiment. In this illustrated embodiment, the second end **1407** of elongate member **1404***a* is positioned between the respective first and the second ends **1405**, **1407** of each of the other elongate members **1404** in stacked arrangement **1415**. In this illustrated embodiment, the length **1411** of elongate member **1404***a* is greater than each of the respective lengths **1411** of the other elongate members **1404** in stacked arrangement **1415**.
(80) The elongate members **1404** may be constructed from various materials including, but not limited to, various metal and non-metal compositions, composite materials such as carbon fiber, or flexible PCB substrates with a fiberglass or Nitinol backing. The elongate members **1404** can include one or more material layers. The elongate members **1404** may form an integral component of the transducer elements **1490**. When the transducer elements (e.g., transducer elements **1490**) form an integral component of the frame **1402**, various material components used in the frame may require various mechanical and electrical properties. If the device **1400** is distinguishing between blood and tissue by sensing convective cooling associated with a moving fluid (i.e., the blood), the material used for at least part of each of various ones of the elongate members **1404** preferably has a measurable change in resistance with temperature that is independent of elongate member **1404** deformation. In some embodiments, a resistance of several ohms per centimeter or higher is preferable as it will reduce the amount of current needed to heat the transducer element. The elongate members **1404** may also act as a support for a secondary assembly that carries the sensing and ablation transducer elements. An example of this is a stainless steel or Nitinol structure used to support transducer elements made with a flexible PCB circuit structure. In this embodiment, elongate members **1404** are resilient metallic elongate members. In this example embodiment, each of elongate members **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f* and are made from 17-7 stainless steel while elongate member **1404***a* is made from Nitinol. The use of Nitinol may be advantageous when a portion of an elongate member **1404** is to be subjected to relative tighter bending conditions or greater angular deflections.
(81) In various embodiments, one or more couplers or joints are employed to physically couple

some or all of the elongate members **1404** together in stacked arrangement **1415**. In various embodiments, two or more couplers or joints are employed to physically couple some or all of the elongate members **1404** in stacked arrangement **1415**. In some example embodiments, at least one of the couplers or joints is employed to pivotally or articulably or articulatably (used interchangeably herein) couple at least some of the elongate members **1404** together in stacked arrangement **1415**. In this illustrated embodiment, a first coupler **1422** and a second coupler **1424** couple various ones of the elongate members **1404** together. In this example embodiment, second coupler **1424** pivotally couples some of the elongate members **1404** (i.e., **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f*) together at a location proximate the respective second ends **1407** of these elongate members **1404**. In this embodiment, first coupler **1422** pivotally couples each of the elongate members **1404** (i.e., **1404***a*, **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f*) together at a location spaced from second coupler **1424** along the respective lengths **1411** of each of the elongate members **1404**. In this embodiment, all of the elongate members **1404** are pivotally coupled together directly by first coupler **1422** while only some, but not all of the elongate members **1404** are directly pivotally coupled together by second coupler **1424**. It is noted however, that in this illustrated embodiment, elongate member **1404***a* is fixedly coupled to elongate member **1404***f* by offset member **1428** and is thereby indirectly pivotally coupled to another of the elongate members **1404** by second coupler **1424**. In some example embodiments, each of the elongate members in a stacked arrangement is directly pivotally or articulably coupled to another of the elongate members in the stacked arrangement by each of at least two couplers or joints.

(82) In this illustrated embodiment, each of the first and the second couplers **1422**, **1424** respectively include first pivot member **1423** and second pivot member **1425** arranged to pivotally couple various ones of the elongate members **1404** together in stacked arrangement **1415**. Second pivot member **1425** is spaced apart from first pivot member **1423** along a respectively coupled one of the elongate members **1404** by a respective length **1426** (only one called out in FIG. **3**A) along the elongate member **1404**. Each length **1426** can vary as the stacked arrangement **1415** is moved between the first/unexpanded configuration and the second/bent configuration or between the second/bent configuration and the third/expanded or fanned configuration. In this example embodiment, each of the first pivot member **1423** and the second pivot member **1425** takes the form of a pin about which various ones of the elongate members **1402** is configured to turn, revolve or rotate about when the stacked arrangement **1415** is moved to or from the third/expanded or fanned configuration shown in FIG. **3**C. In this embodiment, each of the pivot members **1423**, **1425** includes two opposing ends and a longitudinal axis extending between the opposing ends. Specifically, first longitudinal axis **1423***a* is associated with first pivot member **1423** and second longitudinal axis **1425***a* is associated with second pivot member **1425**. In this embodiment, each of the first and the second pivot members **1423**, **1425** is sized to be received in a respective opening provided in various ones of the elongate members **1404**. Each of the first and the second pivot members **1423**, **1425** can include restraining features (not shown) that additionally restrain the elongate members **1404** from axially escaping from the pivot members. Suitable restraining features can be formed by welding operations, heading operations, machining operations or assembly operations in which additional components are physically coupled to the pivot members **1423**, **1425**.

(83) In other embodiments, other forms of couplings can be employed to physically couple two or more of the elongate members **1404** together. For example, various articulated joints including flexure-type joints can be employed. In some example embodiments, one or more flexible lines are employed to physically couple at least two of the elongate members **1404** together. In some embodiments, each elongate member **1404** has a portion that is positioned between a set of at least two spaced apart articulated joints, the portion being articulable about each of the at least two articulated, articulable or articulation (used interchangeably herein) joints when the stacked arrangement **1415** is in the third/expanded configuration. In this example embodiment, if the

elongate members **1404** are arranged successively with respect to one another to form a planar or flat stacked arrangement of the elongate members **1404**, each elongate member **1404** is restrained from turning about each of the first pivot member **1423** and the second pivot member **1425**. In this example embodiment, the orientation of the first and second pivot members **1423** and **1425** and the inherent continuous structure of the elongate members **1404** restrain the elongate members **1404** from turning about each of the first and second pivot members **1423** and **1425** if the elongate members **1404** were to be arranged in a planar or flat stacked arrangement.
(84) FIG. **3**B shows the portion of the device **1400** including the plurality of elongate members **1404** positioned in the second/bent configuration. This configuration may be established within a bodily cavity in accordance with various embodiments. In this illustrated embodiment, various ones of the elongate members **1404** have been bent by a bending action created by bender **1430**. In this embodiment, each elongate member **1404** in the stacked arrangement **1415** is bent about a respective bending axis **1431** (only one shown), each bending axis **1431** extending along a direction having a directional component transversely oriented to the respective length **1411** (not called out in FIG. **3**B) of the elongate member **1404**. In this embodiment, bender **1430** includes at least one control element **1432** configured to alter a curvature or shape of one or more of the elongate members **1404**. In this illustrated embodiment, control element **1432** includes a control line sized to be received by a number of pulleys **1434** (i.e., three called out) that are physically coupled to stacked arrangement **1415**. In this embodiment, each of the pulleys **1434** is physically coupled to elongate member **1404***a*, while in other embodiments, one or more of the pulleys can be physically coupled to other ones of the elongate members **1404**. Pulleys **1434** can be employed to reduce the frictional effects and facilitate the bending of various ones of the elongate members **1404** when a tensile force is applied to control element **1432**. In some embodiments, one or more control elements **1432** are directly coupled to various ones of the elongate members **1404**. In this embodiment, each of the pulleys **1434** is coupled to an elongate member **1404** by a respective control line **1436** (i.e., three called out). The control lines **1436** are, in turn, coupled together by control element **1432**. Various arrangements of control elements **1432** and control lines **1436** can be employed to impart a desired curvature or shape change to various portions of selective ones of the elongate members **1404**. Different shape changes can be achieved by changing a location on an elongate member **1404** to which a shape-changing force is applied to by a given one of the control lines **1436**. A relative movement between various ones of the control elements **1432** or an activation timing of various ones of the control elements **1432**, or both can be controlled to impart a desired shape change to a given one of the elongate members **1404** in stacked arrangement **1415**. Control elements **1432** other than control lines can be employed in other example embodiments. For example, a control element **1432** can include a push member configured to apply a compressive force. In this example embodiment, bender **1430** has altered a curvature of each of the elongate members **1404** in stacked arrangement **1415**. In this example embodiment, bender **1430** has coiled elongate member **1404***a*.
(85) In this embodiment, each of the bent elongate members **1404** assumes a respective arcuate shape between the respective first and second ends **1405**, **1407** of the elongate member. The arcuate shape can include circular, elliptical arcuate or parabolic forms by way of non-limiting example. In various embodiments, the coupling locations of various control elements **1432** to stacked arrangement **1415** can be selectively chosen to impart a particular curvature or shape to various ones of the elongate members **1404** when the stacked arrangement is moved into the second/bent configuration.
(86) FIG. **3**C shows a portion of device **1400** in a third expanded configuration. In this illustrated embodiment, the portion of the device **1400** is moved from the second/bent configuration shown in FIG. **3**B to the third/expanded configuration shown in FIG. **3**C. In this illustrated embodiment, at least some of the elongate members **1404** are repositioned. In this example embodiment, various ones of the elongate members **1404** are moved to space the intermediate portions **1409** of at least

some of the elongate members **1404** apart from one another. In this example embodiment, the respective intermediate portions **1409** of elongate members **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f* are angularly spaced with respect to one another about a first axis **1465**. In this example embodiment, the respective intermediate portions **1409** of elongate members **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f* are radially oriented about first axis **1465**. In this embodiment, the respective intermediate portions **1409** of elongate members **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f* spread out in a ray-like manner from first axis **1465**. In this illustrated embodiment, each of the respective intermediate portions **1409** of elongate members **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f* is at a different radial distance from first axis **1465**. In this embodiment, the radial distance from first axis **1465** that each of the respective intermediate portions **1409** of elongate members **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f* is positioned at, varies at least in part, based on a positioning of the elongate member **1404** in the bent stacked arrangement shown in FIG. **3**B. In this illustrated embodiment, each of the respective intermediate portions **1409** of elongate members **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f* has a different curvature. In this example embodiment, various portions of each of the elongate members **1404***b*, **1404***c*, **1404***d*, **1404***e* and **1404***f* are arranged to form a structure having a domed shape **1419** when the portion of device **1400** is in the third/expanded or fanned configuration. In this example embodiment, the dome-shaped structure is positioned opposite from a portion of at least one of the elongate members **1404** (i.e., elongate member **1404***a*). In some example embodiments the domed-shaped structure may have a generally hemi-spherical shape. In other example embodiments, the domed shape structure may have a different shape. For example, the structure's domed shape may have a first radius of curvature in a first spatial plane and a second radius of curvature in a second spatial plane that intersects the first spatial plane, a magnitude of the second radius of curvature different than a magnitude of the first radius of curvature.

(87) In this illustrated embodiment, various ones of the elongate members **1404** are fanned with respect to one another about a fanning axis in a fanned array when the portion of the device **1400** is in the third/expanded configuration. The fanning axis extends along a direction that has a directional component that is transversely oriented to the bending axis **1431** shown in FIG. **3**B. In this illustrated embodiment, various ones of the elongate members **1404** turn, revolve, or rotate (used interchangeably herein) about each of a respective pivot axis associated with each of first coupler **1422** and second coupler **1424** when the portion of the device **1400** is moved into the third/expanded configuration. In this illustrated embodiment, various ones of elongate members **1404** turn about pivot axis **1462***a* and pivot axis **1462***b*. In this illustrated embodiment, various ones of elongate members **1404** turn about each of first pivot member **1423** and second pivot member **1425** as the elongate members **1404** are fanned. The respective openings in various ones of the elongate members **1404** in which each of the first and the second pivot members **1423**, **1425** is located can be appropriately sized to accommodate misalignment between the pivot members **1423**, **1425** and respective ones of the pivot axes **1462***a*, **1462***b*. In this illustrated embodiment, the respective intermediate portions **1409** of various ones of the elongate members **1404** are angularly spaced about first axis **1465** when the portion of the device **1400** is moved into third/expanded configuration. In this example embodiment, the front surface **1418***a* of each of the elongate members **1404** is positioned to face away from the first axis **1465** when the portion of the device **1400** is in the third/expanded or fanned configuration.

(88) In this example embodiment, separator **1452** moves various ones of the elongate members **1404** to move the portion of device **1400** into the third/expanded or fanned configuration. In this example embodiment, separator **1452** includes two crank members **1454**, each crank member **1454** physically coupled to one of two flexible rotary shafts **1456**. Various articulated joints pivotally couple each of crank members **1454** to a respective one of flexible rotary shafts **1456** to allow the crank members **1454** to assume one configuration suitable for delivery through catheter sheath **1406** and another configuration suitable for applying sufficient force to move various ones of

elongate members **1404**. Selectively applied torque to each of the crank members **1454** via a respective one of flexible rotary shafts **1456** can be applied by various actuators (not shown). In this embodiment, oppositely oriented torques are applied to crank members **1454** to fan different ones of the elongate members **1404** in different directions. In this illustrated embodiment, one of the crank members **1454** is physically coupled to elongate member **1404***b* while the other crank member **1454** is physically coupled to elongate member **1404***c*. In this example embodiment, each of the crank members **1454** is physically coupled to a respective one of the elongate members **1404** by a flexible line. The application of sufficient torque to each of the crank members **1454** causes respective ones of the elongate members **1404***b* and **1404***c* to move. Other separators may be employed additionally or alternatively in other example embodiments. For example, various elements (e.g., flexible lines) may be physically coupled to at least some of the elongate members **1404** to apply a force suitable for fanning various ones of the elongate members **1404** with respect to one another.

(89) Various coupling members **1458** (four called out) physically couple various ones of the elongate members **1404** together. In this example embodiment, each coupling member **1458** allows movement of one of the elongate members **1404** coupled by the coupling member **1458** to also cause movement of another of the elongate members **1404** coupled by the coupling member **1458**. In this example embodiment, the coupling members **1458** are arranged to restrict or limit an amount of movement that an elongate member **1404** undergoes as the portion of the device is moved into the third/expanded configuration. In this embodiment, each coupling member **1458** is a flexible line. For clarity, bender **1430** is not shown in FIG. **3**C. For clarity, separator **1452** is not shown in FIG. **3**B. For clarity, bender **1430** and separator **1452** are not shown in FIG. **3**A.

(90) FIGS. **4**A, **4**B, **4**C, **4**D and **4**E show various elevation views of a portion of a device **1700** positioned within a bodily cavity at five successive intervals of time according to an example embodiment. In this illustrated embodiment, the bodily cavity is a left atrium **1762** of a heart **1760** which is showed sectioned for clarity. Device **1700** includes a structure or frame **1702** that includes a plurality of elongate members **1704***a*, **1704***b*, **1704***c*, **1704***d*, **1704***e* and **1704***f* (collectively **1704**) as best shown in FIGS. **4**D, **4**E. In a manner similar to the embodiment illustrated in FIGS. **3**A, **3**B, and **3**C, and as best exemplified in FIG. **4**F, each of the elongate members **1704** includes a respective distal or first end **1705**, a respective proximal or second end **1707**, a respective intermediate portion **1709** positioned between the first end **1705** and the second end **1707**, and a respective length **1711** between the first end **1705** and the second end **1707**. FIG. **4**F shows an exploded view of an elongate member **1704** and a flexible circuit structure **1780**.

(91) As best shown in FIG. **4**A, each of the elongate members **1704** has a different respective length **1711** in this example embodiment. In some embodiments, two or more of the elongate members **1704** may have substantially equal lengths **1711**. As shown in FIG. **4**F, each elongate member **1704** includes a front surface **1718***a* and a back surface **1718***b* positioned opposite to the first surface **1718***a* across a thickness **1717** of the elongate member **1704**. In a manner similar to that described in some previous embodiments, various transducer elements can be carried into a bodily cavity by various ones of elongate members **1704**. In some embodiments, various transducer elements can be provided on, or by various flexible circuit structures made up of various flexible substrates which can include by way of non-limiting example, elongate member **1704** itself. Flexible circuit structure **1780** shown in FIG. **4**F can include one or more flexible substrates **1782** (i.e., two in this illustrated embodiment) and at least one electrically conductive layer **1784**. In this example embodiment, the at least one conductive layer **1784** has been patterned to form a plurality of transducer elements **1790** (three called out). In this embodiment, the at least one conductive layer has been patterned to form a plurality of electrodes. Various ones of the at least one conductive layers can be patterned to form other features and elements including conductive traces or lines by way of non-limiting example. For clarity, various transducer elements **1790** associated with device **1700** are not shown in FIGS. **4**A, **4**B, **4**C, **4**D, **4**E, **4**G and **4**H. For clarity, various

flexible circuit structures **1780** associated with device **1700** are not shown in FIGS. **4**A, **4**B, **4**C, **4**D, **4**G and **4**H.

(92) In this embodiment, the elongate members **1704** are arranged successively with respect to one another in stacked arrangement **1715** when the portion of device **1700** is in the first or unexpanded configuration shown in FIG. **4**A. In this embodiment, the arrangement of the elongate members **1704** in the stacked arrangement **1715** is an orderly one with each of the elongate members **1704** arranged successively with respect to one another along a first direction (i.e., a stacking direction) represented by arrow **1716**. In this example embodiment, the elongate members **1704** are arranged with one another front surface **1718*a***-toward-back surface **1718*b*** in an array. In some example embodiments, the elongate members **1704** can be interleaved with one another front surface **1718*a***-toward-back surface **1718*b*** in an array. In this illustrated embodiment, the elongate members **1704** are arranged in a stacked array (i.e., stacked arrangement **1715**) when delivered through catheter sheath **1706** (shown sectioned in FIG. **4**A for clarity) which gains access to left atrium **1762** via bodily opening **1764**. Catheter sheath **1706** includes a first end **1706*a***, a second end **1706*b*** and a lumen **1703** extending between the first and the second ends **1706*a***, **1706*b***. In this example embodiment, catheter sheath **1706** is typically positioned such that the second end **1706*b*** of the catheter sheath **1706** is positioned at least proximate to a bodily cavity such as left atrium **1762** when catheter sheath **1706** is employed to provide at least part of a percutaneous or intravascular delivery channel. In this example embodiment, each of the elongate members **1704** is arranged to be delivered through the lumen **1703** of catheter sheath **1706** from the first end **1706*a*** of catheter sheath **1706** to the second end **1706*b*** of catheter sheath **1706**. In this embodiment, each of the elongate members **1704** is arranged in stacked arrangement **1715** such that its respective first end **1705** (i.e., also referred to as the distal end) is advanced out from lumen **1703** from the second end **1706*b*** of catheter sheath **1706** before the respective second end **1707** (i.e., also referred to as the proximal end) is advanced out from lumen **1703**. In this example embodiment, the elongate members are arranged to be advanced out from lumen **1703** into left atrium **1762**. In this illustrated embodiment, elongate member **1704*a*** is an outermost elongate member in stacked arrangement **1715**. In some embodiments, elongate member **1704*a*** is positioned between two of the outermost elongate members **1704** in stacked arrangement **1715**. In this illustrated embodiment, the elongate members **1704** are sized and positioned in stacked arrangement **1715** so that a portion of elongate member **1704*a*** is advanced into left atrium **1762** prior to a portion of each of the other ones of the elongate members **1704** in stacked arrangement **1715**. In this illustrated embodiment, the elongate members **1704** are sized and positioned in stacked arrangement **1715** so that a portion of elongate member **1704*a*** is advanced from the second end **1706*b*** of catheter sheath **1706** prior to a portion of each of the other ones of the elongate members **1704** in stacked arrangement **1715**. In some example embodiments, a respective portion of each of at least two of the elongate members is advanced from the second end **1706*b*** of catheter sheath **1706** prior to a portion of each of the other ones of the elongate members **1704** in stacked arrangement **1715**. In this example embodiment, a portion of elongate member **1704*a*** is cantilevered from stacked arrangement **1715**. In this illustrated embodiment, the elongate members **1704** are sized and positioned in stacked arrangement **1715** so that the first end **1705** of elongate member **1704*a*** is advanced into left atrium **1762** prior to each respective first end **1705** of each of the other ones of the elongate members **1704** in stacked arrangement **1715**. In this example embodiment, the length **1711** of elongate member **1704*a*** is greater than each of the respective lengths of each of the other elongate members **1704** in stacked arrangement **1715**. In some example embodiments, a portion of each of at least two elongate members **1704** of a plurality of elongate members **1704** can be advanced into a bodily cavity prior to a portion of any other elongate member **1704** in the plurality of elongate members **1704**.

(93) In this illustrated embodiment, a first coupler **1722** and a second coupler **1724** physically couple various ones of the elongate members **1704** together. In this example embodiment, second

coupler **1724** pivotally couples at least some of the elongate members **1704** (i.e., **1704***b*, **1704***c*, **1704***d*, **1704***e* and **1704***f*) together at location proximate the respective second ends **1707** of these elongate members **1704**. First coupler **1722** pivotally couples various ones of the elongate members **1704** (i.e., **1704***a*, **1704***b*, **1704***c*, **1704***d*, **1704***e* and **1704***f*) together at a location spaced apart from second coupler **1724** along the respective lengths **1711** of each of these elongate members **1704**. As shown in FIG. **4**A each of the first coupler **1722** and the second coupler **1724** respectively include first pivot member **1723** and second pivot member **1725** arranged to pivotally couple various ones of the elongate members **1704** together in stacked arrangement **1715** in this embodiment. In this example embodiment, each of the first pivot member **1723** and the second pivot member **1725** takes the form of a pin about which various ones of the elongate members **1704** is configured to turn, revolve or rotate about when the stacked arrangement **1715** is moved to, or from, the third/expanded configuration shown in FIG. **4**E. In this embodiment, each of the pivot members **1723**, **1725** includes two opposing ends and a longitudinal axis extending between the opposing ends. Specifically, first longitudinal axis **1723***a* is associated with first pivot member **1723** and second longitudinal axis **1725***a* is associated with second pivot member **1725**. In this embodiment, each of the first and the second pivot members **1723**, **1725** is sized to be received in a respective opening provided in various ones of the elongate members **1704**. Other embodiments may employ other forms of couplers or joints.

(94) As shown in FIGS. **4**B to **4**D, various portions of stacked arrangement **1715** are bent within the left atrium **1762** by bender **1730**. Bender **1730** includes a control element **1732**, which in this illustrated embodiment includes a control line that is coupled to various control lines **1736** that are each coupled to an elongate member **1704**. In this example embodiment, each control line **1736** is coupled to control element **1732** via a pulley **1734**. Control element **1732** is coupled to a control unit **1740** (i.e., schematically shown) that is typically positioned outside of the body. In some embodiments, control unit **1740** is included as part of a catheter system, for example a handle portion of the catheter system that is directly controlled or manipulated by a care provider. In this embodiment, control element **1732** is provided to bending unit **1742**. In this embodiment, control element **1732** is controlled by tensioner **1743** that selectively applies and controls tension provided to control element **1732**. Tensioner **1743** can include various tensioning devices such as cams by way of non limiting example.

(95) In this illustrated embodiment, a portion of the stacked arrangement **1715** is bent within left atrium **1762** by bender **1730** as the portion of the stacked arrangement **1715** is advanced into left atrium **1762**. In this embodiment, each of the elongate members **1704** in each portion of the stacked arrangement **1715** bent by bender **1730** is bent about at least one bending axis **1731** (shown in FIG. **4**C) within left atrium **1762**. In this embodiment, the direction that at least one bending axis **1731** extends along has a directional component transversely oriented to the first or stacking arrangement represented by arrow **1716**. In this embodiment, each of the elongate members **1704** in each portion of the stacked arrangement **1715** bent by bender **1730** is bent in a same direction. FIGS. **4**B, **4**C and **4**D show successive portions of stacked arrangement **1715** bending as each portion is advanced into left atrium **1762**. In some embodiments, various portions of stacked arrangement **1715** are each bent by a substantially same angular amount as the portions are advanced into left atrium **1762**. In some embodiments, various portions of the stacked arrangement **1715** are bent by different angular amounts as the portions are advanced into left atrium **1762**. Each angular amount can be predetermined based at least on various factors including, but not limited to, a measured or estimated dimension of left atrium **1762**. As shown in FIG. **4**D, the various elongate members **1704** have been bent into an arcuate stacked array. In this illustrated embodiment, the elongate members **1704** are still arranged front surface **1718***a*-toward-back surface **1718***b* in the arcuate stacked array.

(96) In this example embodiment, advancing unit **1744** is employed to advance a portion of device **1700** including stacked arrangement **1715** into left atrium **1762**. Advancing unit **1744** can include various manual or powered actuators suitable for delivering a portion of device **1700** through

catheters sheath **1706** into left atrium **1762**. In this embodiment, coordinating unit **1746** coordinates the bending of various portions of stacked arrangement **1715** under the influence of bending unit **1742** with the advancement of the portions of stacked arrangement **1715** into left atrium **1762** under the influence of advancing unit **1744**. Coordinating unit **1746** can include various drive components including gears, pulleys, sprockets and timing belts, etcetera suitably arranged to provide the desired coordinated movement. In various embodiments, coordinating unit **1746** may control bending unit **1742** based on various information (e.g., positional information) associated with, or provided by an operation of advancing unit **1744**.

(97) As shown in FIGS. **4**B, **4**C and **4**D, bender **1730** directly bends various portions of elongate member **1704***a* as these portions are advanced into left atrium **1762** in this illustrated embodiment. Elongate member **1704***a* is suitably arranged and coupled with the other elongate members **1704** in stacked arrangement **1715** to cause the other elongate members **1704** to also bend in a desired manner. In this embodiment, the respective first end **1705** of each of the elongate members **1704** moves from bodily opening **1764** into left atrium **1762** along a respective path in left atrium **1762** during the bending and advancement of various portions of stacked arrangement **1715**. In various embodiments, a portion of each of the respective paths extends along an arcuate trajectory. In this example embodiment, the respective path of the first end **1705** of elongate member **1704***a* is longer than each of the respective paths within the left atrium **1762** of the first ends **1705** of the other ones of the elongate members **1704**. In this embodiment, the second end **1707** of elongate member **1704***a* is advanced into left atrium **1762** prior to the respective second ends **1707** of the other elongate members **1704** in stacked arrangement **1715**. In this embodiment, elongate member **1704***a* is coiled in left atrium **1762**.

(98) The advancement and bending of various portions of stacked arrangement **1715** into left atrium **1762** moves stacked arrangement **1715** into a second or bent configuration shown in FIG. **4**D. Each of the elongate members **1704** has a generally compact form (e.g., a curled form) when the stacked arrangement **1715** is positioned in the second/bent configuration shown in FIG. **4**D. In this embodiment, the respective first ends **1705** and the respective second ends **1707** of each elongate member **1704** is positioned within left atrium **1762** when stacked arrangement **1715** is in the second/bent configuration. Each of the elongate members **1704** has a respective end-to-end dimension between the respective first end **1705** and the respective second end **1707** of the elongate member **1704**. In this embodiment, elongate member **1704***a* has a smaller end-to-end dimension **1750***a* than the end-to-end dimension of the other elongate members **1704** (e.g., the end-to-end dimension **1750***f* of elongate member **1704***f*) in the second/bent configuration. In this embodiment, each of the elongate members **1704** has a smaller end-to-end dimension when the portion of the device **1700** is in the second/bent configuration than when the portion of the device is in the first/unexpanded configuration. In some embodiments, the end-to-end dimension of each elongate member **1704** may be approximately equal to the respective length **1711** of the elongate member when the portion of the device **1700** is in the first/unexpanded configuration. In various embodiments, the bent stacked arrangement **1715** assumes a shape in the second/bent configuration having dimensions suitably sized to allow the bent stacked arrangement **1715** to be positioned at one or more locations within left atrium **1762** with reduced or no contact between the elongate members **1704** and a tissue surface within left atrium **1762**.

(99) Advantageously, in this embodiment, stacked arrangement **1715** is bent as it is advanced from bodily opening **1764** into left atrium **1762** to reduce physical interactions between stacked arrangement **1715** and a tissue surface within left atrium **1762**. A reduction of contact and other physical interaction with the tissue surface within left atrium **1762** during this positioning can reduce occurrences of, or the severity of, damage inflicted to various tissue structures within left atrium **1762** during this positioning. Some conventional “basket-type” catheter systems include resilient members that “spring” outwardly or employ buckling mechanisms that outwardly buckle an arrangement of members, typically have longitudinal lengths (i.e., lengths generally oriented

along a direction of advancement from a bodily opening into a left atrium) that are too large to be directly accommodated within the atrium (i.e., the lengths must be sufficiently sized to allow the members to spring outwardly or buckle laterally within the atrium). Typically, these systems require that the arrangement of members be guided within the atrium to position part of the arrangement into another bodily opening leading to the left atrium (e.g., a pulmonary vein opening) to accommodate their excess length prior to expansion of the portion of device **1700** within the left atrium. This can potentially inflict damage to the pulmonary vein and other structures within the atrium. In various embodiments, catheter sheath **1706** is preferably oriented to allow stacked arrangement **1715** to be introduced generally tangentially to an interior tissue surface of left atrium **1762**. As various portions of stacked arrangement **1715** are subsequently advanced and bent within the left atrium **1762**, the generally tangential orientation with the interior tissue surface of left atrium **1762** is substantially maintained to accommodate the overall length of stacked arrangement **1715** while advantageously reducing occurrences of contact with the tissue surface and allowing the stacked arrangement **1715** to be subsequently positioned in a desired expanded or third configuration as shown in FIG. **4**E. In this example embodiment, elongate member **1704***a* moves along a coiled path within left atrium **1762** to advantageously reduce occurrences of contact with the tissue surface. In this example embodiment, elongate member **1704***a* curls away from an interior tissue surface with left atrium **1762** as the elongate member **1704***a* is advanced into left atrium **1762**.

(100) FIG. **4**E shows the portion of the device **1700** in a third or expanded configuration in left atrium **1762**. In this illustrated embodiment, the elongate members **1704** were moved from the second/bent configuration shown in FIG. **4**D to the third/expanded or fanned configuration shown in FIG. **4**E. In this illustrated embodiment, at least some of the elongate members **1704** are repositioned in left atrium **1762**. In this example embodiment, various ones of the elongate members **1704** are moved to space the intermediate portions **1709** of at least some of the elongate members **1704** apart from one another within left atrium **1762**. In this example embodiment, the respective intermediate portions **1709** of elongate members **1704***b*, **1704***c*, **1704***d*, **1704***e* and **1704***f* are angularly spaced with respect to one another about a first axis **1765** within left atrium **1762**. In this example embodiment, the respective intermediate portions **1709** of elongate members **1704***b*, **1704***c*, **1704***d*, **1704***e* and **1704***f* are radially oriented about first axis **1765** within left atrium **1762**. In this illustrated embodiment, various ones of the elongate members **1704** are fanned with respect to one another about at least one fanning axis into a fanned array. Each fanning axis extends along a direction that has a directional component that is transversely oriented to the bending axis **1731** shown in FIG. **4**C. In this embodiment, elongate member **1704***a* is positioned inboard within the fanned array. In this illustrated embodiment, various ones of the elongate members **1704** are fanned about each a respective pivot axis associated with each of first coupler **1722** and second coupler **1724**. In this illustrated embodiment, various ones of elongate members **1704** turn about each of first pivot member **1723** and second pivot member **1725** as the elongate members **1704** are moved into the fanned arrangement. Spacings between various ones of the elongate members can be adjusted in various manners to facilitate the fanning of the elongate members **1704**. In this example embodiment, the front surfaces **1718***a* of each of the elongate members is positioned to face a tissue surface within left atrium **1762** when the portion of the device **1700** is in the third/expanded or fanned configuration.

(101) Various ones of the elongate members **1704** can be moved in various ways as the portion of device **1700** is moved into the third/expanded configuration. As shown in the cross-section views shown in FIGS. **4**G and **4**H, a first set of elongate members **1704** made up of elongate members **1704***b* and **1704***d* is moved, pivoted, rotated, turned or revolved (used interchangeably herein) along an angular direction represented by arrow **1768** while a second set of the elongate members **1704** made up of elongate members **1704***c* and **1704***e* is moved along an angular direction represented by arrow **1766** when the portion of device **1700** is moved, pivoted, rotated, turned or

revolved (used interchangeably herein) from the second/bent configuration shown in FIG. **4**G to the third/expanded configuration shown in FIG. **4**H. In this illustrated embodiment, the first set of elongate members **1704** is moved along an angular direction that is opposite to the angular direction that the second set of elongate members **1704** is moved along.

(102) In this example embodiment, a portion of at least a one of the elongate members **1704** in the first set of the elongate members **1704** (e.g., elongate member **1704***d*) is positioned between respective portions of at least two of the elongate members **1704** in the second set of elongate members **1704** (i.e., elongate members **1704***c* and **1704***e*) when the portion of the device **1700** is at least in the first/unexpanded configuration. In this example embodiment, the elongate members **1704***b* and **1704***d* in the first set of elongate members **1704** are interleaved in the bent stacked arrangement **1715** with the elongate members **1704***c* and **1704***e* when the portion of device **1700** is in the second/bent configuration as shown in FIG. **4**G and when the portion of the device **1700** is in the first/unexpanded configuration (not shown). It is understood that the elongate members **1704** can be arranged differently in other embodiments. For example, the elongate members **1704***b* and **1704***d* in the first set of elongate members **1704** can be arranged successively adjacent to one another in the stacked arrangement **1715** and the elongate members **1704***c* and **1704***e* in the second set of elongate members **1704** can be arranged successively adjacent to one another in the stacked arrangement **1715** when the portion of the device **1700** is in the first/unexpanded configuration or the second/bent configuration. In other embodiments, each of the first and the second sets of elongate members **1704** can have different numbers of elongate members than shown in FIGS. **4**G and **4**H. For clarity, elongate member **1704***a* is not shown in FIGS. **4**G and **4**H. In some embodiments, an elongate member **1704** that is introduced first in left atrium **1762** (e.g., elongate member **1704***a*) can be positioned between at least two of the elongate members **1704** in the fanned arrangement of the elongate members **1704**. In some embodiments, an elongate member **1704** that is introduced first in left atrium **1762** (e.g., elongate member **1704***a*) can be positioned as an outboard elongate member **1704** in the fanned arrangement of the elongate members **1704**.

(103) As shown in FIG. **4**E, separator **1752** moves various ones of the elongate members **1704** to move the portion of device **1700** including stacked arrangement **1715** into the third/expanded configuration. In this example embodiment, separator **1752** includes two crank members **1754**, each crank member **1754** physically coupled to one of two flexible rotary shafts **1756**. Various articulated joints (not shown) pivotally couple each of crank members **1754** to a respective one of flexible rotary shafts **1756** to allow the crank members **1754** to assume a first configuration suitable for delivery through catheter sheath **1706** and a second configuration within left atrium **1762** suitable for applying sufficient force to move various ones of elongate members **1704**. Flexible rotary shafts **1756** are coupled to separating unit **1748** provided by control unit **1740**. Separating unit **1748** is selectively controllable to selectively apply torque to each of the crank members **1754** via a respective one of flexible rotary shafts **1756**. In this embodiment, oppositely oriented torques are applied to crank members **1754** to fan different ones of the elongate members **1704** in different directions. In this illustrated embodiment, one of the crank members **1754** is physically coupled to elongate member **1704***b* while the other crank member **1754** is physically coupled to elongate member **1704***c*. The application of sufficient torque to each of the crank members **1754** causes respective ones of the elongate members **1704***b* and **1704***c* to move. Various coupling members **1758** (three called out) physically couple various ones of the elongate members **1704** together. In this example embodiment, each coupling member **1758** allows movement of one of the elongate members **1704** coupled by the coupling member **1758** to also cause movement of another of the elongate members **1704** coupled by the coupling member **1758**. In this example embodiment, the coupling members **1758** are arranged to restrict or limit an amount of movement that an elongate member **1704** undergoes as the portion of the device is moved into the third/expanded configuration. In this embodiment, each coupling member **1758** is a flexible line. In this example embodiment, coordinating unit **1746** restricts separator **1752** from being operated to cause

movement of various ones of elongate members **1704** until the portion of the device **1700** is in the second/bent configuration. For clarity, various ones of bender **1730** and separator **1752** are not shown in FIGS. **4**A, **4**D and **4**E.

(104) In this example embodiment, once the portion of device **1700** has been appropriately positioned at a given location within left atrium **1762**, determination of the locations of various components of device **1700** (e.g., transducer elements **1790** including sensors or electrodes or related support structures such as elongate members **1704**) or the locations of various anatomical features within left atrium **1762** can be determined. In this example embodiment, after the portion of device **1700** has been appropriately positioned at a given location within left atrium **1762**, ablation of various regions of a tissue surface within left atrium **1762** can commence.

(105) Typically, when the elongate members **1704** arranged in an arcuate stacked array (i.e., as shown in FIG. **4**D) are repositioned into a fanned array (i.e., as shown in FIG. **4**E), the elongate members **1704** are preferably arranged away from various tissue surfaces within the left atrium **1762** to avoid obstructions that could hinder repositioning or to reduce occurrences in which damage may be inflicted on the tissue surfaces, or both. In some example embodiments, portions of each of some of the elongate members **1704** can be positioned away from a tissue surface within a bodily cavity such as left atrium **1762** when the portion of the device **1700** is in the third/expanded or fanned configuration. In some example embodiments, additional manipulation of a portion of device **1700** including elongate members **1704** within a bodily cavity such as left atrium **1762** is initiated when the portion of the device **1700** is moved into the third/expanded or fanned configuration. In some example embodiments, some of the elongate members **1704** are further manipulated to conform to a shape of a tissue surface with a bodily cavity such as left atrium **1762** when the portion of the device **1700** is moved into the third/expanded or fanned configuration. In some example embodiments, a tissue surface within a bodily cavity such as left atrium **1762** is further manipulated to conform to a shape of a number of the elongate members **1704** when the portion of the device **1700** is moved into the third/expanded or fanned configuration. In some example embodiments, a portion of the elongate members **1704** and a tissue surface within a bodily cavity such as left atrium **1762** are each further manipulated to create conformance between a number of the elongate members **1704** and a portion of the tissue surface when the portion of the device **1700** is moved into the third/expanded configuration. In some example embodiments, bending unit **1742** is operated to further manipulate various ones of the elongate members **1704** when the portion of the device **1700** is moved into the third/expanded or fanned configuration. For example, bending unit **1742** can be operated to adjust tension on control element **1732** to release stored potential energy from various ones of the elongate members **1704**. In some example embodiments, an adjustment in tension will cause a resilient elongate member **1704** to uncoil or unbend and bear against a proximate tissue surface within left atrium **1762** by an amount sufficient to bias the remaining elongate members **1704***b*, **1704***c*, **1704***d*, **1704***e* and **1704***f* towards portions of the tissue surface proximate these elongate members. A location of various transducer elements (e.g., sensors or electrodes, or both) carried by various ones of the elongate members **1704** relative to a tissue surface within left atrium **1762** can also be adjusted by this or other manipulations of the elongate members **1704**.

(106) FIG. **5**A is an isometric view of a portion of a device **2400** according to one example embodiment. Device **2400** includes a structure or frame **2402** that includes an arrangement of elongate members **2404***a*, **2404***b*, **2404***c*, **2404***d*, and **2404***e* (collectively **2404**) illustrated in FIG. **5**A in a first/unexpanded configuration suitably sized for delivery through catheter sheath **2406** (i.e., showed sectioned). The elongate members **2404** are physically coupled to shaft member **2410** which is employed to convey the elongate members **2404** through catheter sheath **2406**. Each of the elongate members **2404** includes a respective distal end **2405** (only one called out), a respective proximal end **2407** (only one called out), a respective intermediate portion **2409** (only one called out) positioned between the distal end **2405** and the proximal end **2407**. In this example

embodiment, each elongate member **2404** is arranged in frame **2402** to be advanced distal end **2405** first into a bodily cavity (not shown).

(107) FIG. **5**B is an isometric view of one of the elongate members **2404** (i.e., elongate member **2404***b*). Each of the elongate members **2404** includes a respective length **2411** between the distal end **2405** and the proximal end **2407**. As shown in FIG. **5**A, each of various ones of the elongate members **2404** has a different respective length **2411** (not called out) than the respective length **2411** (not called out) of another of the elongate members **2404**. In a manner similar to that described in some previous embodiments, various transducer elements can be carried into a bodily cavity by various ones of elongate members **2404**. In some embodiments, various transducer elements can be provided on, or by various flexible circuit structures made up of various flexible substrates which can include by way of non-limiting example, elongate member **2404** itself. As exemplified in FIG. **5**B, each of the elongate members **2404** includes a plurality of transducer elements **2490** (two called out in each of FIGS. **5**A and **5**B) distributed along the respective length **2411** of the elongate member in this example embodiment. For clarity, various transducer elements **2490** associated with device **2400** are not shown in FIGS. **5**C, **5**D, **5**E, **5**F, **5**G, and **5**H.

(108) In some previously described embodiments, various elongate members had respective lengths that were sized to be substantially less than a circumference of a portion of an interior surface of a bodily cavity to which the elongate member was to be positioned at least proximate to when in a deployed configuration. The circumference of the portion of the interior tissue surface may have a measured or anticipated value. For example, in the deployed configuration of device **1700** of the embodiment shown in FIG. **4**E, various ones of the elongate members **1704** have a respective length **1711** that is sized to be equal to approximately half an internal circumference of left atrium **1762**. In the embodiment shown in FIG. **4**E, elongate members **1704***b*, **1704***c*, **1704***d*, **1704***e* and **1704***f* in the deployed configuration are arranged in a generally domed-shaped structure. In the deployed configuration of device **1700** of the embodiment shown in FIG. **4**E, the domed shape structure enclosing a volume sized to be on the order of a volume of a hemispherical half of left atrium **1762**. Various transducer elements (e.g., sensors or electrodes, or both) (not shown) carried by various ones of the elongate members **1704***b*, **1704***c*, **1704***d*, **1704***e* and **1704***f* are essentially distributed across a first region of the interior tissue surface of left atrium **1762** and not across a second region separate from the first region like a region diametrically opposed to the first region. If investigation, sensing or treatment of the second region of the interior tissue surface of left atrium **1762** is additionally required, further operations or manipulations to redeploy device **1700** such that at least a portion of elongate members **1704***b*, **1704***c*, **1704***d*, **1704***e* and **1704***f* are essentially distributed across the second region of the interior tissue surface of left atrium **1762** may be required. This can impose additional requirements when the investigation, sensing or treatment of one region of the interior tissue surface of left atrium **1762** is dependent on a previous investigation, sensing or treatment of another region of the interior tissue surface of left atrium **1762**. For example, in mapping applications, the mapping of features on one region of the interior tissue surface of left atrium **1762** may need to be registered with the mapping of features on another region of the interior tissue surface of left atrium **1762** to provide a global map of the interior surface. In ablation treatment applications, the formation of an ablation lesion extending continuously across both these interior tissue regions may need to employ various stitching techniques to ensure continuity of the ablation lesion.

(109) Unlike some previously described embodiments, each of the elongate members **2404** has a respective length **2411** (not called out in FIGS. **5**A, **5**C, **5**D, **5**E, **5**F and **5**G) that is at least approximately equal to, or greater than a circumference of a portion of a interior tissue surface of a bodily cavity (again not shown) to which the elongate member **2404** is to be positioned at least proximate to when the portion of the device **2400** is in a deployed configuration. The circumference of the portion of the interior tissue surface may have a measured or anticipated value. In this example embodiment, transducer elements **2490** carried by a given one of elongate

members **2404** can be distributed across approximately the entirety of the circumference of a region of an interior tissue surface of a bodily cavity (again, not shown) over which the given one of the elongate members **2404** is positioned at least proximate to in a deployed configuration. In some embodiments, two or more of the elongate members **2404** may have substantially equal lengths **2411**.

(110) As shown in FIG. **5**A, at least the respective intermediate portions **2409** of each of the elongate members **2404** are arranged successively with respect to one another in a stacked arrangement **2415** when the portion of device **2400** is in the first/unexpanded configuration. In this embodiment, the arrangement of the respective intermediate portions **2409** in the stacked arrangement **2415** is an orderly one with each of respective intermediate portions **2409** arranged successively with respect to one another along a first direction (i.e., a stacking direction) represented by arrow **2416**. In the illustrated example embodiment, each of the elongate members **2404** is a strip-like member. As shown in FIG. **5**B, the intermediate portion **2409** of each of the elongate members **2404** includes a set of two opposing major faces or surfaces or **2418** made up of a front surface **2418***a* and a back surface **2418***b*. In this example embodiment, the two opposing surfaces **2418** are separated from one another by a thickness **2417** of the elongate member **2404**. In this illustrated example, the intermediate portion **2409** of each of the elongate members **2404** further includes a pair of side edges **2420***a*, **2420***b* (collectively **2420**) of at least one of the front surface **2418***a* and the back surface **2418***b*, the side edges of each pair of side edges **2420** opposed to one another across at least a portion of the length **2411** of the respective elongate member **2404**. As used herein and in the claims, the term stacked and variations thereof (e.g., stack) refers to an orientation and does not necessarily require that any one member be carried directly on or supported directly by a next successively adjacent elongate member **2404** in the stack.

(111) As best shown in FIG. **5**B, each elongate member includes a geodesic **2414** (i.e., represented by a broken line) extending along a portion of the respective length **2411** between a first location at least proximate the respective proximal end **2407** and a second location at least proximate the distal end **2405** of the elongate member **2404**. As used herein and in the claims the term "geodesic" should be understood to mean the shortest line extending between two points on a given surface (e.g., planar surface, curved surface) of an elongate member employed in various embodiments. In some example embodiments, a geodesic may extend over or bridge a localized opening or other local disruption in the surface of the elongate member as that shortest line extends along the surface between the two points. In this example embodiment, each geodesic **2414** is located at least on the front surface **2418***a* of the intermediate portion **2409** of a respective elongate member **2404**. Each geodesic **2414** is the shortest line on the front surface **2418***a* of the intermediate portion **2409** of a respective elongate member **2404** extending between a first location on the front surface **2418***a* at least proximate the respective proximal end **2407** and a second location on the front surface **2418***a* at least proximate the respective distal end **2405** of the elongate member **2404**. In various embodiments, the distal end **2405** is the portion of the elongate member **2404** is advanced first into a bodily cavity. In some example embodiments, each geodesic **2414** is parallel to a midline, center line, longitudinal axis, etcetera, of a respective major surface **2418** of the elongate members **2404**. In some example embodiments, each geodesic **2414** is a midline, center line, longitudinal axis, etcetera of a respective major surface **2418** of the elongate members **2404**. In some example embodiments, various ones of the elongate members **2404** may be shaped to have a plurality of geodesics **2414** (i.e., each equally sized) extending between locations at least proximate the respective proximal end **2407** and the respective distal end **2405** of the elongate member **2404**. For example, in this illustrated embodiment, the relatively "blunt" or "square" proximal and distal ends **2407**, **2405** of various ones of the elongate members **2404** allow for a plurality of equally sized geodesics **2414** to be defined across the front surface **2418***a* of each respective elongate member **2404**, each geodesic **2414** spaced from each of the opposing side edges **2420** of the respective elongate member **2404** and each geodesic extending between respective locations at least

proximate the proximal and the distal ends **2407**, **2405** of the respective elongate member **2404**. In this illustrated embodiment, a single geodesic **2414** is shown on a respective front surface **2418***a* at a location spaced from the side edges **2420***a* **2420***b* of the front surface **2418***a* for clarity. Some of the other geodesics **2414** that are not shown but having the same length as the illustrated geodesic **2414** may extend over a continuous portion of the front surface **2418***a* between locations at least proximate the respective proximal end **2407** and the respective distal end **2405** of a given elongate member **2404**.

(112) As shown in FIG. **5**A, the elongate members **2404** are arranged in a delivery configuration in this example embodiment. The elongate members **2404** are arranged with respect to one another front surface **2418***a*-toward-back surface **2418***b* in a stacked array sized to be delivered through a bodily opening (i.e., via a lumen of catheter sheath **2406**) leading to a bodily cavity. In various embodiments, the front surface **2418***a* is positionable adjacent to an interior tissue surface in the bodily cavity (not shown) when the portion of device **2400** is in a deployed configuration within the bodily cavity. In some embodiments, each front surface **2418***a* is positionable to face an interior tissue surface in the bodily cavity when the portion of device **2400** is in a deployed configuration within the bodily cavity. In this embodiment, each front surface **2418***a* includes, or supports a transducer element **2490** that is positionable adjacent to an interior tissue surface in the bodily cavity when the portion of device **2400** is in a deployed configuration within the bodily cavity.

(113) As shown in FIG. **5**B, various ones of elongate members **2404** each includes a plurality of openings **2419** including first opening **2419***a*, second opening **2419***b* and third opening **2419***c* in this example embodiment. Each of first opening **2419***a*, second opening **2419***b* and third opening **2419***c* provides a passageway through a respective elongate member **2404**. Each of first opening **2419***a*, second opening **2419***b* and third opening **2419***c* are spaced from one another along the length **2411** of a respective elongate member **2404**.

(114) In various example embodiments, various ones of the elongate members **2404** are physically coupled together by at least one coupler. In this example embodiment, the at least one coupler includes coupler **2422** (i.e., not shown in FIG. **5**B) which forms part of an articulable joint and includes a pivot member **2423** in the form of a pin sized to be received in the first opening **2419***a*. In this embodiment, each of various ones of the elongate members **2404** is configured to turn, revolve, pivot or rotate about pivot member **2423**. The at least one coupler can include other articulated or non-articulated joints in various embodiments.

(115) FIG. **5**C is an isometric view of the portion of the device **2400** including the plurality of elongate members **2404** illustrated as positioned in a second/bent configuration (i.e., an example of one deployed configuration). This configuration can be established within a bodily cavity in accordance with various embodiments. In this example embodiment, each elongate member **2404** in the stacked array shown in FIG. **5**A is bent about a respective bending axis **2431** (only one shown) into an arcuate stacked array as shown in FIG. **5**C. Each bending axis **2431** extends along a direction having a directional component transversely oriented to the respective length **2411** (not called out in FIG. **5**C) of the elongate member **2404**. In this example embodiment, each elongate member **2404** in the stacked array/stacked arrangement **2415** shown in FIG. **5**A is coiled or curved back on itself about a respective bending axis **2431** into a coiled stacked array **2430** as shown in FIG. **5**C.

(116) In this example embodiment, each elongate member **2404** in frame **2402** is bent to have a generally annular or ring-like profile, with each annular or ring-like profile interrupted by a separation. When positioned in the second/bent configuration, a first portion **2421***a* of the front surface **2418***a* of the respective intermediate portion **2409** of each elongate member **2404** is positioned diametrically opposite to a second portion **2421***b* of the front surface **2418***a* in the annular shaped frame **2402**. When positioned in the second/bent configuration, the coiled arrangement of elongate members **2404** is sized too large for delivery through a lumen of catheter sheath **2406**. In some example embodiments, various ones of the elongate members **2404** are bent

by a bending action or force created by a bender (i.e., not shown but similar in function to that of benders **1430** and **1730**) that may include at least one control element configured to alter a curvature or shape of one or more of the elongate members **2404**.

(117) FIGS. **5**D and **5**F show a portion of device **2400** in a third/expanded or fanned configuration (i.e., an example of a deployed configuration), according to one embodiment. FIGS. **5**E and **5**G show a portion of device **2400** in a third/expanded or fanned configuration, (i.e., an example of a deployed configuration) according to another embodiment.

(118) The third/expanded or fanned configuration can be established within a bodily cavity (not shown) in accordance with various embodiments. In one embodiment, the portion of the device **2400** is moved from the second/bent configuration shown in FIG. **5**B to the third/expanded or fanned configuration shown as exemplified by either FIGS. **5**D and **5**F or by FIGS. **5**E and **5**G.

(119) In this illustrated embodiment, at least some of the elongate members **2404** are repositioned with respect to at least one other elongate member **2404** in the coiled stacked array **2430**. In some embodiments, various ones of the elongate members **2404** are fanned, pivoted or turned with respect to at least one other elongate member **2404** about each of one or more axes, the one or more axes positioned to pass through the at least one other elongate member **2404** at two or more locations, each of the two or more locations spaced from another of the two or more locations along the respective length **2411** (not called out in FIGS. **5**D, **5**E, **5**F and **5**G) of the at least one other elongate member **2404**. For example, as shown in FIGS. **5**D and **5**E, various ones of elongate members **2404***b*, **2404***c*, **2404***d* and **2404***e* are rotated about the one or more axes **2435** which is or are arranged to pass through elongate member **2404***a* at each of three spaced apart locations **2436***a*, **2436***b* and **2436***c* along the respective length **2411** of elongate member **2404***a*. Various ones of locations **2436***b* and **2436***c* are not easily seen in each of FIGS. **5**D and **5**E because of the overlapping elongate members **2404** and are called out along with location **2436***a*. It is understood that locations **2436***a*, **2436***b* and **2436***c* are each respectively spaced apart from one another along the one or more axes **2435**. For clarity, the locations **2436***a*, **2436***b* and **2436***c* are represented by a respective “x” in FIG. **5**A which shows elongate member **2404***a* in the first/unexpanded configuration.

(120) In this example embodiment, various ones of elongate members **2404***b*, **2404***c*, **2404***d* and **2404***e* can be fanned with respect to elongate member **2404***a* along a first rotational direction (i.e., represented by first arrow **2437***a*) as shown in FIG. **5**D, and along a second rotational direction (i.e., represented by second arrow **2437***b*) as shown in FIG. **5**E that is opposite to the first rotational direction. When the portion of device **2400** is positioned in the second/bent configuration, location **2436***b* would be located along the respective length **2411** of elongate member **2404***a* between the respective first portion **2421***a* (i.e., called out in FIG. **5**C) and the respective second portion **2421***b* (i.e., called out in FIG. **5**C) of the front surface **2418***a* of elongate member **2404***a*. For clarity, various ones of elongate members **2404***a*, **2404***b*, **2404***c*, **2404***d* and **2404***e* have been called out twice in each of FIGS. **5**D and **5**E to illustrate their annular or quasi-annular or ring-like profile in the third/expanded configuration.

(121) As best illustrated in FIG. **5**F, various elongate members **2404** sweep out two opposing fanned sectors **2438***a* about the one or more axes **2435** (i.e., shown by an “x”) when rotated in the first rotational direction (i.e., represented by first arrow **2437***a*). As best illustrated in FIG. **5**G, the various elongate members **2404** sweep out two opposing fanned sectors **2438***b* about one or more axes **2435** (i.e., shown by an “x”) when rotated in the second rotational direction (i.e., represented by second arrow **2437***b*). In this example embodiment, each fanned sector **2438***a* and **2438***b* forms a quadrant of an approximately spherical fanned envelope created by a combination of the two oppositely fanned rotations. A separator (i.e., not shown, but similar in function to that of separators **1452** and **1752**) may be employed to fan the various elongate members **2404**.

(122) In one example embodiment, elongate member **2404***a* is manipulated separately from the other elongate members **2404** to unbend and bear against a proximate interior tissue surface within

the bodily cavity by an amount sufficient to hold elongate member **2404***a* relatively fast to the interior tissue surface of the bodily cavity. This can be accomplished, for example, by the use of a bending unit (i.e., not shown but similar in function to that of benders **1430** and **1730**) which increases or releases stored potential energy in elongate member **2404***a* independently from the other elongate members **2404**. With elongate member **2404***a* substantially fixed with respect to the interior surface of the bodily cavity, various ones of elongate members **2404***b*, **2404***c*, **2404***d* and **2404***e* can be fanned with respect to elongate member **2404***a* along the first rotational direction (i.e., represented by first arrow **2437***a*) to distribute transducer elements **2490** (not shown in FIGS. **5**D, **5**E, **5**F, and **5**G) across a first set of two opposing regional quadrants of an interior tissue surface within the bodily cavity.

(123) With elongate member **2404***a* substantially fixed with respect to the interior surface of the bodily cavity, various ones of elongate members **2404***b*, **2404***c*, **2404***d* and **2404***e* can be fanned with respect to elongate member **2404***a* along the second rotational direction (i.e., represented by second arrow **2437***b*) to distribute the transducer elements **2490** (again not shown in FIGS. **5**D, **5**E, **5**F, and **5**G) across another set of two opposing regional quadrants of interior tissue surface within the bodily cavity. After each of the first and the second rotational movements, an investigational, sensing or treatment action may be undertaken on the respective two opposing quadrants of interior surface region of the bodily cavity associated with each of the first and the second rotational movements. Preferably, elongate members **2404***b*, **2404***c*, **2404***d* and **2404***e* are positioned to reduce contact between the elongate members and an interior tissue surface of the bodily cavity during each of the first and the second rotational movements to reduce occurrences of damage to the interior tissue surface during these movements. After each of the first and the second rotational movements, various ones of elongate members **2404***b*, **2404***c*, **2404***d* and **2404***e* may be additionally manipulated to engage with, or be positioned at least proximate to, the interior tissue surface within the bodily cavity using a same or different mechanism employed to cause the engagement of elongate member **2404***a* with the interior tissue surface.

(124) Advantageously, the substantial fixing of elongate member **2404***a* to the tissue surface can reduce the burden of a registration requirement associated with the investigation, sensing or treatment of each of the two sets of two opposing quadrants of the interior tissue surface region within the bodily cavity. Specifically, in mapping applications, the mapping of features on one set of opposing regional quadrants of the interior surface the bodily cavity can be readily registered with mapping of features on the other set of opposing regional quadrants of the interior surface of the bodily cavity to provide a greater contiguous area map or even a global map of the interior tissue surface. In ablation treatment applications, the formation of an ablation lesion extending continuously across both adjacent regional quadrants of the interior surface of the bodily cavity can reduce stitching burdens to better ensure continuity of the ablation lesion.

(125) Advantageously, the number of elongate members **2404** employed in this embodiment allows for the investigating, sensing or treatment of a larger region of the interior tissue surface of a bodily cavity while reducing a need to add additional elongate members **2404** that would increase the stacked size of stacked arrangement **2415** and possibly necessitate a use of a larger diameter catheter sheath **2406**. This is possible since each elongate member **2404** has a respective length **2411** approximately equal or greater than a circumference of a portion of an interior tissue surface of a bodily cavity to which the elongate member **2404** is positioned at least proximate to when the portion of the device **2400** is in a deployed configuration. This allows for a greater region of the tissue surface to be investigated, sensed or treated while providing a stacked arrangement **2415** having a relatively small stacked size along the first direction (i.e., as represented by arrow **2416**). It is additionally noted that the greater respective lengths **2411** of the elongate members **2404** can increase their flexibility to further facilitate their delivery through catheter **2406** when the portion of the device is in the first/unexpanded configuration. The respective length **2411** of each elongate member **2404** may be preselected to be greater than a circumference of a portion of an interior

tissue surface of a bodily cavity to which the elongate member **2404** is positioned to account for variances in the actual circumference of the portion of the interior tissue surface. The circumference of the portion of the interior tissue surface may have a measured or anticipated value.

(126) Referring back to FIGS. **5**D and **5**E, the one or more axes **2435** is or are represented as a single axis arranged to pass through at least elongate member **2404***a* at each of three spaced apart locations **2436***a*, **2436***b* and **2436***c* along the respective length **2411** of elongate member **2404***a* in this embodiment. Again, the three spaced apart locations **2436***a*, **2436***b* and **2436***c* are best seen in FIG. **5**A. In some embodiments, the one or more axes **2435** may include two or more axes, each of the two or more axes passing though a respective one of at least one of the locations **2436***a*, **2436***b* and **2436***c* that are spaced along the respective length **2411** of at least elongate member **2404***a*. In some embodiments, at least a first axis of the two or more axes is collinear with a second axis of the two or more axes. In some embodiments, at least a first axis of the two or more axes is not collinear with a second axis of the two or more axes. Minor distortions in the elongate members **2404** or various pivot clearances may allow for some degree of non-colinearity between the axes during the fanning.

(127) In this illustrated embodiment, each of the elongate members **2404***b*, **2404***c*, **2404***d* and **2404***e* cross elongate member **2404***a* in an “X” configuration at location **2436***b* in the third/expanded configuration. In various example embodiments, a first elongate member **2404** may cross a second elongate member **2404** in an “X” configuration at two or more locations spaced apart from one another along the respective length **2411** of the second elongate member **2404** in the third/expanded configuration. In some example embodiments, a first elongate member **2404** may cross a second elongate member **2404** in an “X” configuration at least at three locations spaced apart from one another along the respective length **2411** of the second elongate member **2404** in the third/expanded configuration. As used herein and in the claims, when a first elongate member crosses a second elongate member in an X configuration at each of one or more locations, a respective portion of the first elongate member crosses a respective portion of the second elongate member at each location of the one or more locations in a crossed configuration similar in form to the letter “X” as viewed or projected perpendicularly from one of the elongate members at the portion, location or point of the crossing. It is understood that a crossing angle between respective pairs of crossed first and second elongate members may vary within a given embodiment or between different embodiments.

(128) In this example embodiment, one of the respective side edges **2420** of at least a first elongate member **2404** crosses one of the respective side edges **2420** of a second elongate member **2404** at each of a plurality of spaced apart locations along the respective length **2411** of the second elongate member **2404** as viewed normally to each of a respective one of a plurality of portions of the front surface **2418***a* of the second elongate member **2404** over which each of the plurality of spaced apart locations along the respective length **2411** of the second elongate member **2404** is positioned in the third/expanded configuration. In this example embodiment, one of the respective side edges **2420***a* and **2420***b* of at least a first elongate member **2404** crosses an opposite or opposed one of the respective side edges **2420***a* and **2420***b* of a second elongate member **2404** at each of a plurality of spaced apart locations along the respective length **2411** of the second elongate member **2404** as viewed normally to each of a respective one of a plurality of portions of the front surface **2418***a* of the second elongate member **2404** over which each of the plurality of spaced apart locations along the respective length **2411** of the second elongate member **2404** is positioned in the third/expanded configuration. That is, the one of the respective side edges **2420***a* and **2420***b* of the first elongate member **2404** and the crossed one of side edges **2420***a* and **2420***b* of the second elongate member **2404** are on opposing sides of the stacked arrangement **2415** during the first/unexpanded configuration. For example, as shown in FIG. **5**D, the side edge **2420***b* of elongate member **2404***a* crosses the side edge **2420***a* of elongate member **2404***b* at each of a plurality of spaced apart

locations along the respective length **2411** of elongate member **2404***b* as viewed normally to each of a respective one of a plurality of portions of the front surface **2418***a* of elongate member **2404***b* over which each of the spaced apart locations along the respective length **2411** of elongate member **2404***b* is positioned when the various elongate members **2404** are fanned along the first rotational direction (i.e., as represented by first arrow **2437***a*). Conversely, the side edge **2420***a* of elongate member **2404***a* crosses the side edge **2420***b* of elongate member **2404***b* at each of a plurality of spaced apart locations along the respective length **2411** of elongate member **2404***b* as viewed normally to each of a respective one of a plurality of portions of the front surface **2418***a* of elongate member **2404***b* over which each of the spaced apart locations along the respective length **2411** of elongate member **2404***b* is positioned when the various elongate members **2404** are fanned along the second rotational direction (i.e., as represented by second arrow **2437***b*) as shown in FIG. **5**E. The various side edges **2420** of elongate member **2404***a* cross the side edges **2420** of the other elongate members **2404***c*, **2404***d* and **2404***e* in a similar manner in this illustrated embodiment. It is additionally noted in this illustrated embodiment that each of the respective side edges **2420***a* and **2420***b* of at least a first elongate member **2404** crosses a same one (i.e., edges on a same side of stacked arrangement **2415**) of the respective side edges **2420***a* and **2420***b* of a second elongate member **2404** at each of a respective plurality of spaced apart locations along the respective length **2411** of the second elongate member **2404** as viewed normally to each of a respective one of a plurality of portions of the front surface **2418***a* of the second elongate member **2404** over which each of the respective plurality of spaced apart locations along the respective length **2411** of the second elongate member **2404** is positioned when the portion of device **2400** is in the third/expanded configuration.

(129) In this example embodiment, the back surface **2418***b* of elongate member **2404***a* contacts the front surface **2418***a* of elongate member **2404***b* at each of at least one of the spaced apart locations along the respective length **2411** of elongate member **2404***b* where a side edge **2420** of elongate member **2404***a* crosses a side edge **2420** of elongate member **2404***b*. In this example embodiment, the back surface **2418***b* of elongate member **2404***a* is separated or spaced from the front surface **2418***a* of each of elongate members **2404***c*, **2404***d* and **2404***e* at each of at least one of the spaced apart locations along the respective length **2411** of each of elongate members **2404***c*, **2404***d* and **2404***e* where a side edge **2420** of elongate member **2404***a* crosses a side edge **2420** of each of elongate members **2404***c*, **2404***d* and **2404***e*.

(130) In this example embodiment, each of locations **2436***b* and **2436***c* passed through by one or more axes **2435** is spaced along the respective length **2411** of elongate member **2404***a* from a location of coupler **2422**. In this example embodiment, coupler **2422** forms part of an articulable joint comprising a pivot axis that is generally coincident with the one or more axes **2435** at location **2436***a* in the third/expanded or fanned configuration. In this example embodiment, coupler **2422** is located relatively closer to the proximal end **2407** of elongate member **2404***a* than each of locations **2436***b* and **2436***c* as best exemplified in FIG. **5**A. Additional couplers may be employed in other example embodiments. For example, an additional coupler may be employed to couple various ones of the elongate members **2404** together to cause the elongate members **2404** to cross or fan with respect to each other at location **2436***c* in the third/expanded or fanned configuration or maintain a crossed or fanned state at location **2436***c* in the third/expanded or fanned configuration. Additionally, a coupler may be employed to couple the elongate members **2404** at a location at least proximate to location **2436***b*. It is noted that various shearing translational movements typically are present between adjacent ones of the elongate members **2404** in stacked arrangement **2415** when the stacked arrangement **2415** is moved from the first/unexpanded configuration to the third/expanded or fanned configuration especially when the stacked arrangement **2415** is coiled within a bodily cavity. In some example embodiments, couplers employing obliquely oriented pivot members may be employed to allow for the shearing movement. In various embodiments, an employed pivot member may be a relatively rigid member or a relatively flexible member. In this

example embodiment, each opening **2419***b* and **2419***c* is sized to receive at least one flexible line **2440** (called out twice) arranged to pass through each of the opening **2419***b* (i.e., shown in broken lines) and **2419***c* (not called out) provided in each of the elongate members **2404** as shown in FIG. **5**C. A tubular member **2442** having a lumen sized to receive the at least one flexible line **2440** is additionally provided. Tubular member **2442** is partially sectioned to show flexible line **2440**. Upon the application of tension to flexible line **2440** after the stacked arrangement **2415** has been coiled within a bodily cavity, the various elongate members **2404** can be drawn together to align respective ones of the openings **2419***b* together and respective ones of the openings **2419***c* together. Tubular member **2442** is provided to control or impede undesired movement of various portions of the elongate members **2404** towards one another along the at least one axis **2435** (not shown in FIG. **5**C) under the influence of the tension in flexible line **2440** when the portion of the device **2400** is in the third/expanded or fanned configuration. In the first/unexpanded configuration, little tension is typically provided in flexible line **2440** and tubular member **2442** is conveyed along with the stacked arrangement **2415** through catheter sheath **2406**. For clarity, flexible line **2440** and tubular member **2442** are not shown in FIGS. **5**A, **5**B, **5**D, **5**E, **5**F, **5**G and **5**H.
(131) The respective geodesics **2414** of the elongate members **2404** may also cross themselves in the third/expanded or fanned configuration. As best shown in FIGS. **5**D and **5**E, the respective geodesic **2414** of elongate member **2404***a* crosses the respective geodesic **2414** of at least one other elongate member **2404** (i.e., elongate member **2404***b* in this exemplary case) at various locations along the respective length **2411** of the at least one other elongate member **2404** as viewed normally to a respective portion of the front surface **2418***a* of the at least one other elongate member **2404** over which each respective location is positioned in the third/expanded or fanned configuration. For clarity of illustration, the respective geodesics **2414** of other ones of the elongate members **2404** are not shown in FIGS. **5**D and **5**E.
(132) FIG. **5**H is a schematic representation of elongate member **2404***b* crossed by various portions of elongate member **2404***a* in the third/expanded or fanned configuration. For clarity, each of elongate members **2404***b* and **2404***a* are shown in a “flattened” state and it is understood that these elongate members comprise respective arcuate profiles as exemplified in FIGS. **5**D and **5**E. In this example embodiment, elongate member **2404***b* is crossed by various portions of elongate member **2404***a* in an X configuration. In this example embodiment, the respective geodesic **2414** of elongate member **2404***a* advantageously crosses the respective geodesic **2414** of elongate member **2404***b* at three spaced apart locations including a first location **2444***b* positioned between two other locations **2444***a* and **2444***c* along the respective geodesic **2414** of elongate member **2404***b* in the third/expanded or fanned configuration. In this illustrated embodiment, each of the three spaced apart locations **2444***a*, **2444***b* and **2444***c* is positioned at least proximate to one of locations **2436***a*, **2436***b* and **2436***c* (i.e., marked by an “X” in FIG. **5**H) on elongate member passed though by the one or more axes **2435** (not shown in FIG. **5**H). It is noted that other geodesics **2414** defined on each of elongate members **2404***a* and **2404***b* may also cross each other in a similar manner. Other embodiments may employ other spatial relationships between the geodesic crossing locations and the locations **2436***a*, **2436***b* and **2436***c* passed through by the one or more axes **2435**. In some embodiments, various ones of the geodesic crossing locations or various ones of the locations **2436***a*, **2436***b* and **2436***c* passed through by the one or more axes **2435** may not coincide with a location of a coupler (e.g., coupler **2422**) employed to couple an elongate member **2404** with at least one other elongate member **2404**.
(133) In this example embodiment, various ones of the three spaced geodesic crossing locations including geodesic crossing location **2444***b* are located along the respective length **2411** of elongate member **2404***b* between a location of the coupler **2422** and the respective distal end **2405** of elongate member **2404***b*. In this example embodiment, geodesic crossing location **2444***b* is also located along the respective length **2411** of elongate member **2404***b* between coupler **2422** and a second coupler comprising flexible line **2440** (not shown in FIG. **5**H) passing through opening

2419*c* in elongate member **2404***b*.

(134) FIG. **6**A is a side elevation view of a portion of a device **2500** according to one example embodiment. Device **2500** includes a structure or frame **2502** that includes an arrangement of elongate members **2504***a*, **2504***b*, **2504***c*, **2504***d*, **2504***e*, **2504***f*, **2504***g*, **2504***h*, and **2504***i* (collectively **2504**). Various ones of the elongate members **2504** are physically coupled to shaft member **2510** which is sized to convey the elongate members **2504** through catheter sheath **2506**. Shaft member **2510** includes a first end portion **2510***a* physically coupled to a handle portion **2503** and a second end portion **2510***b* physically coupled to frame **2502**. In this example embodiment, the second end portion **2510***b* of shaft member **2510** is coupled to frame **2502** at one or more locations proximate to the respective proximal ends **2507** (only one called out) of various ones of the elongate members **2504**. In this example embodiment, the second end portion **2510***b* of shaft member **2510** is physically coupled to frame **2502** at a location proximate the respective proximal end **2507** of elongate member **2504***a*.

(135) FIG. **6**B is an isometric view of a representative one of the elongate members **2504**. Each of the elongate members **2504** includes a respective distal end **2505**, a respective proximal end **2507** and an intermediate portion **2509** positioned between the proximal end **2507** and the distal end **2505**. Each elongate member **2504** includes a respective length **2511** between the respective proximal and distal ends **2507**, **2505** of the elongate member. In this example embodiment, each of various ones of the elongate members **2504** has a different respective length **2511** than the respective length **2511** of another of the elongate members **2504**. In some embodiments, two or more of the elongate members **2504** may have substantially equal lengths **2511**. In a manner similar to the respective length of various previously described elongate members, each of the elongate members **2504** has a respective length **2511** (not called out in FIGS. **6**A, **6**C, **6**D, **6**E, **6**F, **6**G, **6**H, **6**I, **6**J, **6**K, **6**L, and **6**M) that is at least approximately equal or greater than a circumference of a portion of an interior tissue surface of a bodily cavity (not shown) to which the elongate member **2504** is positioned at least proximate to when the portion of the device **2500** is in a deployed configuration. In a manner similar to other described embodiments, transducer elements (not shown) may be distributed along the respective length **2511** of various ones of the elongate members **2504**. Transducer elements carried by a given one of elongate members **2504** can be distributed around a circumferential region of the interior tissue surface of a bodily cavity (again not shown) over which the given one of the elongate members **2504** is positioned at least proximate to in a deployed configuration.

(136) Referring back to FIG. **6**B, the intermediate portion **2509** of each of the elongate members **2504** includes a set of two opposing major faces or surfaces **2518** made up of a front surface **2518***a* and a back surface **2518***b*. In this example embodiment, the two opposing surfaces **2518** are separated from one another by a thickness **2517** of the elongate member **2504**. In this illustrated example, the intermediate portion **2509** of each elongate member **2504** further includes a pair of side edges **2520***a*, **2520***b* (collectively **2520**) of at least one of the front surface **2518***a* and the back surface **2518***b* (i.e., front surface **2518***a* in this embodiment), the side edges of each pair of side edges **2520** opposed to one another across at least a portion of the length **2511** of the respective elongate member **2504**. In this example embodiment, the pair of side edges **2520** defines a portion of a periphery of the front surface **2518***a* of the elongate member **2504**. A geodesic **2514** (i.e., shown as a broken line) is definable for each elongate member **2504**. Each geodesic **2514** extends along a portion of the elongate member **2504** between a first location at least proximate the proximal end **2507** and a second location at least proximate the distal end **2505** of the elongate member **2504**. In this embodiment, each geodesic **2514** extends across the respective front surface **2518***a* of the elongate member **2504**. A portion of geodesic **2514** is shown on the back surface **2518***b* of elongate member **2504***b* in FIG. **6**B for clarity only. It is understood that the geodesic **2514** in FIG. **6**B extends across the front surface **2518***a* of elongate member **2504**. Each elongate member **2504** includes a plurality of openings including first opening **2519***a*, second opening

2519*b* and third opening **2519***c*. In this embodiment, each of first opening **2519***a*, second opening **2519***b* and third opening **2519***c* provides a passageway through the intermediate portion **2509** of a respective elongate member **2504**. Each of first opening **2519***a*, second opening **2519***b* and third opening **2519***c* is spaced from one another along the length **2511** of a respective elongate member **2504**.

(137) In this example embodiment, at least the respective intermediate portions **2509** (one called out in FIG. **6**A) of various ones of the elongate members **2504** are preformed to have a substantially bent, arcuate or curved profile in an initial state (i.e., a low energy state). As best shown in FIG. **6**A, each of various ones of the elongate members **2504** has a coiled profile (e.g., a profile that curves back on itself) in the initial or low energy state. In some example embodiments, various ones of the elongate members **2504** are coiled in the initial or low energy state. In this particular embodiment, each of the elongate members **2504** includes a scrolled or volute shape profile in the initial configuration. As shown in FIG. **6**A, each of the respective intermediate portions **2509** of the elongate members **2504** are arranged with respect to one another front surface **2518***a*-toward-back surface **2518***b* in an initial stacked array **2516** in the initial configuration. In this illustrated embodiment, the initial stacked array **2516** is an arcuate stacked array. In this illustrated embodiment, the initial stacked array **2516** is a coiled stacked array. In this illustrated embodiment, each of the elongate members **2504** has a different curvature along its respective length **2511** in the initial stacked array **2516**. In this example embodiment, each of the elongate members **2504** makes at least one full turn within the initial stacked array **2516**.

(138) In various example embodiments, each of various ones of the elongate members **2504** is physically coupled together with at least one other elongate member **2504** by at least one coupler. In this illustrated embodiment, device **2500** includes a plurality of couplers **2522** including a proximal coupler **2522***a*, a distal coupler **2522***c* and at least one intermediate coupler **2522***b*. In various example embodiments, each of proximal coupler **2522***a*, distal coupler **2522***c* and at least one intermediate coupler **2522***b* is arranged to couple at least a first one of the elongate members **2504** with at least one other of the elongate members **2504**. In this illustrated embodiment, proximal coupler **2522***a* forms part of a pivotable joint and includes a pivot member **2523**. In this embodiment pivot member **2523** is in the form of a pin sized to be received in the respective first opening **2519***a* (i.e., first opening **2519***a* shown in FIG. **6**B) provided in each of the elongate members **2504**. Each of various ones of the elongate members **2504** is configured to turn, revolve, pivot or rotate (i.e., used interchangeably herein) about a pivot axis associated with pivot member **2523**.

(139) In this example embodiment, distal coupler **2522***c* includes a first portion **2541***a* of a flexible line **2540***c* sized and arranged to be received in the respective third opening **2519***c* (i.e., best seen in FIG. **6**B) of each of the elongate members **2504** thereby physically coupling each of the elongate members **2504** together. In this example embodiment, at least a second portion **2541***b* of flexible line **2540***c* forms part of a control member of an elongate member manipulator **2550**, a portion of which may extend along a path through catheter sheath **2506**. Elongate member manipulator **2550** may include various actuators (not shown) operably coupled to various control members to transmit force via the various control members. Suitable actuators may include powered or passive actuators. Suitable actuators may include a handle, knob, lever, etcetera (not shown) manipulated by a care provider to cause force to be transmitted via a control member. In some embodiments, a separate control member is coupled to the first portion **2541***a* of flexible line **2540***c*. In this example embodiment, intermediate coupler **2522***b* includes a flexible line **2540***b* sized and arranged to be received in the respective second opening **2519***b* (i.e., best seen in FIG. **6**B) of each of the elongate members **2504** thereby physically coupling each of the elongate members together. Various knots, ferrules, bushings, etcetera may be employed to restrain a flexible line positioned in at least one of second and third openings **2519***b*, **2519***c* from escaping from the openings. It is noted that alternative or additional couplers **2522** can be employed in some embodiments. For

example, couplers such as coupling members **1458**, **1758** may be employed to couple various ones of the elongate members **2504** together. It is noted that the number of couplers **2522** is not limited to three and may include a number less than or greater than three. In some example embodiments only proximal coupler **2522***a* and distal coupler **2522***c* are employed. Various ones of the proximal coupler **2522***a*, distal coupler **2522***c* and at least one intermediate coupler **2522***b* may each couple some or all of the elongate members **2504** in various example embodiments.

(140) In this example embodiment, FIGS. **6**C, **6**D, **6**E, and **6**F are various side elevation views of a portion of device **2500** positioned within a bodily cavity at four successive intervals of time according to an example embodiment. In this illustrated embodiment, the bodily cavity is a left atrium **2562** of a heart **2560** which is shown sectioned for clarity. As shown in FIG. **6**C, the elongate members **2504** (only one called out) are interleaved with one front surface **2518***a* toward another's back surface **2518***b* (not called out in FIG. **6**C) in a stacked array **2515** sized to be delivered through a bodily opening **2564** (i.e., via a lumen **2506***c* of catheter sheath **2506** shown sectioned in FIG. **6**C) when a portion of device **2500** is in a delivery configuration also known as a first or unexpanded configuration. In this example embodiment, the bodily opening **2564** leads to left atrium **2562** which includes an interior tissue surface **2562***a* that is interrupted by a port **2564***a* of opening **2564**. In this example embodiment, the respective intermediate portions **2509** (only one called out) of the elongate members **2504** are arranged in stacked array **2515** such that each elongate member **2504** is advanced distal end **2505** first into left atrium **2562** in the first/unexpanded configuration. In this example embodiment, the plurality of couplers **2522** are arranged to be advanced distal coupler **2522***c* first into left atrium **2562** in the delivery configuration. For clarity, flexible lines **2540***b* and **2540***c* associated with respective ones of intermediate coupler **2522***b* and distal coupler **2522***c* are not shown in FIGS. **6**C, **6**D, **6**E, **6**F, **6**G, **6**H, **6**I, **6**K, **6**L, **6**N and **6**O.

(141) In this example embodiment, the respective intermediate portions **2509** of various ones of the elongate members **2504** in the initial stacked array **2516** have been stressed into a higher energy state from their initial or low energy state shown in FIG. **6**A. In this example embodiment, the elongate members **2504** in the initial stacked array **2516** have been stressed into a higher energy state suitable for unbending them sufficiently enough for delivery through catheter sheath **2506** during the delivery configuration as shown in FIG. **6**C. In this example embodiment, the initial stacked array **2516** is stressed into a higher energy state by retracting the initial stacked array **2516** into catheter sheath **2506** prior to inserting catheter sheath **2506** into a body. In some example embodiments, the initial stacked array **2516** is stressed into a higher energy state by uncoiling the initial stacked array **2516** and inserting the initial stacked array into catheter sheath **2506**. In some example embodiments, the arrangement of elongate members **2504** is reconfigured from the initial configuration shown in FIG. **6**A to the delivery configuration shown in FIG. **6**C at a point-of-use. In some example embodiments, the arrangement of elongate members **2504** is reconfigured from the initial configuration shown in FIG. **6**A to the delivery configuration shown in FIG. **6**C at a place of manufacture, assembly or distribution. In various embodiments, various devices including various guides or manipulators may be employed to reconfigure the arrangement of elongate members **2504** from the initial configuration shown in FIG. **6**A to the delivery configuration shown in FIG. **6**C. In some of these various embodiments, the devices form part of device **2500**. In some of these various embodiments, the devices are extraneous to device **2500**. Preferably, the higher energy states are controlled to not cause damage to device **2500** or catheter sheath **2506** during delivery therethrough.

(142) In this example embodiment, potential energy is imparted into the various elongate members **2504** in the stacked array **2515** by the higher energy state, the potential energy sufficient to return the arrangement of elongate members **2504** generally back to their initial energy state when released from the confines of catheter sheath **2506**. In this example embodiment, the lumen **2506***c* is positioned between a first end **2506***a* of catheter sheath **2506** and a second end **2506***b* of catheter

sheath **2506**. In some embodiments, catheter sheath **2506** may include a plurality of lumens. In this embodiment, each of the elongate members **2504** is arranged to be delivered through the lumen **2506***c* of the catheter sheath from the first end **2506***a* toward the second end **2506***b* in the delivery configuration. In this example embodiment, each of the elongate members **2504** is arranged to be advanced distal end **2505** first out from the lumen **2506***c* of the catheter sheath **2506** in the delivery configuration.

(143) FIG. **6**D shows the portion of the device **2500** including the plurality of elongate members **2504** positioned in a deployed configuration also known as a second or bent configuration within left atrium **2562**. In this example embodiment, each elongate member **2504** (only one called out) is bent about a respective bending axis **2531** (only one shown) into an arcuate stacked array **2532**. In some embodiments, a portion of each of various ones of the elongate members **2504** is bent with a substantially constant curvature about a respective bending axis **2531**. In some embodiments, a portion of each various ones of the elongate members **2504** is bent with a varying curvature about a respective bending axis **2531**. Each bending axis **2531** extends along a direction having a directional component transversely oriented to the respective length **2511** (not called out in FIG. **6**D) of the elongate member **2504**. In this example embodiment, each elongate member **2504** in the arcuate stacked array **2532** is coiled about a respective bending axis **2531** into a coiled stacked array. In this example embodiment, each elongate member **2504** is bent to have a volute shape profile within the left atrium **2562**. In this example embodiment, each elongate member is bent to have a curvature within the left atrium that varies at least once along the respective length **2511** of the elongate member **2504**. When positioned in the second/bent configuration, a first portion **2521***a* of the front surface **2518***a* of the respective intermediate portion **2509** (only one called out) of each elongate member **2504** is positioned diametrically opposite to a second portion **2521***b* of the front surface **2518***a* in the volute shaped frame **2502**. When positioned in the second/bent configuration, the coiled arrangement of elongate members **2504** is sized too large for delivery through the lumen **2506***c* of catheter sheath **2506**.

(144) In this illustrated embodiment, the respective intermediate portions **2509** of various ones of the elongate members **2504** have been preformed to autonomously bend when the intermediate portions **2509** are advanced into a bodily cavity such as left atrium **2562**. As the respective intermediate portions **2509** are advanced into left atrium **2562**, they are freed of the confines of catheter sheath **2506** and return to their low energy state (i.e., their initial coiled configuration). In this example embodiment, the respective distal end **2505** of various ones of the elongate members **2504** moves along a coiled path (e.g., a path that curves back on itself) within the left atrium **2562** when the portion of the device **2500** is moved between the first/unexpanded configuration and the second/bent configuration. In this example embodiment, the coiled path makes at least one full turn within left atrium **2562**. In some embodiments, at least part of the coiled path may extend along a volute path. In this example embodiment, the elongate members **2504** in the second/bent configuration are arranged in an arcuate stacked array **2532** that is similar to the initial stacked array **2516** that elongate members **2504** are arranged in their initial state (i.e., as shown in FIG. **6**A). In this example embodiment, shaft member **2510** and frame **2502** have a projected outline generally in the shape of the Greek letter rho (p) in the second/bent configuration, which letter may be open at point where a loop of the letter would intersect a tail of the letter, and either without, or with, an opening defined by the loop portion of the letter represented in the projected outline.

(145) In this embodiment, various elongate members **2504** are preformed to cause stacked array **2515** to autonomously coil as it is advanced into left atrium **2562** in a manner that may advantageously reduce physical interactions between stacked arrangement **2515** and interior tissue surface **2562***a* within left atrium **2562** since the respective distal ends **2505** (only one called out) of the elongate members **2504** continuously bend or curl away from the interior tissue surface **2562***a* as the elongate members **2504** are advanced into left atrium **2562**. A reduction of contact and other physical interaction with the interior tissue surface **2562***a* can reduce occurrences of, or the severity

of, damage inflicted to various tissue structures within left atrium **2562** during this positioning. In this illustrated embodiment, the arcuate stacked array **2532** is preferably sized to be positionable within left atrium **2562** with at most, minor amounts of contact with the interior tissue surface **2562***a* of left atrium **2562**. This illustrated embodiment may additionally reduce potential damage to various tissue structures within left atrium **2562** over embodiments employing benders (e.g., benders **1430**, and **1730**) that bend the elongate members as they are advanced into a bodily cavity. Many benders can impart potential energy into the elongate members during the bending of various portions of the elongate members within a bodily cavity. A failure of either the bender or the elongate member itself can release at least a portion of the potential energy and possibly damage various tissue structures in the bodily cavity. Unlike those embodiments, the elongate members **2504** in the arcuate stacked array **2532** have little potential energy since they are substantially already in their low energy state.
(146) FIG. **6**E shows the portion of the device **2500** in a deployed configuration also referred to as a third or expanded or fanned configuration in left atrium **2562**. In this illustrated embodiment, the elongate members **2504** (only one called out) were moved from the second/bent configuration shown in FIG. **6**D to the third/expanded or fanned configuration shown in FIG. **6**E. In this illustrated embodiment, at least some of the elongate members **2504** in the arcuate stacked array **2515** shown in FIG. **6**E are repositioned in left atrium **2562**. In this example embodiment, various ones of the elongate members **2504** are moved to angularly space various portions of at least some of the elongate members **2504** with respect to one another within left atrium **2562**. In this illustrated embodiment, various ones of the elongate members **2504** are fanned with respect to one another about one or more fanning axes (not shown in FIG. **6**E) into a first fanned array **2570**.
(147) As shown in FIGS. **6**G, **6**H, **6**I and **6**J, at least one of the elongate members **2504** crosses another of the elongate members **2504** in an X configuration at a location proximate a first axis **2535**. As shown in FIGS. **6**G, **6**H, **6**I and **6**J, various ones of the elongate members **2504** are fanned about first axis **2535**. In this example embodiment, first axis **2535** passes though a plurality of spaced apart locations along the respective length **2511** of each of at least some of the elongate members **2504** when the portion of the device is in the third/expanded or fanned configuration. In this example embodiment, the respective intermediate portions **2509** of each of at least some of the elongate members **2504** are angularly spaced with respect to one another about first axis **2535**. In this illustrated embodiment, each of the at least some of the plurality of elongate members **2504** includes a curved portion **2509***a* (i.e., shown in FIGS. **6**G, **6**H, and **6**I) arranged to extend along at least a portion of a respective curved path that intersects the first axis **2535** at each of a respective at least two spaced apart locations along first axis **2535** in the third/expanded configuration. In various embodiments, a curved portion **2509***a* of an elongate member **2504** can extend entirely along, or at least partway along a respective curved path that intersects the first axis **2535** at each of a respective at least two spaced apart locations along first axis **2535** in the third/expanded configuration. In various embodiments, the curved path is an arcuate path. In various embodiments, at least the portion of the curved path extended along by curved portion **2509***a* is arcuate. In this embodiment, at least a first elongate member **2504** crosses a second elongate member **2504** in an X configuration at each of at least one of the respective at least two spaced apart locations along the first axis **2535** intersected by at least the portion of the respective curved path extended along by the curved portion **2509***a* of the second elongate member **2504** in the third/expanded configuration. In this example embodiment, the first axis **2535** is shown as a single axis. It is understood that first axis **2535** can include one or more axes in various embodiments. As shown in FIG. **6**I, in this example embodiment a portion of frame **2502** is radially spaced from first axis **2535** by a first dimension **2580***a* in the third/expanded configuration. In various example embodiments, the portion of frame **2502** that is radially spaced from first axis **2535** by first dimension **2580***a* may include the respective curved portion **2509***a* of at least one of the elongate members **2504**.
(148) In this illustrated embodiment, the second end portion **2510***b* of shaft member **2510** is not

physically coupled or connected to frame **2502** at various locations on frame **2502** that are symmetrically positioned about first axis **2535** as viewed along first axis **2535** in the third/expanded configuration. Rather, in this example embodiment, the second end portion **2510***b* of shaft member **2510** is physically coupled or connected to frame **2502** at one or more locations on frame **2502**, each of the one or more locations on the structure to which the second end portion **2510***b* is coupled positioned to one side of at least one spatial plane (not shown) that is coincident with first axis **2535**. In this example embodiment, the second end portion **2510***b* of shaft member **2510** is physically coupled or connected at least proximate to the proximal ends **2507** of various ones of the elongate members **2504** in frame **2502**. In this illustrated embodiment, the positioning between frame **2502** and the second end portion **2510***b* of shaft member **2510** results at least in part from the coiling of various ones of the elongate members **2504** within left atrium **2562**. In this example embodiment, shaft member **2510** is positioned to avoid intersection by first axis **2535** in the third/expanded configuration. In this example embodiment, shaft member **2510** is positioned to avoid intersection of the second end portion **2510***b* by first axis **2535** in the third/expanded configuration. In some example embodiments, each of at least some of the plurality of elongate members **2504** may extend generally tangentially from the second end portion **2510***b* of shaft member **2510** in the third/expanded or fanned configuration. In this example embodiment, shaft member **2510** and frame **2502** have a projected outline in the shape of the Greek letter rho (p) in the third/expanded configuration. As noted above, the Greek letter rho may be represented as open at a point where a loop of the letter would intersect a tail of the letter if closed or not open, and either without or with an opening defined by a loop portion of the letter represented.

(149) Various ones of the elongate members **2504** can be moved in various ways as the portion of the device **2500** is moved into the third/expanded or fanned configuration. In this example embodiment, elongate members **2504** are fanned in a manner similar to that illustrated in FIGS. **4**G and **4**H when the portion of device **2500** is moved from the second/bent configuration shown in FIG. **6**D to the third/expanded configuration shown in FIG. **6**E. In this example embodiment, a first set of “even” elongate members **2504** (i.e., elongate members **2504***b*, **2504***d*, **2504***f* and **2504***h*) in the sequential arrangement of elongate members **2504** in the arcuate stacked arrangement **2532** are fanned along an opposite direction than a second set of the “odd” elongate members **2504** (i.e., elongate members **2504***c*, **2504***e*, **2504***g* and **2504***i*) in the sequential arrangement of elongate members **2504** in the arcuate stacked arrangement **2532** are fanned along. In this context, the words “even” and “odd” relate to a position of a respective one of the elongate members **2504** in the arcuate stacked array **2532**. In this example embodiment, the elongate members **2504** in the “even” set are interleaved with the elongate member **2504** in the “odd” set in the arcuate stacked array **2532**. In this example embodiment, various fanning mechanisms (not shown) can be employed to move various ones of the elongate members **2504** into the third/expanded configuration. In some example embodiments, various separators similar to previously described separators **1452** and **1752** may be employed to partially or fully fan at least some of the elongate members **2504**.

(150) In this example embodiment, when the portion of the device **2500** is moved into the third/expanded configuration, a portion of the front face **2518***a* (not called out in FIG. **6**E) of each of at least some of the elongate members **2504** in the arcuate stacked array **2532** that faces the back surface **2518***b* (not called out in FIG. **6**E) of another elongate member **2504** in the arcuate stacked array **2532** is repositioned in left atrium **2562** such that the portion of the front face **2518***a* of each of the at least some of the elongate members **2504** in the first fanned array **2570** directly faces a portion of the interior tissue surface **2562***a* within left atrium **2562**. FIGS. **6**G and **6**H are respective detailed isometric views of the elongate members **2504** arranged in the first fanned array **2570** during the third/expanded or fanned configuration, each of the views showing one of two opposing sides of the first fanned array **2570**. Elongate member **2504***a* and the set of “odd” elongate members **2504***c*, **2504***e*, **2504***g* and **2504***i* are called out in FIG. **6**G while elongate member **2504***a* and the set of “even” elongate members **2504***b*, **2504***d*, **2504***f* and **2504***h* are called out in FIG. **6**H.

In this example embodiment, each of a first portion **2521***a* (one called out) of the front surface **2518***a* of each elongate member **2504** is positioned diametrically opposite to a second portion **2521***b* (only one called out) of the front surface **2518***a* (i.e., as compared between FIGS. **6**G and **6**H) when the portion of device **2500** is in the third/expanded configuration.

(151) In this embodiment, frame **2502** is a structure that includes a proximal portion **2502***a* and a distal portion **2502***b*, each of the proximal and distal portions **2502***a*, **2502***b* made up of a respective portion of each elongate member **2504** of the plurality of elongate members **2504**. As best seen in FIG. **6**C, frame **2502** is arranged to be advanced distal portion **2502***b* first into left atrium **2562** when the portion of the device **2500** is in the first/unexpanded configuration. As best seen in each of the FIGS. **6**G and **6**H, the proximal portion **2502***a* of frame **2502** defines a first domed shape **2508***a* and the distal portion **2502***b* of frame **2502** defines a second domed shape **2508***b* when the portion of the device is in the third/expanded or fanned configuration. In this example embodiment, first domed shape **2508***a* has a respective apex **2512***a* (i.e., shown in FIG. **6**H) and second domed shape **2508***b* has a respective apex **2512***b* (i.e., shown in FIG. **6**G). In some example embodiments, apex **2512***b* associated with the distal portion **2502***b* of frame **2502** is positioned relatively closer to the port **2564***a* of opening **2564** than apex **2512***a* associated with the proximal portion **2502***a* of frame **2502** when the portion of the device is in the third/expanded or fanned configuration. In some example embodiments, apex **2512***b* associated with the distal portion **2502***b* of frame **2502** is positioned between port **2564***a* and apex **2512***a* associated with the proximal portion **2502***a* of frame **2502** when the portion of device **2500** is in the third/expanded or fanned configuration. In some example embodiments, apex **2512***b* associated with the distal portion **2502***b* of frame **2502** is positioned between second end **2506***b* of catheter sheath **2506** and apex **2512***a* associated with the proximal portion **2502***a* of frame **2502** when the portion of device **2500** is in the third/expanded or fanned configuration. In some example embodiments, apex **2512***b* associated with the distal portion **2502***b* of frame **2502** is positioned between a portion of shaft member **2510** and apex **2512***a* associated with the proximal portion **2502***a* of frame **2502** when the portion of device **2500** is in the third/expanded or fanned configuration.

(152) In various example embodiments, either of the first and the second domed shapes **2508***a*, **2508***b* need not be substantially hemispherical. For example, at least one of the first domed shape **2508***a* and the second domed shape **2508***b* may have a first radius of curvature in a first spatial plane and a second radius of curvature in a second spatial plane that intersects the first spatial plane, a magnitude of the second radius of curvature different than a magnitude of the first radius of curvature. In this example embodiment, each elongate member **2504** of at least some of the plurality of elongate members **2504** crosses at least one other elongate member **2504** of the plurality of elongate members **2504** at a location between the proximal and the distal portions **2502***a*, **2502***b* of frame **2502** when the portion of the device **2500** is in the third/expanded configuration. In this example embodiment, the proximal and the distal portions **2502***a*, **2502***b* of frame **2502** are arranged in a clam shell configuration in the third/expanded configuration.

(153) FIG. **6**I is a sectioned side elevation view of the detailed isometric view of the first fanned array **2570** shown in FIG. **6**G. Each of FIGS. **6**G, **6**H, **6**I and **6**J additionally shows a respective portion of shaft member **2510** and catheter sheath **2506** as well as a portion of the port **2564***a* interrupting the interior tissue surface **2562***a* (not called out in FIG. **6**H) of left atrium **2562**. In this illustrated embodiment, each of the elongate members **2504** includes a scrolled or a volute shape profile in the third/expanded configuration as best exemplified by elongate member **2504***a* in FIG. **6**I. In this illustrated embodiment, various portions of the elongate members **2504** are fanned such that the second opening **2519***b* (only one called out in each of FIGS. **6**G, **6**H, **6**I and **6**J) and third opening **2519***c* (only one called out in each of FIGS. **6**G, **6**H, **6**I and **6**J) of each of various ones of elongate members **2504** is not aligned with a respective one of the second opening **2519***b* and third opening **2519***c* of another of the elongate members **2504**. For clarity, each of flexible line **2540***b* and the first portion **2541***a* of flexible line **2540***c* that form part of a respective one of intermediate

coupler **2522***b* and distal coupler **2522***c* and which are arranged to pass through a respective one of the second opening **2519***b* and the third opening **2519***c* in each of the elongate members **2504** are not shown in each of FIGS. **6**G, **6**H and **6**I.

(154) FIG. **6**J is a partially sectioned end elevation view of the first fanned array **2570** showing the respective distal ends **2505** (two called out) of the elongate members **2504**. Various ones of the elongate members **2504** are partially sectioned in FIG. **6**J to better show the respective distal ends **2505** of the elongate members **2504**. FIG. **6**J shows the first portion **2541***a* of flexible line **2540***c* follows a winding, zig-zag or serpentine path through the third openings **2519***c* (i.e., only one called out) of alternating ones of the "even" elongate members **2504***b*, **2504***d*, **2504***f* and **2504***h* and the "odd" elongate members **2504***c*, **2504***e*, **2504***g* and **2504***i*. Flexible line **2540***b* (not shown) may follow a similar path through the second openings **2519***b* (i.e., only one called out). The second portion **2541***b* of flexible line **2540***c* is also shown in FIG. **6**J.

(155) As best shown in FIGS. **6**G and **6**H, the respective geodesic **2514** of elongate member **2504***g* crosses the respective geodesic **2514** of at least one other elongate member **2504** (i.e., elongate member **2504***i* in this exemplary case) at various locations along the respective length **2511** (not called out) of the at least one other elongate member **2504** as viewed normally to a respective portion of the front surface **2518***a* of the at least one other elongate member **2504** over which each respective location is positioned in the third/expanded configuration. For clarity of illustration, the respective geodesics **2514** of various ones of the elongate members **2504** are not shown in FIGS. **6**G and **6**H.

(156) FIG. **6**N schematically shows a portion of the first fanned array **2570** that includes second elongate member (i.e., elongate member **2504***i*) with various portions of a first elongate member (i.e., elongate member **2504***g*) crossing the second elongate member **2504***i* in an X configuration at various locations in the third/expanded or fanned configuration. For clarity, each of elongate members **2504***i* and **2504***g* are shown in a "flattened" state and it is understood that these elongate members include respective arcuate profiles as exemplified in FIGS. **6**G and **6**H. The respective geodesic **2514** of the first elongate member **2504***g* crosses the respective geodesic **2514** of the second elongate member **2504***i* at a plurality of spaced apart locations (i.e., each represented by an "X" in FIG. **6**N) including a first location **2544***c* positioned relatively closer to the respective distal end **2505** of the second elongate member **2504***i* than two other locations **2544***a* and **2544***b* along the respective geodesic **2514** of second elongate member **2504***i* in the third/expanded or fanned configuration. It is understood that each of the crossing locations **2544***a*, **2544***b* and **2544***c* is located on the front surface **2518***a* of the second elongate member **2504***i* and is overlapped by first elongate member **2504***g* in FIG. **6**N. In this illustrated embodiment, the first location **2544***c* is positioned between the location of the proximal coupler **2522***a* and the respective distal end **2505** of the second elongate member **2504***i*. In this illustrated embodiment, the first location **2544***c* is positioned along the respective length **2511** of the second elongate member **2504***i* between the respective locations of distal coupler **2522***c* (i.e., the first portion **2541***a* of flexible line **2540***c* which is not shown but whose location in FIG. **6**N is represented by third opening **2519***c*) and the intermediate coupler **2522***b* (i.e., flexible line **2540***b* whose location in FIG. **6**N is represented by second opening **2519***b*). In this example embodiment, the first location **2544***c* is positioned along the respective length **2511** of second elongate member **2504***i* relatively closer to the respective distal end **2505** of second elongate member **2504***i* than a respective location of each of the intermediate coupler **2522***b* and the proximal coupler **2522***a*. In this example embodiment, the first location **2544***c* is spaced apart from the respective distal end **2505** of second elongate member **2504***i*. In this example embodiment, the first elongate member **2504***g* crosses the second elongate member **2504***i* in an X configuration at each of locations **2544***b* and **2544***c*.

(157) In this example embodiment, additional manipulation of a portion of device **2500** including elongate members **2504** within a bodily cavity such as left atrium **2562** is initiated when the portion of the device **2500** is moved into the third/expanded or fanned configuration. Typically, when the

elongate members **2504** arranged in arcuate stacked array **2532** are repositioned into a fanned array (i.e., first fanned array **2570** in this example embodiment), the elongate members **2504** are preferably arranged generally away from various tissue surfaces within the left atrium **2562** to avoid obstructions that could hinder repositioning or to avoid inflicting damage to the tissue surfaces. Referring to FIG. **6**E, various portions of each of some of the elongate members **2504** are positioned away from the interior tissue surface **2562***a* within left atrium **2562** when the portion of the device **2500** is in the third/expanded configuration. As compared between FIGS. **6**G and **6**H, the first portions **2521***a* (only one called out) and the second portions **2521***b* (only one called out) of the front surface **2518***a* of each of least some of the elongate members **2504** in the first fanned array **2570** are angularly spaced about first axis **2535** when the portion of the device **2500** is in the third/expanded configuration. In this illustrated embodiment, at least some of the elongate members **2504** are further manipulated in the third/expanded configuration to vary a radial spacing between the first axis **2535** and at least one of the first portion **2521***a* and the second portion **2521***b* of the front surface **2518***a* of various ones of the elongate members **2504**.

(158) As shown in FIG. **6**F, at least some of the elongate members **2504** (only one called out) are further manipulated in the third/expanded configuration to form a second fanned array **2572**. In this example embodiment, at least some of the elongate members **2504** are further manipulated to increase a radial distance between the first axis **2535** and at least one of the first portion **2521***a* (not called out in FIG. **6**F) and the second portion **2521***b* (not called out in FIG. **6**F) of the front surface **2518***a* of various ones of the elongate members **2504**. In this example embodiment, at least some of the elongate members **2504** are further manipulated to increase first dimension **2580***a* (not called out in FIG. **6**F).

(159) Further manipulation of the at least some of the elongate members **2504** may be motivated for various reasons. For example, the at least some of the elongate members **2504** may be further manipulated to adjust a positioning between various transducer elements carried by the elongate members **2504** and a tissue surface within a bodily cavity. The at least some of the elongate members **2504** may be further manipulated to create conformance with a tissue surface with a bodily cavity such as left atrium **2562** when the portion of the device **2500** is moved into the third/expanded or fanned configuration. In some example embodiments, a tissue surface within a bodily cavity such as left atrium **2562** is further manipulated to conform to a shape of a number of the elongate members **2504** when the portion of the device **2500** is moved into the third/expanded or fanned configuration. In some example embodiments, a portion of the elongate members **2504** and a tissue surface within a bodily cavity such as left atrium **2562** are each further manipulated to create conformance between a number of the elongate members **2504** and a portion of the tissue surface when the portion of the device **2500** is moved into the third/expanded or fanned configuration. In this example embodiment, shaft member **2510** and frame **2502** have a projected outline in the shape of the Greek letter rho (p), as noted above, when the elongate members **2504** are further manipulated into the second fanned array **2572**.

(160) FIGS. **6**K and **6**L are respective detailed isometric views of the elongate members **2504** arranged in the second fanned array **2572** shown in FIG. **6**F, each of the views showing one of two opposing sides of the second fanned array **2572**. In some example embodiments, the proximal and the distal portions **2502***a*, **2502***b* of frame **2502** are additionally manipulated when the portion of the device is moved into the third/expanded or fanned configuration. In some example embodiments, the respective dome shaped structures (i.e., first and second domed shapes **2508***a*, **2508***b*) of the proximal and the distal portions **2502***a*, **2502***b* of frame **2502** are physically coupled together to pivot with respect to one another when the structure is in the third/expanded configuration. In this example embodiment, the respective dome shaped structures (i.e., first and second domed shapes **2508***a*, **2508***b*) of the proximal and the distal portions **2502***a*, **2502***b* of frame **2502** may be pivoted with respect to one another about a region of reduced bending stiffness in frame **2502**. In some example embodiments, portions of various ones of the elongate members

2504 provide a flexure portion of the frame **2502** between the proximal and the distal portions **2502***a*, **2502***b* that pivotably couples the proximal and the distal portions **2502***a*, **2502***b* together. In some example embodiments, the proximal and the distal portions **2502***a*, **2502***b* are pivoted with respect to one another to change a distance therebetween. For example, the proximal and the distal portions **2502***a*, **2502***b* may be pivoted apart to create conformance between frame **2502** and a portion of a tissue surface within a bodily cavity. In some example embodiments, the proximal and the distal portions **2502***a*, **2502***b* are pivoted with respect to one another to change a distance between apex **2512***a* and apex **2512***b*.

(161) In this example embodiment, at least one of the proximal and the distal portions **2502***a*, **2502***b* of frame **2502** is additionally manipulated to distort a respective one of the first domed shape **2508***a* and the second domed shape **2508***b* to move between the first fanned array **2570** and the second fanned array **2572**. Each of the first domed shape **2508***a* and the second domed shape **2508***b* has a respective volume therein. In some example embodiments, at least one of the proximal and the distal portions **2502***a*, **2502***b* of frame **2502** is acted upon to reduce a difference between the respective volumes of the first and the second domed shapes **2508***a*, **2508***b*. In some example embodiments, frame **2502** is acted upon to vary the respective volume of at least one of the first and the second domed shapes **2508***a*, **2508***b*. In this example embodiment, a respective volume associated with at least the second domed shape **2508***b* is increased to move between the first fanned array **2570** and the second fanned array **2572**. In some example embodiments, each of the proximal and the distal portions **2502***a*, **2502***b* of frame **2502** are pivotable with respect to one another at a pivot location (e.g., near a crossing location of the elongate members) and each of the first and the second domed shapes **2508***a*, **2508***b* may be characterized at least in part by a respective height (not shown) extending normally from a respective spatial plane (not shown) to the respective apex (i.e., apex **2512***a* or apex **2512***b*) of the domed shape. Frame **2502** may be acted upon to vary at least one of a magnitude of the respective height of the first domed shape **2508***a* and a magnitude of the respective height of the second domed shape **2508***b* to move between the first fanned array **2570** and the second fanned array **2572**.

(162) FIG. **6**M shows a sectioned elevation view of the detailed isometric view of FIG. **6**K. Each of FIGS. **6**K, **6**L and **6**M additionally includes a respective portion of shaft member **2510** and catheter sheath **2506** as well as the port **2564***a* interrupting the interior tissue surface **2562***a* (not called out in FIG. **6**L) within left atrium **2562**. As shown in FIGS. **6**K and **6**L, the respective intermediate portions **2509** (only one called out) are still fanned or angularly spaced about first axis **2535** in this example embodiment, albeit the first axis **2535** passes through at least some locations through various ones of the elongate members **2504** that are different than the respective locations passed through by the first axis **2535** in the first fanned array **2570** shown in FIGS. **6**G and **6**H. In this respect, the angular arrangement is similar to an arrangement of lines of longitude about a body of rotation, which may or may not be a spherical body of rotation. In this illustrated embodiment, each of at least some of the plurality of elongate members **2504** continues to include a curved portion **2509***a* arranged to extend along at least a portion of a respective curved path that intersects the first axis **2535** at each of a respective at least two spaced apart locations along first axis **2535** after the additional manipulation. As shown in FIGS. **6**K and **6**L, the first portions **2521***a* (only one called out) and the second portions **2521***b* (only one called out) of the front surfaces **2518***a* of the elongate members **2504** are circumferentially arranged about the first axis **2535**, similar to lines of longitude about an axis of rotation of a body of revolution, which body of revolution may, or may not, be spherical. Use of the word circumference in the application, and derivatives thereof, such as circumferential, circumscribe, circumlocute and other derivatives, refers to a boundary line of a shape, volume or object which may, or may not, be circular or spherical. The terms “radially arranged”, and “angularly arranged” are used interchangeably herein and in the claims, to refer to an arrangement similar to lines of longitude distributed at least partially (e.g., hemispherical) about an axis (e.g., polar axis) of a body (e.g., body of revolution). In this example embodiment, the first

portion **2521***a* of the front surface **2518***a* of each elongate member **2504** is positioned to face a first portion of the interior tissue surface **2562***a* (not shown) within left atrium **2562** and the second portion **2521***b* of the front surface **2518***a* of the elongate member **2504** is positioned to face a second portion of the interior tissue surface **2562***a* (not shown) within left atrium **2562**, the second portion of the interior tissue surface **2562***a* positioned diametrically opposite from the first portion of the interior tissue surface **2562***a* in the third/expanded or fanned configuration.

(163) As shown in the sectioned view of FIG. **6**M, the distal coupler **2522***c* is located with left atrium **2562** at a respective location positioned relatively closer to port **2564***a* than a respective location of intermediate coupler **2522***b* within the left atrium **2562** when the portion of the device **2500** is in the third/expanded or fanned configuration. In this example embodiment, the distal coupler **2522***c* is located within left atrium **2562** at a respective location positioned relatively closer to the proximal coupler **2522***a* than a respective location of intermediate coupler **2522***b* in the third/expanded or fanned configuration. In this example embodiment, the distal coupler **2522***c* is located within left atrium **2562** at a respective location positioned relatively closer to the proximal coupler **2522***a* in the third/expanded or fanned configuration than when each of the proximal coupler **2522***a* and the distal coupler **2522***c* are located within lumen **2506***c* of catheter **2506** in the first/unexpanded configuration (e.g., as shown in FIG. **6**C).

(164) As shown in FIG. **6**M, proximal coupler **2522***a* is located within the left atrium **2562** at a respective location positioned relatively closer to port **2564***a* than the respective location of intermediate coupler **2522***b* in this illustrated embodiment. In some example embodiments, the respective location of the proximal coupler **2522***a* is located relatively closer to port **2564***a* than the respective location of distal coupler **2522***c* within the left atrium **2562** when the portion of the device **2500** is in the third/expanded or fanned configuration shown in FIG. **6**F. In some example embodiments, the respective location of the distal coupler **2522***c* is located relatively closer to port **2564***a* than the respective location of the proximal coupler **2522***a* within the left atrium **2562** when the portion of the device **2500** is in the third/expanded or fanned configuration shown in FIG. **6**F. In this illustrated embodiment, the proximal coupler **2522***a* is positioned within the left atrium **2562** when the portion of the device **2500** is in the third/expanded or fanned configuration shown in FIG. **6**F. In some example embodiments, the proximal coupler **2522***a* is positioned in the bodily opening **2564** when the portion of the device **2500** is in the third/expanded or fanned configuration shown in FIG. **6**F. In some example embodiments, the proximal coupler **2522***a* is positioned within the body at a respective location outside of the left atrium **2562** when the portion of the device **2500** is in the third/expanded or fanned configuration shown in FIG. **6**F.

(165) In this illustrated embodiment, various ones of the elongate members **2504** cross others of the elongate members **2504** at various crossing locations within left atrium **2562** when the portion of the device is in the third/expanded or fanned configuration shown in each of the FIGS. **6**F, **6**K, **6**L and **6**M. For example as best shown in FIGS. **6**K and **6**L, at least the first elongate member (i.e., elongate member **2504***g*) is positioned to cross the second elongate member (i.e., elongate member **2504***i*) at each of a number of crossing locations **2546** within the left atrium **2562**. In this example embodiment, at least the first elongate member **2504***g* is positioned to cross the second elongate member **2504***i* in an X configuration at some of the crossing locations **2546**. In this embodiment, each of the crossing locations **2546** is located on the front surface **2518***a* of second elongate member **2504***i* at a respective one of a number of locations along the respective geodesic **2514** of second elongate member **2504***i* that is crossed by the respective geodesic **2514** of first elongate member **2504***g* as viewed normally to a respective one of a number of portions of the front surface **2518***a* of the second elongate member **2504***i* over which each of the respective ones of the number of locations along the respective geodesic **2514** of second elongate member **2504***i* is located.

(166) The crossing locations **2546** are best shown in FIG. **6**O which is a schematic representation of a portion of the second fanned array **2572** that includes second elongate member **2504***i* with various portions of first elongate member **2504***g* crossing second elongate member **2504***i* in the

third/expanded or fanned configuration. For clarity, each of elongate members **2504***g* and **2504***i* are shown in a "flattened" state and it is understood that these elongate members include respective arcuate profiles as exemplified in FIGS. **6**K and **6**L. Each crossing location **2546** is represented by an "X" in FIG. **6**O. In this illustrated embodiment, the plurality of crossing locations **2546** include a proximal crossing location **2546***a*, an intermediate crossing location **2546***b* and a distal crossing location **2546***c*. It is understood that each of the crossing locations **2546***a*, **2546***b* and **2546***c* is located on the front surface **2518***a* of the second elongate member **2504***i* and is overlapped by the first elongate member **2504***g* in FIG. **6**O.

(167) In this illustrated embodiment, the proximal crossing location **2546***a* is located on the front surface **2518***a* of the second elongate member **2504***i* at least proximate to proximal coupler **2522***a*, the intermediate crossing location **2546***b* is located on the front surface **2518***a* of the second elongate member **2504***i* at least proximate to intermediate coupler **2522***b* (i.e., whose location is represented by second opening **2519***b* in FIG. **6**O) and the distal crossing location **2546***c* is located on the front surface **2518***a* of the second elongate member **2504***i* at least proximate to the distal coupler **2522***c* (i.e., whose location is represented by third opening **2519***c* in FIG. **6**O). In this example embodiment, a location of the intermediate crossing location **2546***b* along the respective geodesic **2514** of the second elongate member **2504***i* is positioned along the respective length **2511** of the second elongate member **2504***i* between the respective locations of the proximal coupler **2522***a* and the distal coupler **2522***c* when the portion of the device **2500** is in the third/expanded or fanned configuration shown in each of the FIGS. **6**F, **6**K, **6**L, and **6**M. In this embodiment, a location of the distal crossing location **2546***c* along the respective geodesic **2514** of the second elongate member **2504***i* is positioned along the respective length **2511** of the second elongate member **2504***i* relatively closer to the respective distal end **2505** of the second elongate member **2504***i* than a respective location of each of proximal coupler **2522***a* and intermediate coupler **2522***b* when the portion of the device **2500** is in the third/expanded or fanned configuration shown in each of FIGS. **6**F, **6**K, **6**L and **6**M.

(168) In this example embodiment, the back surface **2518***b* of the respective intermediate portion **2509** of the first elongate member **2504***g* is separated from the front surface **2518***a* of the respective intermediate portion **2509** of second elongate member **2504***i* at each of the crossing locations **2546** along the respective geodesic **2514** of the second elongate member **2504***i* when the portion of the device **2500** is in the third/expanded or fanned configuration shown in each of the FIGS. **6**F, **6**K, **6**L and **6**M. In some example embodiments, the back surface **2518***b* of the respective intermediate portion **2509** of a first elongate member **2504** contacts the front surface **2518***a* of the respective intermediate portion **2509** of a second elongate member **2504** at each of at least one of the crossing locations **2546** along the respective geodesic **2514** of the second elongate member **2504** when the portion of the device **2500** is in the third/expanded or fanned configuration shown in each of the FIGS. **6**F, **6**K, **6**L and **6**M. As best seen in FIG. **6**M, the respective distal end **2505** (only one called out) of each elongate member **2504** is positioned within the left atrium **2562** at a respective location positioned relatively closer to port **2564***a* than at least one of the crossing locations **2546** (e.g., intermediate crossing locations **2546***b* in this example embodiment) when the portion of the device **2500** is in the third/expanded or fanned configuration shown in each of the FIGS. **6**F, **6**K, **6**L and **6**M. In this example embodiment, at least one or more of the other crossing locations **2546** (i.e., each of proximal crossing location **2546***a* and distal crossing location **2546***c* in this embodiment) are positioned within left atrium **2562** relatively closer to port **2564***a* than the intermediate crossing location **2546***b* when the portion of the device **2500** is in the third/expanded or fanned configuration shown in each of the FIGS. **6**F, **6**K, **6**L and **6**M. In this example embodiment, the respective proximal end **2507** (only one called out) of various ones of the elongate members **2504** is positioned within left atrium **2562** at a respective location located relatively closer to port **2564***a* than at least the intermediate crossing location **2546***b* when the portion of the device **2500** is in the third/expanded or fanned configuration shown in each of the FIGS. **6**F, **6**K, **6**L and **6**M.

(169) In this embodiment, an actuator (not shown) associated with elongate member manipulator **2550** is employed in the third/expanded configuration to further manipulate various elongate members **2504** to reconfigure the first fanned array **2570** shown in FIG. **6**E into the second fanned array **2572** shown in FIG. **6**F. In this example embodiment, a suitable tension is applied to the second portion **2541***b* of flexible line **2540***c* in the third/expanded or fanned configuration to further manipulate first fanned array **2570** shown in FIG. **6**E into the second fanned array **2572** shown in FIG. **6**F. As shown in FIG. **6**M the tension applied to the second portion **2541***b* of flexible line **2540***c* is sufficient to change the volute shaped profile of each of at least some of the elongate members **2504** in the first fanned array **2570** into a generally more uniform annular or ring-like profile as shown in the second fanned array **2572** of FIG. **6**M. As compared between FIGS. **61** and **6**M, the tension applied to the second portion **2541***b* of flexible line **2540***c* is sufficient to reduce a curvature of the curved portion **2509***a* of each of at least some of the elongate members **2504** along their respective lengths **2511** to manipulate the first fanned array **2570** into the second fanned array **2572**. In this example embodiment, the curvature of at least one portion of an elongate member **2504** that is located between a respective distal end **2505** and a respective location passed through by the first axis **2535** is reduced when a suitable tension is applied to the second portion **2541***b* of flexible line **2540***c*. In this example embodiment, the reduction in curvature of the curved portion **2509***a* of each of at least some of the elongate members **2504** advantageously increases the first dimension **2580***a* associated with the first fanned array **2570** shown in FIG. **6**I to have a larger magnitude as represented by the first dimension **2580***b* associated with the second fanned array **2572** shown in FIG. **6**M. As used herein, the word “curvature” should be understood to mean a measure or amount of curving. In some example embodiments, the word “curvature” is associated with a rate of change of the angle through which the tangent to a curve turns in moving along the curve.
(170) In some example embodiments, the first fanned array **2570** includes a second dimension along first axis **2535** (not shown) in the third/expanded or fanned configuration and elongate member manipulator **2550** is employed to reduce the curvature of the curved portion **2509***a* of each of at least some of the elongate members **2504** to increase the second dimension in the third/expanded or fanned configuration. For example, the second dimension may be an overall dimension **2581** of frame **2502** along the first axis **2535** that is increased as the curvature of various ones of the curved portions **2509***a* is reduced. In some example embodiments, the second dimension is a dimension between a first location where the first axis **2535** passes through at least one of the elongate members **2504** and a second location where the first axis **2535** passes through the at least one of the elongate members **2504**. In some example embodiments, the curvature of each of at least some of the curved portions **2509***a* is reduced to concurrently increase the first dimension **2580***a* and the second dimension.
(171) As compared between FIGS. **6**I and **6**M, a reduction in curvature of each of at least some of the curved portions **2609***a* results in the first axis **2535** passing through an elongate member **2504** at a location spaced relatively closer to the respective distal end **2505** of the elongate member **2504** when the first fanned array **2570** is additionally manipulated into the second fanned array **2572**.
(172) As compared between FIGS. **6**N and **6**O, tension applied to the second portion **2541***b* of flexible line **2540***c* causes at least one of the locations **2544** along the respective geodesic of the second elongate member **2504***i* that is crossed by the respective geodesic **2514** of the first elongate member **2504***g* in the first fanned array **2570** to be repositioned along the respective geodesic **2514** of the second elongate member **2504***i* to assume a position in the second fanned array **2572** as shown by the corresponding crossing locations **2546**. In various embodiments, at least one of the first elongate member **2504***g* and the second elongate member **2504***i* is repositioned by the elongate member manipulator **2550** (not shown in FIGS. **6**N and **6**O) to cause a least one of the locations **2544** along the respective geodesic of the second elongate member **2504***i* that is crossed by the respective geodesic **2514** of the first elongate member **2504***g* in the first fanned array **2570** to be

repositioned along the respective geodesic **2514** of the second elongate member **2504***i* into the second fanned array **2572**. In this illustrated embodiment, the elongate member manipulator **2550** causes the first location **2544***c* along the respective geodesic **2514** of the second elongate member **2504***i* as shown in FIG. **6**N to be repositioned relatively closer to the respective distal end **2505** of the second elongate member **2504***i* as shown by distal crossing location **2546***c* in FIG. **6**O. In this illustrated embodiment, the respective distal ends **2505** of various ones of elongate members **2504** are spaced apart with respect to one another in the first fanned array **2570** as best shown in FIG. **6**J by a first end-to-end distance **2585** (only one called out). In this embodiment, elongate member manipulator **2550** is employed to vary a distance between at least some of the distal ends **2505** and at least one of the crossing locations to manipulate the first fanned array **2570** into the second fanned array **2572**. In this embodiment, elongate member manipulator **2550** is employed to reduce an end-to-end distance **2585** between the respective distal ends **2505** of at least some of the elongate members **2504** to manipulate the first fanned array **2570** into the second fanned array **2572**. In this example embodiment, elongate member manipulator **2550** is employed to reduce an end-to-end distance **2585** between the respective distal ends **2505** of at least some of the elongate members **2504** while varying a respective distance between at least one of the crossing locations and each of the distal ends **2505** of the at least some of the elongate members **2504**. It is noted that in some embodiments, the respective distance between the at least one of the crossing locations and each of the distal ends **2505** of the at least some of the elongate members **2504** may be varied by a different amount for each of the at least some of the elongate members while the respective end-to-end distance **2585** is reduced. For example, the respective distance between the at least one crossing location and a first one of the distal ends **2505** may be varied by a first amount and the respective distance between the at least one crossing location and a second one of the distal ends **2505** may be varied by a second amount different than the first amount. In some embodiments, the first and second amounts vary to expand frame **2502** by different amounts in different directions.

(173) It is noted that relative movement between the ends need not be limited to the distal ends **2505**. In various example embodiments, relative movement may be provided between at least some of the ends in a first set of the proximal ends **2507** of the elongate members **2504** to reduce an end-to-end distance between the at least some of the ends in the first set while expanding frame **2502** to have a size too large for delivery through the lumen **2506***c* of catheter sheath **2506**. In various example embodiments, relative movement may be provided between at least some of the ends in a second set of the distal ends **2505** of the elongate members **2504** to reduce an end-to-end distance **2585** between the at least some of the ends in the second set while expanding frame **2502** to have a size too large for delivery through the lumen **2506***c* of catheter sheath **2506**. In some of these various embodiments, the relative movement between the at least some of the ends in the first set or between the at least some of the ends in the second set is provided while restraining relative movement between at least some of the ends in the other of the first set and the second set along at least one direction during the expanding of frame **2502**. In some of these various embodiments, the relative movement between the at least some of the ends in the first set or between the at least some of the ends in the second set is provided while restraining relative movement between the respective intermediate portions **2509** of at least some of elongate members **2504** during the expanding of frame **2502**. In some of these various embodiments, the relative movement between the at least some of the ends in the first set or between the at least some of the ends in the second set is provided while decreasing a distance between the respective distal end **2505** and the respective proximal end **2507** of each of at least some of the plurality of elongate members **2504** during the expanding of frame **2502**. For example, as compared between FIGS. **6**I and **6**M, a distance between the respective distal end **2505** and the respective proximal end **2507** of each of various ones of the elongate members **2504** is reduced as the end-to-end distance **2585** between the distal ends **2505** is reduced.

(174) As shown in FIG. **6**M, the second portion **2541***b* of the flexible line **2540***c* is manipulated to

more substantially align the respective third openings **2519***c* of the elongate members **2504** in the second fanned array **2572**. In this example embodiment, the second portion **2541***b* of the flexible line **2540***c* is manipulated to more substantially align the respective second openings **2519***b* of the elongate members **2504** in the second fanned array **2572**. It is understood that alignment between the respective third openings **2519***c* and the alignment between the respective second openings **2519***b* in the second fanned array **2572** need not be a collinear one as shown in FIG. **6**M. In embodiments in which the first fanned array **2570** is manipulated to cause the front surfaces **2518***a* of the various elongate members **2504** in the second fanned array **2572** to contact the interior tissue surface **2562***a*, variances in a local or global size of the left atrium **2562** may cause varying degrees of alignment between the respective groupings of openings **2519***b*, **2519***c*. Flexible line couplings (e.g., flexible lines **2540***b* and **2540***c*) may be employed to advantageously physically couple the elongate members **2504** together while having a reduced sensitivity to misalignments between the respective third openings **2519***c* and the respective second openings **2519***b*. Other embodiments may employ other types of couplings.

(175) As shown in FIG. **6**M, the respective intermediate portion **2509** of each of the various elongate members **2504** has a generally annular or ring-like profile interrupted by a separation in the third/expanded configuration. The separation may not be present in other embodiments. Device **2500** may further include at least one bridging portion arranged to bridge the separation in some embodiments. A bridging portion can include by way of non-limiting example, a portion of an elongate member **2504**, a portion of a coupler (e.g., first coupler **2522***a*), a portion of shaft member **2510** or a portion of catheter sheath **2506**.

(176) In various example embodiments, once frame **2502** is deployed within atrium **2562**, a sensing, investigation or treatment procedure may be undertaken. In this embodiment, each front surface **2518***a* includes, carries or supports a transducer element (i.e., not shown, e.g., transducer element **2490**) that is positionable adjacent to a tissue surface in the bodily cavity when the first fanned array **2570** is manipulated into the second fanned array **2572**. In this example embodiment, once the second fanned array **2572** has been appropriately positioned at a given location within left atrium **2562**, determination of the locations of various components of device **2500** (e.g., transducer elements including sensors or electrodes, or related support structures such as elongate members **2504**), or the locations of various anatomical features within left atrium **2562** may be determined by various methods. In this example embodiment, after the portion of the device **2500** has been appropriately positioned at a given location within left atrium **2562**, ablation of various regions of a tissue surface within left atrium **2562** may commence. The portion of the device **2500** may be removed from the left atrium **2652** by reconfiguring the portion of the device **2500** back into the second/bent configuration and then further back into the first/unexpanded configuration.

(177) FIG. **7**A is an isometric view of a portion of a device **2600** in an initial configuration according to one example embodiment. Device **2600** includes a structure or frame **2602** that includes an arrangement of elongate members **2604***a*, **2604***b*, **2604***c*, **2604***d*, **2604***e*, **2604***f*, and **2604***g*, (collectively **2604**). Various ones of the elongate members **2604** are physically coupled to shaft member **2610** which is employed to transport the elongate members **2604** through a catheter sheath **2606** (shown in FIGS. **7**C, **7**D, **7**E and **7**F) arranged for delivery through a bodily opening (not shown) leading to a bodily cavity (also not shown). The bodily cavity can include an intra-cardiac cavity by way of non-limiting example.

(178) FIG. **7**B is an isometric view of a representative one of the elongate members **2604** in the initial configuration. Each of the elongate members **2604** includes a respective first or distal end **2605** and a respective second or proximal end **2607**. Each elongate member **2604** includes a respective length **2611** (i.e., called out only in FIGS. **7**B and **7**G) between the respective proximal and distal ends **2607**, **2605** of the elongate member **2604**. In various embodiments, two or more of the elongate members **2604** may have substantially equal lengths **2611** or substantially unequal lengths **2611**. In this example embodiment, a respective portion of each of the elongate members

2604 has a length that is at least approximately equal to or greater than a circumference of a portion of an interior tissue surface of a bodily cavity (not shown) into which the elongate member **2604** is to be positioned at least proximate to when the portion of the device **2600** is in a deployed configuration. The circumference of the portion of the interior tissue surface may have a measured or anticipated value. In a manner similar to other described embodiments, transducer elements **2690** (two called out) are distributed along a surface of each of various ones of the elongate members **2604**. Transducer elements **2690** arranged on a given one of elongate members **2604** may be circumferentially distributed along a region of the interior tissue surface of a bodily cavity (again not shown) over which the given one of the elongate members **2604** is positioned at least proximate to in a deployed configuration. In this example embodiment, each elongate member **2604** includes at least a portion of a flexible circuit structure **2680** (not shown or called out in FIGS. **7**A, **7**B, **7**C, **7**D, **7**E and **7**F for clarity) that at least provides an electrically communicative path to various ones of the transducer elements **2690**.

(179) Each of the elongate members **2604** includes a set of two opposing major faces or surfaces **2618** denominated as a front surface **2618***a* and a back surface **2618***b*. In this example embodiment, the two opposing surfaces **2618** are separated from one another by a thickness **2617** of the elongate member **2604**. In this illustrated example, each elongate member **2604** includes a plurality of various portions **2609** arranged between the respective proximal and distal ends **2607**, **2605** of the elongate member **2604**. In this example embodiment, the portions **2609** include a first portion **2609***a*, a second portion **2609***b* and a third portion **2609***c* positioned between the first and the second portions **2609***a*, **2609***b*. In this example embodiment, first portion **2609***a* is positioned relatively closer to proximal end **2607** than to distal end **2605** and second portion **2609***b* is positioned relatively closer to distal end **2605** than to proximal end **2607**. In this example embodiment, the various portions **2609** are combined in a unitary structure. In this example embodiment, each of the portions **2609** includes a pair of side edges including first side edge **2620***a* and second side edge **2620***b* (collectively **2620**), the side edges of each pair of side edges **2620** are opposed to one another across at least a portion of the length **2611** of the respective elongate member **2604**. In this example embodiment, each pair of side edges **2620** defines a portion or at least some of a periphery of the front surface **2618***a* of the elongate member **2604**.

(180) In this example embodiment, a number of the respective portions **2609** of various ones of the elongate members **2604** include various distortions or deformations. In this example embodiment, the words “distortion” or deformation are used interchangeably herein to mean modification in shape away from an elongated strip-like form that prior to any distortion or deformation predominately a body with a relatively small thickness as compared to a length or width, although major faces of the body may not necessarily have smooth planar surfaces. For example, the respective second portion **2609***b* of the representative elongate member **2604** shown in FIG. **7**B has a coiled profile (e.g., a profile that curves back on itself). In this particular embodiment, the respective second portion **2609***b* includes a volute shaped profile in the initial configuration. Also for example, the respective third portion **2609***c* of the representative elongate member **2604** shown in FIG. **7**B includes a twisted profile about a respective twist axis **2633** extending across at least a part of the third portion **2609***c* of the elongate member **2604**, the twist in the third portion **2609***c* arranged to rotationally offset (e.g., angularly rotated or twisted out of plane about an axis that may extend generally along a length of the elongate member prior to any distortion of deformation thereof) the respective second portion **2609***b* of the elongate member **2604** from the respective first portion **2609***a* of the elongate member **2604** along a portion of the length **2611** of the elongate member **2604**. In this example embodiment, the respective first portion **2609***a* of the representative elongate member **2604** includes a bent profile about a respective bending axis **2631**.

(181) In FIG. **7**A, each of the elongate members **2604** is arranged in an arrangement having an initial configuration in which each elongate member **2604** is provided essentially in its distorted form. In this example embodiment, the initial configuration is representative of an initial or low

energy state. In this example embodiment, each elongate member **2604** is a resilient member and further distortion of various portions **2609** of the elongate member **2604** can increase spring or potential energy of the elongate member **2604** and thereby bring it into a higher energy state.

(182) As shown in FIG. **7**A, at least the respective second portions **2609***b* of various ones of the elongate members **2604** each has a coiled profile (e.g., a profile that curves back on itself) in the initial or low energy state. In this example embodiment, at least the respective second portions **2609***b* (two called out) of various ones of the elongate members **2604** are fanned into a fanned array in the initial or low energy state. As shown in FIG. **7**A, each of the respective first portions **2609***a* of the elongate members **2604** are arranged front surface **2618***a*-toward-back surface **2618***b* with respect to one another in the initial configuration. In this example embodiment, the bent profiles of the respective first portions **2609***a* (one called out) of various ones of the elongate members **2604** are arranged to fan or partially fan at least the respective second portions **2609***b* of various ones of elongate members **2604** into the fanned array in the initial configuration. In this embodiment, various ones of the second portions **2609***b* are fanned along a direction to increase a relative distance between the respective side edges **2620** (two respective sets of edges **2620***a* and **2620***b* called out) of adjacent ones of the second portions **2609***b* in the initial configuration. In this example embodiment, parts of the first portions **2609***a* are also fanned in the initial configuration. In this embodiment, various ones of the first portions **2609***a* are fanned along a direction to increase a relative front surface **2618***a*-to-back surface **2618***b* distance between adjacent ones of the first portions **2609***a* in the initial configuration.

(183) In some example embodiments, the respective twist axis **2633** (FIG. **7**B) about which one of the third portions **2609***c* (one called out) is twisted is arranged to rotationally offset a respective second portion **2609***b* from a respective first portion **2609***a* as well as to fan the respective second portion **2609***b* into the fanned array in the initial configuration as exemplified in FIG. **7**A. It is noted however that relatively limited fanning angles **2619** (only one called out in FIG. **7**A) are typically achieved between a respective pair of the first and the second portions **2609***a*, **2609***b* by positional adjustments of the twist axis **2633**. Fanning angles **2619** generally greater than 45 degrees associated with at least some of the elongate members **2604** (e.g., elongate members **2604***a* and **2604***g*) in FIG. **7**A may be difficult to achieve solely by a positional adjustment of various ones of the twist axes **2633**. Greater fanning angles **2619** are typically associated with relatively large numbers of elongate members **2604** as shown in FIG. **7**A. It is also noted that when various ones of the third portions **2609***c* are twisted to additionally fan respective second portions **2609***b* into a fanned array as shown in FIG. **7**A, the twisted third portions **2609***c* typically do not nest well together when the various portions **2609** are arranged in an arrayed arrangement suitable for intravascular or percutaneous delivery (e.g., as shown in FIG. **7**C). Nesting difficulties may arise because each of the respective third portions **2609***c* of various ones of the elongate members **2604** has a different twisted form in accordance with the particular fanning angle that the each of the various ones of the elongate members **2604** must be fanned by. Difficulties with the nesting of the respective third portions **2609***c* typically increase with increased fanning angles **2619**. Nesting difficulties can require larger catheter sheaths to be employed to accommodate a bulkier arrangement of at least the third portions **2609***c* when delivered percutaneously. In some example embodiments, each of the respective second portions **2609***b* of various ones of the elongate members **2604** are fanned in the initial configuration based at least in part by a configuration of the twisted profile of a respective third portion **2609***c* and based at least in part by a configuration of the bent profile of a respective first portion **2609***a*.

(184) In various example embodiments, various ones of the elongate members **2604** are physically coupled together with at least one other elongate member **2604** by at least one coupler. In this illustrated embodiment, device **2600** includes at least one coupler **2622** arranged to couple at least the respective first portions **2609***a* of the elongate members **2604** together in the initial array. In this example embodiment, coupler **2622** includes a pin member **2622***a* arranged to secure the first

portions **2609***a* together. Other forms of couplers may be employed in other example embodiments. For example, in embodiments where various ones of the elongate members **2604** includes a flexible printed structure having a relatively large number of electrically conductive traces, a coupling that couples at least the side edges **2620** of the first portions **2609***a* may be better suited than a pin-type coupling that is arranged to pass through the flexible circuit structures in a manner that possibly imposes undesired space constraints on the placement of the electrically conductive traces. In various example embodiments, additional couplers (e.g., couplers **2522***b*, **2522***c*) may also be employed to couple various other portions **2609** of various ones of the elongate members **2604** together.

(185) FIGS. **7**C, **7**D, **7**E, and **7**F are various side elevation views of a portion of the device **2600** positioned at four successive intervals of time as the portion of the device **2600** is selectively reconfigured according to an example embodiment. For clarity, transducer elements **2690** are not shown in FIGS. **7**C, **7**D, **7**E, and **7**F. As shown in FIG. **7**C, the respective first portions **2609***a* (only one called out) of the elongate members **2604** (only one called out) are arranged with respect to one another front surface **2618***a*-toward-back surface **2618***b* along a first direction represented by arrow **2616***a* in a first stacked array **2615***a* sized to be delivered through lumen **2506***c* of catheter sheath **2606** that is positionable within a bodily opening (again, not shown) leading to a bodily cavity (also not shown) when a portion of the device **2600** is in a delivery configuration also known as a first or unexpanded configuration. As shown in FIG. **7**C, the respective second portions **2609***b* (only one called out) of the elongate members **2604** are arranged with respect to one another front surface **2618***a*-toward-back surface **2618***b* along a second direction as represented by arrow **2616***b* in a second stacked array **2615***b* sized to be delivered through the lumen of catheter sheath **2606** when the portion of the device **2600** is in the delivery configuration. In this example embodiment, the first direction (i.e., arrow **2616***a*) and the second direction (i.e., arrow **2616***b*) are non-parallel directions. In this example embodiment, the elongate members **2604** are arranged within catheter sheath **2606** such that each elongate member **2604** is to be advanced distal end **2605** first into a bodily cavity. In this example embodiment, the elongate members **2604** are arranged within catheter sheath **2606** such that each elongate member **2604** is to be advanced out distal end **2605** first from an end of catheter sheath **2606** arranged to be positioned at least proximate to the bodily cavity.

(186) Notably, as used herein and in the claims, the term stacked does not necessarily require the elongate members **2604** rest directly or even indirectly upon one another, but rather refers to an ordered arrangement which may include spaces or gaps between immediately adjacent or most immediate neighboring pairs of elongate members **2604**. It is also noted that while illustrated in FIG. **7**C as a plurality of substantially parallel stacked plates or strips, the elongate members **2604** are not perfectly rigid so there may be some flex, sag or curvature even when the catheter sheath **2606** is essentially straight. It is further noted that in use, the catheter sheath **2606** will often curve or even twist to follow a bodily lumen. The elongate members **2604** may adopt or conform to such curvatures or twists as the elongate members **2604** are advanced. In either of these situations, the elongate members **2604** maintain the relative positions to one another as a stacked arrangement.

(187) In this example embodiment, the respective first, second and third portions **2609***a*, **2609***b* and **2609***c* (only one of each called out) of various ones of the elongate members **2604** in the initial configuration have been stressed into a higher energy state from their initial or low energy state shown in FIG. **7**A. In this example embodiment, the respective second portions **2609***b* of various ones of the elongate members **2604** in the initial configuration (i.e., as shown in FIG. **7**A) have been stressed into a higher energy state suitable for unbending or uncoiling them sufficiently enough to allow the elongate members **2604** to be delivered through catheter sheath **2606** in the delivery configuration as shown in FIG. **7**C. In this example embodiment, the at least one of the respective first portions **2609***a* and the third portions **2609***c* of each of various ones of the elongate members **2604** (i.e., as shown in FIG. **7**A) have been stressed into a higher energy state suitable for

un-fanning at least the second portions **2609***b* of the elongate members **2604** sufficiently enough to allow the elongate members **2604** to be introduced into, and delivered though catheter sheath **2606**. In this example embodiment, potential energy is imparted to the various elongate members **2604** in the delivery configuration by the higher energy state, the potential energy sufficient to return the arrangement of elongate members **2604** generally back to their initial energy state when released from the confines of catheter sheath **2606**. In some example embodiments, the arrangement of elongate members **2604** is stressed into a higher energy state by retracting the arrangement of elongate members **2604** into catheter sheath **2606** prior to inserting catheter sheath **2606** into a body. In some example embodiments, the arrangement of elongate members **2604** is stressed into a higher energy state by uncoiling the elongate members **2604** and inserting the arrangement of elongate members **2604** into catheter sheath **2606**. In some example embodiments, the arrangement of elongate members **2604** is reconfigured from the initial configuration shown in FIG. **7**A to the delivery configuration shown in FIG. **7**C at a point-of-use. In some example embodiments, the arrangement of elongate members **2604** is reconfigured from the initial configuration shown in FIG. **7**A to the delivery configuration shown in FIG. **7**C at a place of manufacture, assembly or distribution. In various embodiments, various devices including various guides or manipulators may be employed to reconfigure the arrangement of elongate members **2604** from the initial configuration shown in FIG. **7**A to the delivery configuration shown in FIG. **7**C. In some of these various embodiments, the devices form part of device **2600**. In some of these various embodiments, the devices are extraneous to device **2600**. Preferably, the higher energy states are controlled to not cause damage to device **2600** or catheter sheath **2606** during delivery therethrough.

(188) FIG. **7**D shows a portion of the device **2600** including the plurality of elongate members **2604** positioned in a deployed configuration also referred to as a second or bent configuration. In this example embodiment, the respective second portions **2609***b* (only one called out) of various ones of the elongate members **2604** have cleared the confines of catheter sheath **2606** while other portions **2609** of the elongate members **2604** remain within the confines of catheter sheath **2606**. In this example embodiment, at least the respective second portions **2609***b* of each elongate member **2604** are bent about a respective bending axis **2634** (only one shown) into an arcuate stacked array **2632**. Each bending axis **2634** extends along a direction having a directional component transversely oriented to the respective length **2611** (not called out in FIG. **7**D) of the elongate member **2604**. In this example embodiment, each of the respective second portions **2609***b* of various ones of the elongate members **2604** in the arcuate stacked array **2632** is coiled about a respective bending axis **2634** into a coiled stacked array. In this example embodiment, each respective second portion **2609***b* is bent to have a scrolled or volute shaped profile. In this example embodiment, each second portion **2609***b* is bent to have a curvature that varies at least once along the respective length **2611** of the elongate member **2604**. When positioned in the second/bent configuration, a first portion **2621***a* of the front surface **2618***a* (only one called out) of the respective second portion **2609***b* of each elongate member **2604** is positioned diametrically opposite to a second portion **2621***b* of the front surface **2618***a* in the volute shaped frame **2602**. When positioned in the second/bent configuration, the coiled arrangement of elongate members **2604** is sized or dimensioned too large for delivery through a lumen of catheter sheath **2606**.

(189) In this illustrated embodiment, the respective second portions **2609***b* of various ones of the elongate members **2604** have been preformed to autonomously bend when the second portions **2609***b* are advanced out of catheter sheath **2606**. As the respective second portions **2609***b* are advanced from the confines of catheter sheath **2606**, they are urged or biased to seek their low energy state (i.e., their initial coiled configuration). In this example embodiment, the respective distal ends **2605** of various ones of the elongate members **2604** moves along a coiled path (e.g., a path that curves back on itself) when the portion of the device **2600** is moved between the first/unexpanded configuration and the second/bent configuration. In this example embodiment, the coiled path makes at least one full turn. In some embodiments, at least part of the coiled path may

extend along a volute path.

(190) In this embodiment, the respective second portions **2609***b* of various ones of the elongate members **2604** are preformed to autonomously coil as they are advanced into a bodily cavity (not shown) in a manner that may advantageously reduce physical interactions between elongate members **2604** and an interior tissue surface within the bodily cavity. In a manner similar to the elongate members **2504** shown in FIG. **6**D, the respective distal ends **2605** (only one called out) of the elongate members **2604** are arranged to continuously bend or curl away from an interior tissue surface within a bodily cavity (not shown) into which they are introduced. A reduction of contact and other physical interaction with an interior tissue surface within a bodily cavity can reduce occurrences of, or the severity of, damage inflicted to various tissue structures during the positioning. In various embodiments, the arcuate stacked array **2632** is arranged to have a predetermined size that will allow the arcuate stacked array **2632** to be positioned within a bodily cavity with at most relatively minor amounts of contact with an interior tissue surface within the bodily cavity.

(191) FIG. **7**E shows the portion of the device **2600** in deployed configuration also referred to as a third or expanded configuration. In this illustrated embodiment, the elongate members **2604** were moved from the second/bent configuration shown in FIG. **7**D to the third/expanded configuration shown in FIG. **7**E. In this example embodiment, the portion of the device **2600** is further advanced through catheter sheath **2606** so that at least the respective third portions **2609***c* (only one called out) of various ones of the elongate members **2604** are clear of the confines of catheter sheath **2606**. In this example embodiment, the portion of the device **2600** is further advanced through catheter sheath **2606** so that at least the respective first portions **2609***a* (only one called out) of various ones of the elongate members **2604** are clear of the confines of catheter sheath **2606**. As shown in FIG. **7**E, the respective second portions **2609***b* (only one called out) of various ones of the elongate members **2604** are spaced apart from one another in the third/expanded configuration. In this illustrated embodiment, at least the respective second portions **2609***b* of various ones of the elongate members **2604** are angularly spaced with respect to one another about an axis when the portion of the device **2600** is in the third/expanded configuration. In this illustrated embodiment, at least the respective second portions **2609***b* of at least some of the elongate members **2604** are fanned with respect to one another about one or more fanning axes **2635** into a first fanned array **2670** when the portion of the device **2600** is in the third/expanded configuration. As shown in FIG. **7**E, in this example embodiment the one or more fanning axes **2635** are arranged to pass through a plurality of spaced apart locations along the respective length **2611** (not called out) of each of the at least some of the elongate members **2604** when the portion of the device **2600** is in the third/expanded or fanned configuration. In this example embodiment, the one or more fanning axes **2635** are shown as a single axis (i.e., also referred to as fanning axis **2635**) for clarity. It is understood that one or more axes **2635** can include two or more axes in various embodiments. In this illustrated embodiment, each of the at least some of the plurality of elongate members **2604** includes a curved portion arranged to extend along at least a portion of a respective curved path that intersects fanning axis **2635** at each of a respective at least two spaced apart locations along fanning axis **2635** in the third/expanded or fanned configuration.

(192) In this example embodiment, the respective first portions **2609***a* of various ones of the elongate members **2604** have been preformed to autonomously bend when the first portions **2609***a* are advanced out of catheter sheath **2606**. As the respective first portions **2609***a* are advanced from the confines of catheter sheath **2606**, stored potential energy is released and the first portions **2609***a* are urged or biased to assume a lower energy state (i.e., similar to their initial configuration shown in FIG. **7**A) and cause at least the respective second portions **2609***b* of various ones of the elongate members **2604** to autonomously fan at least in part, with respect to one another into the third/expanded or fanned configuration. In some example embodiments, as the respective third portions **2609***c* are advanced from the confines of catheter sheath **2606**, stored potential energy is

released and the respective third portions **2609***c* are urged or biased into a lower energy state to cause at least the respective second portions **2609***b* of various ones of the elongate members **2604** to autonomously fan, at least in part, with respect to one another into the third/expanded or fanned configuration. In some example embodiments, as both the respective third portions **2609***c* and the respective first portions **2609***a* of various ones of the elongate members **2604** are advanced from the confines of catheter sheath **2606**, stored potential energy is released and the respective first and third portions **2609***a*, **2609***c* are urged or biased into respective lower energy states to cause at least the respective second portions **2609***b* of various ones of the elongate members **2604** to autonomously fan at least in part, with respect to one another into the third/expanded or fanned configuration.

(193) In some example embodiments, additional fanning mechanisms (not shown) may be employed to assist in the fanning of, or to promote an additional fanning of, various ones of the elongate members **2604** as the elongate members **2604** are moved into the third/expanded or fanned configuration. In some example embodiments, various separators similar to previously described separators **1452** and **1752** may be employed to further fan, or to assist in the fanning of, at least some of the elongate members **2604**. In this example embodiment, the elongate members **2604** are fanned in a different manner than previously described elongate members **2504**. In this example embodiment a first set made up elongate members **2604***a*, **2604***b*, and **2604***c* are fanned along an opposite direction from a second set made up of elongate members **2604***e*, **2604***f* and **2604***g*. Unlike the described embodiment employing elongate members **2504**, the elongate members **2604** in the first set of elongate members **2604** are not interleaved with the elongate members **2604** in the second set of elongate members **2604** in this example embodiment.

(194) FIG. **7**E shows that various parts of the respective second portions **2609***b* of various ones of the elongate members **2604** cross one another at various crossing locations in the third/expanded configuration in a manner similar to that previously described for the elongate members **2504** shown in their respective third/expanded or fanned configurations in FIGS. **6**E, **6**G, **6**H and **6**I. In this example embodiment at least a first one of the plurality of elongate members **2604** crosses a second one of the plurality of elongate members **2604** in an X configuration at each of a plurality of locations spaced from one another along the respective length **2611** of the second one of the plurality of elongate members **2604** when a portion of device **2600** is moved into the third/expanded or fanned configuration. In this example embodiment, additional manipulation of a portion of device **2600** including elongate members **2604** may be initiated when the portion of the device **2600** is moved into the third/expanded configuration. Typically, when the elongate members **2604** are arranged within a bodily cavity in the third/expanded or fanned configuration, the arrangement of the elongate members **2604** is preferably sized sufficiently small enough to reduce occurrences where damage may be inflicted to the tissue surfaces within the bodily cavity by the arrangement of elongate members **2604**. As shown in FIG. **7**E, first portions **2621***a* (only one called out) and the second portions **2621***b* (only one called out) of the respective front surface **2618***a* (only one called out) of each of at least some of the elongate members **2604** in the first fanned array **2670** are angularly arranged about fanning axis **2635** when the portion of the device **2600** is in the third/expanded configuration. In this illustrated embodiment, at least some of the elongate members **2604** are further manipulated in the third/expanded or fanned configuration to vary a radial spacing between fanning axis **2635** and at least one of the first portion **2621***a* and the second portion **2621***b* of the respective front surface **2618***a* of each of various ones of the elongate members **2604**. In this embodiment, frame **2602** includes a proximal portion **2602***a* having a first domed shape **2608***a* and a distal portion **2602***b* having a second domed shape **2508***b*, the proximal and distal portions **2602***a*, **2602***b* arranged in a clam shell configuration.

(195) In FIG. **7**F, at least some of the elongate members **2604** are further manipulated in the third/expanded configuration to form a second fanned array **2672**. In this example embodiment, at least some of the elongate members **2604** are further manipulated to increase a radial spacing

between fanning axis **2635** and at least one of the first portion **2621***a* (only one called out) and the second portion **2621***b* (only one called out) of the respective front surface **2618***a* (only one called out) of each of various ones of the elongate members **2604**. In some example embodiments, at least some of the elongate members **2604** are further manipulated to distort at least one of the first and the second domed shapes **2608***a*, **2608***b* of a respective one of the proximal and the distal portion **2602***a*, **2602***b* of frame **2602**. Further manipulation of the at least some of the elongate members **2604** may be motivated for various reasons. For example, the at least some of the elongate members **2604** may be further manipulated to create a conformance with a tissue surface with a bodily cavity (not shown in FIGS. **7**C, **7**D, **7**E and **7**F) when the portion of the device **2600** is moved into the third/expanded or fanned configuration. In some example embodiments, the at least some of the elongate members **2604** may be further manipulated to position various transducer elements **2690** (again not shown in FIGS. **7**C, **7**D, **7**E and **7**F) relatively closer to an interior tissue surface within a bodily cavity.
(196) In this example embodiment, an end portion of shaft member **2610** is physically coupled or connected to frame **2602** at one or more locations on frame **2602**, each of the one or more locations on the structure to which the end portion is coupled positioned to one side of at least one spatial plane (not shown) that is coincident with fanning axis **2635**. In this example embodiment, shaft member **2610** and frame **2602** have a projected outline in the shape of the Greek letter rho (p) in the third/expanded or fanned configuration, as indicated above.
(197) In this example embodiment, various ones of the elongate members **2604** cross at least one other of the elongate members **2604** at various crossing locations when the portion of the device **2600** is in the third/expanded or fanned configuration shown FIG. **7**E. In this example embodiment, a number of the elongate members **2604** are additionally manipulated to vary at least one of the crossing locations to arrange the elongate members **2604** in the second fanned array **2672** shown in FIG. **7**F. In some example embodiments, an elongate member manipulator (e.g., elongate member manipulator **2550**) is employed to further manipulate the various elongate members **2604** to reconfigure the first fanned array **2670** shown in FIG. **7**E into the second fanned array **2672** shown in FIG. **7**F in the third/expanded or fanned configuration. It is noted that if a flexible line similar to the flexible line **2540***c* of elongate member manipulator **2550** is employed to further manipulate the first fanned array **2670** shown in FIG. **7**E into the second fanned array **2672** shown in FIG. **7**F, the flexible line may be arranged to follow a path less tortuous than the zig-zag path that the flexible line **2540***c* follows in FIG. **6**J. A less tortuous path may be achieved at least in part because the elongate members **2604** in the first set of elongate members **2604** are not interleaved with the elongate members **2604** in the second set of elongate members **2604** in this example embodiment.
(198) Other techniques may be employed to additionally manipulate or expand a structure of elongate members (e.g., frame **2602**) in the deployed configuration. For example, FIGS. **9**A and **9**B respectively show an isometric view and a partially sectioned plan view of a portion of a device **2800** according to one example embodiment in a deployed configuration also known as third or expanded configuration similar to that employed by device **2600** in FIG. **7**E. Device **2800** includes a structure or frame **2802** physically coupled to a shaft member **2810**. Frame **2802** includes a plurality of elongate members **2804** that include elongate members **2804***a*, **2804***b*, **2804***c*, **2804***d*, **2804***e*, **2804***f* and **2804***g*. In this embodiment, each of the elongate members **2804** includes a distal end **2805**, a twisted portion **2809***c* and a bent portion **2809***a* positioned proximate to shaft member **2810**. Each of the elongate members **2804** includes a front surface **2818***a* that is positionable to face an interior tissue surface within a bodily cavity (not shown) and a back surface **2818***b* opposite the front surface **2818***a*. In some embodiments, each of the elongate members **2804** is arranged front surface **2818***a*-toward-back surface **2818***b* in a stacked array during a delivery configuration similar to that employed by other described embodiments. In this embodiment, each of the elongate members **2804** is arranged in a first fanned array **2870** that is similar to the first fanned array **2670** of elongate members **2604** shown in FIG. **7**E. In this example embodiment, each elongate member

2804 includes a respective slot **2820**. As best seen in the partially sectioned plan view of FIG. **9**B, the slots **2820** of various ones of the elongate members **2804** cross one another at a crossing location **2825** in the first fanned array **2870**. In some embodiments each of at least some of the slots **2820** are positioned to one side of a midline or centerline of a respective one of the elongate members **2804**.

(199) FIGS. **9**C and **9**D respectively show an isometric view and a partially sectioned plan view of a portion of device **2800** which has been additionally manipulated from the first fanned array **2870** shown in FIGS. **9**A, **9**B to form a second fanned array **2872**. As compared between FIGS. **9**B and **9**D, a change in the positioning where various ones of the slots **2820** cross one another accompanies a manipulation between the first fanned array **2870** and the second fanned array **2872**. In this example embodiment, a movement of the respective distal ends **2805** of the elongate members **2804** generally along a direction toward crossing location **2825** accompanies a movement between the first fanned array **2870** and the second fanned array **2872**. In this example embodiment, the respective distal ends **2805** of the elongate members **2804** are moved generally along a radial direction toward crossing location **2825**. In this example embodiment, at least one flexible line **2821** (shown and called out only in FIGS. **9**B and **9**D for clarity) is employed to further manipulate between the first fanned array **2870** shown in FIGS. **9**A, **9**B and the second fanned array **2872** shown in FIGS. **9**C, **9**D. In this example embodiment, at least one flexible line **2821** is sized for passage through holes **2812** in various ones of the elongate members **2804**. As compared with the embodiment shown in FIG. **6**J, flexible line **2821** follows a less tortuous path than the flexible line **2540***c* of elongate member manipulator **2550**. In various example embodiments, various ones of the elongate members **2804** may be physically coupled together by one or more coupling members (not shown for clarity) arranged to be slidably received in respective slots **2820** of the various ones of the elongate members **2804**. In some embodiments, the one or more coupling members may include a relatively rigid member while in other embodiments, the one or more coupling members may include a relatively flexible member. In some example embodiments, the one or more coupling members may be employed to assist in establishing generally radial movement of various portions of the elongate members **2804** towards crossing location **2825**. In some example embodiments, one or more flexible lines are sized and arranged to be received in the respective slots **2820** of various ones of the elongate members **2804**.

(200) As shown in FIGS. **9**A and **9**C, frame **2802** includes a proximal portion **2802***a* having a first domed shape **2808***a* and a distal portion **2802***b* having a second domed shape **2808***b*. In this example embodiment, the proximal and the distal portions **2802***a*, **2802***b* are arranged in a clam shell configuration in the third/expanded configuration. In this example embodiment, frame **2802** is additionally manipulated to distort a respective one of the first domed shape **2808***a* and the second domed shape **2808***b* to accompany a movement between the first fanned array **2870** and the second fanned array **2872**. In this example embodiment, various ones of the slots **2820** have different longitudinal dimensions. In some example embodiments, various ones of the slots **2804** are sized differently to vary amounts of movement between various portions of respective elongate member **2804** during the manipulating. In some example embodiments, each of various ones of the slots **2804** is sized to vary amounts of distortion imparted to their respective elongate members **2804** during the manipulating. In this embodiment, the slots **2820** have been selectively sized to distort distal portion **2802***b* to have a more prolate second domed shape **2808***b* than the first domed shape **2808***a* of the proximal portion **2802***a* during the manipulating.

(201) In this example embodiment, various ones of the elongate members **2804** are physically coupled together by coupling members **2858** (two called out in each of FIGS. **9**A, **9**B, **9**C and **9**D). In various example embodiments, each coupling member **2858** may allow movement of one of the elongate members **2804** coupled by the coupling member **2858** to also cause movement of another of the elongate members **2804** coupled by the coupling member **2858**. In some example embodiments, the coupling members **2858** are arranged to restrict or limit an amount of movement

that an elongate member **2804** undergoes as the portion of the device is moved into the third/expanded configuration. In this example embodiment, coupling members **2858** are positioned to extend across the back surfaces **2818***b* of the elongate members **2804** in the third/deployed configuration. In this embodiment, two quasi-circumferential arrangements of coupling members **2858** are provided. Different arrangements of coupling members **2858** may be employed in other embodiments.

(202) In this embodiment, device **2800** includes separator **2852** arranged to manipulate various ones of the elongate members **2804**. In this embodiment, separator **2852** includes a first flexible line **2853***a* and a second flexible line **2853***b* (collectively flexible lines **2853**). In this example embodiment, each of the flexible lines **2853** is physically coupled to elongate member **2804***g*. Each of the flexible lines **2853** is sized to be slidably received in a lumen of a respective one of tubular members **2854***a* and **2854***b* (collectively tubular members **2854**). Tubular member **2854***b* is not shown in each of FIGS. **9**A and **9**C. Tubular members **2854** are physically coupled to elongate member **2804***a* at respective spaced apart locations along a length of elongate member **2804***a*.

(203) In this example embodiment, the flexible lines **2853** may be manipulated to move a portion of device **2800** into the third/expanded or fanned configuration. For example, flexible lines **2853** may be manipulated to move device **2800** from a second/bent configuration (e.g., similar to that shown by device **2600** in FIG. **7**D) into the third/expanded or fanned configuration. In this example embodiment, the flexible lines **2853** may be manipulated to fan at least some of the elongate members **2804**. In this example embodiment, the flexible lines **2853** may be manipulated to further fan at least some of the elongate members **2804** which have been initially fanned under an influence of a biasing action provided by one or more portions (e.g., the twisted portion **2809***c* or the bent portion **2809***a*, or both) of each of various ones of the at least some of the elongate members **2804**. In some embodiments, the flexible lines **2853** are manipulated to vary a distance between the proximal and the distal portions **2802***a*, **2802***b* in the third/expanded configuration. In some embodiments, the flexible lines **2853** may be manipulated to vary a distance between adjacent elongate members (e.g., elongate members **2804***a*, **2804***g*) in the third/expanded configuration. In some embodiments, the flexible lines **2853** are manipulated to distort at least one of the first domed shape **2808***a* and the second domed shape **2808***b*. For example, when the portion of device **2800** is moved into the second fanned array **2872**, flexible line **2853** may be manipulated to reduce a deviation in a shape of frame **2802** (e.g., a “radial step” between elongate members **2804***a*, **2804***g* as compared between FIGS. **9**B and **9**D). Reducing deviations in the shape of frame **2802** may be motivated by various reasons including providing a more uniform distribution in an arrangement of transducers (not shown) that may be carried by the device **2800**. In various example embodiments, manipulation of the flexible lines **2853** may include relatively sliding the flexible lines **2853** within their respective tubular members **2854**. In some example embodiments, manipulation of the flexible lines **2853** includes tensioning the flexible lines **2853**. Other numbers of flexible lines **2853** may be employed in other embodiments.

(204) Various embodiments in this disclosure include various systems or devices that are each selectively movable from an unexpanded or delivery configuration in which a portion of the device is suitably sized for percutaneous delivery to a bodily cavity and an expanded or deployed configuration in which the portion of the device or system is sized too large for percutaneous delivery to the bodily cavity. In some embodiments, additional positioning (e.g., repositioning) of a system or device that is selectively moved from an unexpanded configuration to an expanded configuration occurs after the system or device has been moved into the expanded configuration and or while the system or device is the expanded configuration. For example, a portion of a medical system or device **2900** is shown in an unexpanded configuration in FIG. **10**A and in an expanded configuration in FIG. **10**B according to various embodiments. System or device **2900** includes a frame or structure **2902** that includes a plurality of elongate members **2904**. Each of the elongate members **2904** includes a proximal end **2907**, a distal end **2905** and a respective

intermediate portion **2909** between the proximal end **2907** and the distal end **2905**. Each of the elongate members **2904** includes a front surface **2918***a* (i.e., called out in FIG. **10**B) that is positionable to face an interior surface of a bodily cavity (not shown) into which the structure **2902** may be deployed. Each of the elongate members **2904** includes a back surface **2918***b* (i.e., called out in FIG. **10**B) opposite the corresponding front surface **2918***a* across a thickness of the elongate member **2904**.

(205) In various embodiments, a set of one or more transducer elements **2990** is located on each of at least some of the elongate members **2904**. As in other embodiments described in this disclosure, each transducer element **2990** may include an electrode by way of non-limiting example. In various embodiments, a transducer element **2990**, or a component thereof may be located on (a) the front surface **2918***a*, (b) the back surface **2918***b*, or both (a) and (b) of a corresponding elongate member **2904**. For example, an electrode may be located on one, or both of the front surface **2918***a* and back surface **2918***b* of a given elongate member **2904** in some embodiments. In various embodiments, energy may be selectively transmittable from an electrode. In some of these various embodiments, the energy is sufficient for tissue ablation. In some of the various embodiments, the energy is insufficient for tissue ablation.

(206) In FIG. **10**A, the structure **2902** is in an unexpanded configuration suitably sized for delivery through catheter sheath **2906** (i.e., showed sectioned), for example for percutaneous delivery. The structure **2902** is physically coupled to a shaft member **2910** which is appropriately sized to convey structure **2902** through catheter sheath **2906** during the delivery. In some embodiments, shaft member **2910** is typically sufficiently flexible to allow for percutaneous delivery of structure **2902** through a tortuous path. Percutaneous delivery typically includes moving or otherwise conveying a structure (e.g., structure **2902**) through a bodily opening leading to a bodily cavity. In various embodiments, shaft member **2910** includes a first end portion **2910***a* and a second end portion **2910***b* spaced from the first end portion **2910***a* across an elongated portion **2910***c* of the shaft member **2910**. In FIGS. **10**A and **10**B, structure **2902** is physically coupled to the shaft member **2910** at least proximate the second end portion **2910***b* of the shaft member **2910**.

(207) In some embodiments, a handle portion **2903** is physically coupled to the shaft member **2910** at a location at least proximate the first end portion of **2910***a* of shaft member **2910**. In various embodiments, handle portion **2903** is directly manipulable by a user to percutaneously deliver structure **2902** to a bodily cavity when structure **2902** is in the unexpanded configuration. In some example embodiments, at least a portion of the shaft member **2910** is directly manipulable by a user to percutaneously deliver structure **2902** to a bodily cavity. For example, the directly manipulable portion of shaft member **2910** may include at least part of the elongated portion **2910***c* of the shaft member **2910**. The phrase “directly manipulable” and variants thereof (e.g., directly manipulated) employed herein in this disclosure may include grasping, gripping, or other similar handling performed directly on a particular entity (e.g., handle portion **2903**, elongated portion **2910***c*) by a user or operator (for example, by a hand of a user or operator).

(208) In some embodiments, a surface of shaft member **2910** contacts a lumen of catheter sheath **2906** when structure **2902** is percutaneously delivered through catheter sheath **2906**. In various example embodiments, each elongate member **2904** is arranged in structure **2902** to be advanced distal end **2905** first into a bodily cavity (not shown).

(209) In FIG. **10**B, structure **2902** is positioned in an expanded configuration. Shaft member **2910** is shown partially sectioned in FIG. **10**B for clarity of illustration of various components. For clarity, catheter sheath **2906** is not shown.

(210) In various embodiments, each of the respective intermediate portions **2909** of the plurality of elongate members **2904** is radially or angularly arranged with respect to one another at least partially about or around a first axis **2935** when the structure **2902** is in the expanded or deployed configuration. That is, each of the intermediate portions **2909** is radially or angularly distributed at least partially about or around the first axis **2935** (i.e., when looking along a direction that the first

axis **2935** extends along), for instance like lines of longitude about a rotational or polar axis. In various embodiments, each of the respective intermediate portions **2909** of the elongate members **2904** is radially spaced from the first axis **2935** when structure **2902** is in the expanded configuration. In various embodiments, the intermediate portions **2909** may be circumferentially arranged about the first axis **2935** when the structure **2902** is in the expanded configuration.

(211) In some embodiments, each of the elongate members **2904** includes a curved portion **2923** (only two called out) having a curvature configured to cause the curved portion **2923** to extend along at least a portion of a curved path, the curvature configured to cause the curved path to intersect the first axis **2935** at each of a respective at least two spaced apart locations along the first axis **2935** when structure **2902** is in the expanded configuration. In some embodiments, the curved path is defined to include an imagined extension of the curved portion along the curved portion's extension direction while maintaining the curved portion's curvature (e.g., radius of curvature or change in radius of curvature). In some embodiments, each curved portion **2923** may extend entirely along, or at least part way along the respective curved path to physically intersect at least one of the respective at least two spaced apart locations along the first axis **2935**. In some particular embodiments, no physical portion of a given elongate member of an employed structure intersects any of the at least two spaced apart locations along the first axis intersected by the respective curved path associated with the curved portion of the given elongate member. For example, the end portion of the given elongate member **2904** may be physically separated from the first axis **2935** by a hub device (e.g., hub **2965**) employed to physically couple or align the given elongate member **2904** to another elongate member **2904**. Additionally or alternatively, a given elongate member **2904** may include a recurve portion arranged to physically separate the given elongate member **2904** from the first axis **2935**. In some embodiments, various ones of the elongate members **2904** cross one another at a location on the structure **2902** passed through by the first axis **2935** when the structure **2902** is in the expanded configuration. In various embodiments, the curved path is an arcuate path. In various embodiments, at least the portion of the curved path extended along by corresponding curved portion **2923** is arcuate.

(212) In some embodiments, each of the elongate members **2904** is a resilient member that stores potential or spring energy when confined in a confining structure (e.g., catheter sheath **2906**) in the unexpanded configuration. Upon being advanced from the confining structure, at least some of the potential or spring energy is released to cause the structure **2904** to assume a lower energy state defined by the expanded configuration. In FIG. **10**B, each of at least some of the elongate members **2904** is physically coupled to control member **2960***a* of an expansion control actuator **2960**, a portion of which may, in some embodiments, extend along a path through shaft member **2910** or catheter sheath **2906**. In some embodiments, the expansion control actuator **2960** is located on handle portion **2903**. In some embodiments, the expansion control actuator **2960** is operable to impart force (e.g., tensile force) to control member **2960***a* sufficient to cause the intermediate portions **2909** of various ones of the elongate members **2904** to buckle outwardly from the first axis **2935** to move structure **2902** into the expanded configuration. In various embodiments, control member **2960***a* can include a flexible control line/wire/cable, a control rod or other force transmission members by way of non-limiting example. In some embodiments, the respective distal end **2905** of each of at least some of the elongate members **2904** is physically coupled (i.e., directly or indirectly) to control member **2960***a*. In some embodiments, the control member **2960***a* is physically coupled (i.e., directly or indirectly) to each of various ones of the elongate members **2904** at a location between the respective proximal and distal ends **2907**, **2905** of each of the various ones of the elongate members **2904**. For example, a single elongate member **2904** may form two diametrically opposed portions of the structure **2902**, with the control member **2960***a* physically coupled (i.e., directly or indirectly) at a location on the elongate member **2904** between the two diametrically opposed portions. Other embodiments may employ other mechanisms or modes of operation for moving a structure (e.g., structure **2902**) from an unexpanded configuration

to an expanded configuration.

(213) In various embodiments, structure **2902** is rotationally coupled to the second end portion **2910***b* of the shaft member **2910**. In FIG. **10**B, each of the elongate members **2904** is physically coupled to a hub **2965** (shown partially sectioned), the hub **2965** rotationally coupled to the second end portion **2910** of shaft member **2910**. In some embodiments, the respective proximal end **2907** of each of the elongate members **2904** is directly coupled to hub **2965**. In various embodiments, the structure **2902** is operably coupled to at least one actuator, the at least one actuator selectively operable to rotate the intermediate portion **2909** of each of at least some of the plurality of elongate members **2904** at least partially about or around the first axis **2935** when or while structure **2902** is in the expanded configuration. In various embodiments, the structure **2902** is operably coupled to at least one actuator, the at least one actuator selectively operable to concurrently rotate the intermediate portions **2909** of all of the plurality of elongate members **2904** about the first axis **2935** when or while structure **2902** is in the expanded configuration. In various embodiments, the intermediate portion **2909** of each of at least some of the plurality of elongate members is moved with respect to, or relatively to, at least the second end portion **2910***b* of the shaft member **2910** by the at least one actuator when or while the structure is in the expanded configuration. In various embodiments, the intermediate portions **2909** of all of the plurality of elongate members are moved with respect to, or relatively to, at least the second end portion **2910***b* of the shaft member **2910** by the at least one actuator when or while the structure is in the expanded configuration. For example, in FIG. **10**B, hub **2965** is physically coupled to a control member **2970***a* (shown sectioned) of at least one actuator that includes a rotation actuator **2970**, a portion of which may, in some embodiments, extend along a path through shaft member **2910** or catheter sheath **2906** (again not shown in FIG. **10**B). In some embodiments, the rotation actuator **2970** is located on handle portion **2903**. In various embodiments, the rotation actuator **2970** is operable to manipulate control member **2970***a* to cause the intermediate portions **2909** of all of the plurality of elongate members **2904** to concurrently rotate about the first axis **2935** and move with respect to, or relatively to, at least the second end portion **2910***b* of the shaft member **2910**. In some embodiments, the rotation actuator **2970** is operable to impart rotational movement (e.g., movement associated with an applied torque) to control member **2970***a* sufficient to cause the intermediate portions **2909** of all of the plurality of elongate members **2904** to rotate concurrently about the first axis **2935** and move with respect to, or relatively to, at least the second end portion **2910***b* of the shaft member **2910**. In various embodiments, the intermediate portions **2909** of all of the plurality of elongate members **2904** are configured to concurrently move with respect to, or relatively to, the second end portion **2910***b* of the shaft member **2910** and to concurrently rotate about the first axis **2935**. In various embodiments, the intermediate portions **2909** of all of the plurality of elongate members **2904** are configured to concurrently move throughout the duration of their movement with respect to, or relative to, the second end portion **2910***b* of the shaft member **2910** and throughout the duration of their rotation about the first axis **2935**. In various embodiments, the intermediate portions **2909** of all of the plurality of elongate members **2904** are configured to concurrently move throughout only a portion of the duration of their movement with respect to, or relatively to, the second end portion **2910***b* of the shaft member **2910** and throughout only a portion of the duration of their rotation about the first axis **2935**. Thus, as used herein and in the claims, the terms concurrently, and similar terms (e.g., current), means at least partially overlapping in time, even if not starting and ending at the same time.

(214) Rotation of various ones and sometimes all of the intermediate portions **2909** of the elongate members **2904** about the first axis **2935** when or while structure **2902** is in the expanded configuration may be motivated by various reasons. For example in some embodiments when structure **2902** is deployed in the expanded configuration in a bodily cavity, various ones of the transducer elements **2990** may not be able to effectively interact with bodily tissue in the cavity, and an additional rotation of a portion of the structure **2902** on which the transducer elements **2990**

are located may be required to increase the effectiveness of the interaction of with the bodily tissue. In FIG. **10**B, the respective transducer elements **2990***a* and **2990***b* of a first adjacent pair of transducers **2990** are circumferentially spaced with respect to each other (i.e., about first axis **2935**) by a greater amount than a circumferential spacing between the respective transducer elements **2990***c* and **2990***d* of a second pair of transducer elements **2990**. In FIG. **10**B, each of transducer elements **2990***a* and **2990***b* are radially spaced from first axis **2935** by a greater radial distance than each of the transducer elements **2990***c* and **2990***d*. In some embodiments, a circumferential distance between an adjacent pair of transducer elements (e.g., various transducer elements **2990**) may be too large to effectively ablate tissue between the two transducer elements of the adjacent pair, thereby necessitating an additional rotation in accordance with various embodiments. For example, a rotation of a portion of structure **2902** may occur after at least the two transducer elements **2990***a* and **2990***b* are activated to ablate respective tissue regions, the rotation sufficient to position one of the transducer elements **2990***a* and **2990***b* to ablate a tissue region between the two previously ablated tissue regions. In various embodiments, the rotation of the portion of the structure **2902** about first axis **2935** when or while the structure **2902** is in the expanded configuration rotates all the transducer elements **2990** about first axis **2935**. In various embodiments, the rotation of the portion of the structure **2902** about first axis **2935** when or while the structure **2902** is in the expanded configuration rotates the intermediate portions **2909** of all of the plurality of elongate members **2904** about first axis **2935**. The intermediate portions **2909** of all of the plurality of elongate members **2904** may be controlled to rotate about the first axis **2935** by other angular amounts in various other embodiments.

(215) In FIG. **10**B, control member **2960***a* is arranged in a lumen provided in control member **2970***a*. In various embodiments, control member **2970***a* is arranged in a lumen provided in control member **2960***a*. In some embodiments control member **2960***a* may be arranged to transmit an axially compressive force to move structure **2902** from the unexpanded configuration to the expanded configuration. For example, an axially compressive force may be applied to buckle the intermediate portions **2909** of at least some of the elongate members **2904** as structure **2902** is moved from the unexpanded configuration to the expanded configuration. In some embodiments, control member **2960***a* is arranged to concurrently rotate as the intermediate portion **2909** of each of at least some or all of the plurality of elongate members **2904** is rotated about the first axis **2935** by rotation actuator **2970**. In other embodiments, control member **2960***a* is arranged to not concurrently rotate as the intermediate portion **2909** of each of at least some or all of the plurality of elongate members **2904** is rotated about the first axis **2935** by rotation actuator **2970**. In some embodiments, control member **2970***a* is physically coupled (i.e., directly or indirectly) to the respective proximal end **2907**, the respective distal end **2905**, or each of the respective proximal and distal ends **2907**, **2905** of each of at least some of the elongate members **2904**. In various embodiments, rotation of the intermediate portion **2909** of each of at least some or all of the elongate members **2904** by rotation actuator **2970** when or while structure **2902** is in the expanded configuration is accompanied by a concurrent rotation of each of the corresponding respective proximal and distal ends **2907** and **2905**. In various embodiments, rotation of the intermediate portion **2909** of each of at least some or all the elongate members **2904** by rotation actuator **2970** when or while structure **2902** is in the expanded configuration is accompanied by a concurrent rotation of one, but not both, of the respective proximal and distal ends **2907** and **2905**. In some of these various embodiments, various ones of the elongate members **2904** assume a helical form around first axis **2935** when the intermediate portion **2909** of each of at least some or all the elongate members **2904** is rotated about the first axis **2935** by rotation actuator **2970** when or while structure **2902** is in the expanded configuration. In some embodiments, rotation of the intermediate portion **2909** of each of at least some or all the elongate members **2904** by rotation actuator **2970** when or while structure **2902** is in the expanded configuration is not accompanied by a concurrent rotation of any of the respective proximal and distal ends **2907** and **2905**.

(216) In FIG. **10**B, the second end portion **2910***b* of shaft member **2910** includes a surface **2912**, a portion of the surface **2912** positioned at an end **2913** of flexible shaft member **2910**, the portion of the surface **2912** being circumferentially arranged about a second axis **2937**. End **2913** defines an end or terminus of flexible shaft member **2910**, and in particular, an end of second end portion **2910***b*. In various embodiments, an extent of the portion of surface **2912** is defined at least in part by end **2913**. In various embodiments, the second axis **2937** is parallel to the first axis **2935**. In some embodiments, the second axis **2937** and the first axis **2935** are substantially collinear. In various embodiments, the intermediate portion **2909** of each of at least some or all of the plurality of elongate members **2904** is rotated about the second axis **2937** by rotation actuator **2970**.
(217) In various embodiments, the expanded configuration is a first expanded configuration in which the respective intermediate portion **2909** of each of at least some of the elongate members **2904** is radially spaced from the first axis **2935** by a respective first radial distance. In some of these various embodiments, the structure **2902** is further selectively moveable between the first expanded configuration and a second expanded configuration in which the respective intermediate portion **2909** of each of the at least some of the plurality of elongate members **2904** is radially spaced from the first axis **2935** by a second radial distance, each second radial distance having a greater magnitude than a magnitude of the corresponding or respective first radial distance. This may be motivated by various reasons. For example, the at least some of the elongate members **2904** may be further manipulated to adjust a positioning between various transducer elements **2990** located on the elongate members **2904** and a tissue surface within a bodily cavity in which the structure **2902** is positioned. The at least some of the elongate members **2904** may be further manipulated to create conformance with a tissue surface of the bodily cavity when structure **2902** is moved from the first expanded configuration to the second expanded configuration. In some embodiments, a size of the structure **2902** in the first expanded configuration is configured to reduce contact between the structure **2902** and an interior tissue surface of the bodily cavity in which the structure **2902** is positioned. This may be motivated by different reasons including reducing occurrences of damage to the interior tissue surface during the rotation of the intermediate portions **2909** of at least some or all of the elongate members **2904** by rotation actuator **2970**. After the rotational movement, the structure **2902** may be selectively moved into the second expanded configuration to engage with, or be positioned at least proximate to, the interior tissue surface within the bodily cavity.
(218) FIGS. **11**A and **11**B show a system including a medical system or device **3000** according to various embodiments. System or device **3000** includes a frame or structure **3002** that comprises a plurality of elongate members **3004**. System or device **3000** may include a plurality of transducer elements located on the structure **3002** (i.e., not shown for clarity, but similar to transducer elements **120**, **206**, **1490**, **2490**, **2690** and **2990**), the plurality of transducer elements positionable within a bodily cavity (not shown). In some embodiments, the plurality of transducer elements are arrangeable to form a two- or three-dimensional distribution, grid or array of the transducer elements capable of mapping, ablating or stimulating an inside surface of a bodily cavity or lumen without requiring mechanical scanning. In various example embodiments, at least some of the transducer elements include respective electrodes, each electrode including a respective energy transmission surface configured for transferring energy to tissue, from tissue, or both to and from tissue.
(219) In a manner similar to other embodiments described in this disclosure, structure **3002** is selectively movable between an unexpanded or delivery configuration (e.g., as shown in FIG. **11**A) and an expanded or deployed configuration (e.g., as shown in FIG. **11**B) that may be used to position elongate members **3004** against a tissue surface within the bodily cavity or position the elongate members **3004** in the vicinity of the tissue surface. In some embodiments, structure **3002** has a size in the unexpanded or delivery configuration suitable for percutaneous delivery through a bodily opening (e.g., via catheter sheath **3012**) to the bodily cavity. In some embodiments, structure

3002 has a size in the expanded configuration too large for percutaneous delivery through a bodily opening (e.g., via catheter sheath **3012**, not shown in FIG. **11**B) to the bodily cavity. The elongate members **3004** may form part of a flexible circuit structure (i.e., also known as a flexible printed circuit board (PCB) circuit). In some embodiments, the elongate members **3004** include a plurality of different material layers. In some embodiments, each of the elongate members **3004** includes a plurality of different material layers.

(220) In FIG. **11**A, each of the elongate members **3004** includes a respective distal end **3005** (only one called out), a respective proximal end **3007** (only one called out) and an intermediate portion **3009** (only one called out) positioned between the proximal end **3007** and the distal end **3005**. The respective intermediate portion **3009** of each elongate member **3004** includes a first or front surface **3018***a* that is positionable to face an interior tissue surface within a bodily cavity (not shown) and a second or back surface **3018***b* opposite across a thickness of the intermediate portion **3009** from the front surface **3018***a*. In various embodiments, the intermediate portion **3009** of each of the elongate members **3004** includes a respective pair of side edges of the front surface **3018***a*, the back surface **3018***b*, or both the front surface **3018***a* and the back surface **3018***b*, the side edges of each pair of side edges opposite to one another, the side edges of each pair of side edges extending between the proximal end **3007** and the distal end **3005** of the respective elongate member **3004**. In some embodiments, each pair of side edges includes a first side edge **3027***a* (only one called out in FIG. **11**A) and a second side edge **3027***b* (only one called out in FIG. **11**A). In some embodiments, each of the elongate members **3004**, including each respective intermediate portion **3009**, is arranged front surface **3018***a*-toward-back surface **3018***b* in a stacked array during an unexpanded or delivery configuration. In many cases, a stacked array allows the structure **3002** to have a suitable size for percutaneous or intravascular delivery. In some embodiments, the elongate members **3004** are arranged to be introduced into a bodily cavity (again not shown) distal end **3005** first. For clarity, not all of the elongate members **3004** of structure **3002** are shown in FIG. **11**A. In some embodiments, each of at least some of the elongate members includes a bent portion **3009***a* (i.e., similar to portions **2609***a*, **2809***a*) as called out in FIG. **11**B. In some embodiments, each of at least some of the elongate members includes a twisted portion **3009***c* (i.e., similar to twisted portions **2609***c*, **2809***c*) as called out in FIG. **11**B.

(221) Each of the elongate members **3004** is arranged in a fanned arrangement **3080** in FIG. **11**B. Elongate members **3004** are identified as elongate members **3004***a*, **3004***b*, **3004***c*, **3004***d*, **3004***e*, **3004***f*, **3004***g*, **3004***h*, **3004***i* and **3004***j* in FIG. **11**B. In some embodiments, the fanned arrangement **3080** is formed during the expanded or deployed configuration in which structure **3002** is manipulated to have a size too large for percutaneous or intravascular delivery. In some embodiments, structure **3002** includes a proximal portion **3002***a* having a first domed shape **3008***a* and a distal portion **3002***b* having a second domed shape **3008***b* when structure **3002** is in the expanded configuration. In some embodiments, the proximal and the distal portions **3002***a*, **3002***b* include respective portions of elongate members **3004**. In some embodiments, the structure **3002** is arranged to be delivered distal portion **3002***b* first into a bodily cavity (again not shown) when the structure **3002** is in the unexpanded or delivery configuration as shown in FIG. **11**A. In some embodiments, the proximal and the distal portions **3002***a*, **3002***b* are arranged in a clam shell configuration in the expanded or deployed configuration shown in FIG. **11**B. In various example embodiments, each of the front surfaces **3018***a* (three called out in FIG. **11**B) of the intermediate portions **3009** of the plurality of elongate members **3004** face outwardly from the structure **3002** when the structure **3002** is in the expanded configuration. In various embodiments, each of the front surfaces **3018***a* of the intermediate portions **3009** of the plurality of elongate members **3004** are positioned adjacent an interior tissue surface of a bodily cavity (not shown) in which the structure **3002** (i.e., in the expanded configuration) is located. In various example embodiments, each of the back surfaces **3018***b* (two called out in FIG. **11**B) of the intermediate portions **3009** of the plurality of elongate members **304** face an inward direction when the structure **3002** is in the

expanded configuration.

(222) In various embodiments, the respective intermediate portions **3009** of various ones of the elongate members **3004** are angularly arranged with respect to one another about a first axis **3035** when structure **3002** is in the expanded configuration. In various embodiments, each of the respective intermediate portions **3009** of the plurality of elongate members **3004** are radially arranged with respect to one another at least partially about or around a first axis **3035** when the structure **3002** is in the expanded configuration. That is, each of the intermediate portions **3009** is radially distributed at least partially about or around the first axis **3035** (i.e., when looking along a direction that the first axis **3035** extends along), for example like lines of longitude about a rotational or polar axis. Thus, in various embodiments, each of the respective intermediate portions **3009** of the elongate members **3004** may be described as being radially spaced from the first axis **3035** when structure **3002** is in the expanded configuration. In various embodiments, the intermediate portions **3009** of various ones of the elongate members **3004** may be described as being circumferentially arranged about first axis **3035** when structure **3002** is in the expanded configuration, similar to lines of longitude about an axis of rotation of a body of revolution, which body of revolution may, or may not be spherical.

(223) In some embodiments, each of the elongate members **3004** includes a curved portion **3023** (two called out in FIG. **11**B) having a curvature configured to cause the curved portion **3023** to extend along at least a portion of a curved path, the curvature configured to cause the curved path to intersect the first axis **3035** at each of a respective at least two spaced apart locations along the first axis **3035** when structure **3002** is in the expanded configuration. In some embodiments, the curved path is defined to include an imagined extension of the curved portion along the curved portion's extension direction while maintaining the curved portion's curvature (e.g., radius of curvature or change in radius of curvature). In some embodiments, each curved portion **3023** may extend entirely along, or at least part way along the respective curved path to physically intersect at least one of the respective at least two spaced apart locations along the first axis **3035**. In some particular embodiments, no physical portion of a given elongate member of an employed structure intersects some of the at least two spaced apart locations along the first axis **3035** intersected by the respective curved path associated with the curved portion **3023** of the given elongate member. In some embodiments, various ones of the elongate members **3004** cross one another at a location on the structure **3002** passed through by the first axis **3035** when the structure **3002** is in the expanded configuration. In various embodiments, the curved path is an arcuate path. In various embodiments, at least the portion of the curved path extended along by corresponding curved portion **3023** is arcuate or volute. In some embodiments, structure **3002** is selectively movable between a first expanded configuration and a second expanded configuration similar to various embodiments described above in this disclosure (e.g., selective manipulation of frame **2502** from a first fanned array **2570** to a second fanned array **2572** or selective manipulation of frame **2802** from a first fanned array **2870** to a second fanned array **2872**). In various embodiments, the curved portions **3023** are circumferentially arranged about the first axis **3035** when the structure **3002** is in the expanded configuration.

(224) In various embodiments, a shaft member **3010** is used to deliver structure **3002** through catheter sheath **3012**. In some embodiments, shaft member **3010** is typically sufficiently flexible to allow for percutaneous delivery of structure **3002** through a tortuous path. In FIGS. **11**A and **11**B, structure **3002** is physically coupled to shaft member **3010**. In various embodiments, shaft member **3010** includes a first end portion **3010***a* and a second end portion **3010***b* spaced from the first end portion **3010***a* across an elongated portion **3010***c* of the shaft member **3010**. In FIGS. **11**A and **11**B, structure **3002** is physically coupled to the shaft member **3010** at least proximate the second end portion **3010***b* of the shaft member **3010**. In some embodiments, a handle portion **3003** is physically coupled to the shaft member **3010** at a location at least proximate the first end portion **3010***a* of shaft member **3010**. In various embodiments, handle portion **3003** is directly manipulable

by a user to percutaneously deliver structure **3002** to a bodily cavity when structure **3002** is in the unexpanded configuration. In some example embodiments, a least a portion of the shaft member **3010** is directly manipulable by a user to percutaneously deliver structure **3002** to a bodily cavity. For example, the directly manipulable portion of shaft member **3010** may include at least part of the elongated portion **3010***c* of the shaft member **3010**. In various embodiments, an external surface of shaft member **3010** is positioned for contact with a surface of a lumen of a catheter sheath (e.g., catheter sheath **3012**) through which a portion of shaft member **3010** is passed through when structure **3002** is percutaneously delivered in the unexpanded configuration. Various communication paths (e.g., transducer element data paths, energy transmission paths, etcetera, not shown) may be provided through a portion of shaft member **3010**. In some embodiments, various control paths, communication paths or data transmission paths (not shown) may be provided between shaft member **3010** and a controller (e.g., controller **224**).

(225) In some embodiments, structure **3002** is fixedly coupled to shaft member **3010**. In various embodiments, the respective proximal end **3007**, the respective distal end **3005**, or each of the respective proximal and distal ends **3007**, **3005** of each of the elongate members **3004** is fixedly coupled to shaft member **3010**. For example, in FIGS. **11**A and **11**B, the respective proximal end **3007** of each of the elongate members **3004** is fixedly coupled to shaft member **3010**. In some example embodiments, each location on the structure **3002** to which shaft member **3010** is physically coupled is positioned to one side (i.e., a same or a common one of the sides) of at least one plane (also referred to as a spatial plane) when the structure **3002** is in the expanded configuration, each plane of the at least one plane coincident with the first axis **3035**. For example, in FIG. **11**B, a plane **3039** is coincident with first axis **3035** when structure **3002** is in the expanded configuration. In FIG. **11**B, each location on the structure **3002** to which shaft member **3010** is physically coupled is positioned to one or a same side of plane **3039**. It is understood that other planes may also be positioned in a similar relationship with shaft member **3010**. Plane **3039** is depicted as having boundaries merely for purposes of clarity of illustration in FIG. **11**B. In some embodiments, at least some of the respective curved portions **3023** of at least two of the elongate members **3004** are arranged on each side of a plane positioned coincident with first axis **3035** (e.g., plane **3039**) when the structure **3002** is in the expanded configuration. In some embodiments, at least some of the respective intermediate portions **3009** of at least two of the elongate members **3004** are arranged on each side of a plane positioned coincident with first axis **3035** (e.g., plane **3039**) when the structure **3002** is in the expanded configuration. FIG. **11**C is a plan view of structure **3002** in the expanded configuration of FIG. **11**B. The plan view of FIG. **11**C has an orientation such that first axis **3035** is viewed along the axis in this particular embodiment. The plan view of FIG. **11**C has an orientation such that plane **3039** is viewed 'on edge' to its respective planar surface. It is noted in various embodiments, plane **3039** is an imaginary spatial plane (i.e., not itself a physical structure) and has no or infinitesimal thickness, and 'on edge' is intended to refer to an 'on edge' perspective assuming that the plane had an edge of infinitesimal or minimal thickness. Plane **3039** is represented by a respective "heavier" line in FIG. **11**C. First axis **3035** is represented by a "•" symbol in FIG. **11**C. It is understood that each of the depicted lines or symbols "•" used to represent any corresponding plane, or axis in this disclosure do not impart any size attributes on the corresponding plane or axis.

(226) In FIGS. **11**B and **11**C, the second end portion **3010***b* of shaft member **3010** includes a surface **3014**, a portion of the surface **3014** positioned at an end **3013** of shaft member **3010** being circumferentially arranged about a second axis **3037**. End **3013** defines an end of shaft member **3010**, and in particular, an end of second end portion **3010***b*. In various embodiments, an extent of the portion of surface **3012** is defined at least in part by end **3013**. In various embodiments, the second axis **3037** is not parallel to the first axis **3035** when structure **3002** is in the expanded configuration. In various embodiments, the second axis **3037** is not collinear with first axis **3035** when structure **3002** is in the expanded configuration.

(227) Structure **3002** may be selectively moved between the unexpanded configuration and the expanded configuration by the use of various methods and devices such as those employed with structures or frames **2702**, **2802** by way of non-limiting example. In some example embodiments, at least the respective intermediate portions **3009** of at least some of the plurality of elongate members **3004** are fanned as the structure **3002** is moved between the unexpanded configuration and the expanded configuration. At least a portion of the fanning may include autonomous fanning as described above in this disclosure. In some example embodiments, at least the respective intermediate portions **3009** of at least some of the plurality of elongate members **3004** are rotated about an axis as the structure **3002** is moved between the unexpanded configuration and the expanded configuration. In some example embodiments, when the structure **3002** is moved between the unexpanded configuration and the expanded configuration, at least the respective intermediate portion **3009** of each elongate member **3004** of a first set of the elongate members **3004** is rotated in a first rotational direction (e.g., a clockwise rotational direction), and at least the respective intermediate portion **3009** of each elongate member **3004** of a second set of the elongate members **3004** different than the first set is rotated in a second rotational direction (e.g., a counter-clockwise rotational direction) opposite to the first rotational direction. For example in some embodiments, the respective intermediate portions of each of a first set of the elongate members and a second set of the elongate members are rotated in opposite directions in a manner similar to the elongate members **1704***b*, **1704***c*, **1704***d*, **1704***e*, **1704***f* in FIGS. **4**G and **4**H as an associated structure that includes the first and the second sets is moved between an unexpanded configuration and an expanded configuration. In some example embodiments, the respective intermediate portions of each of a first set of the elongate members and a second set of the elongate members are rotated in opposite directions in a manner similar to the elongate members **2604***a*, **2604***b*, **2604***c* **2604***e*, **2604***f* and **2604***g* in various ones of FIG. **7** as an associated structure that includes the first and the second sets is moved between an unexpanded configuration and an expanded configuration. Rotations may have differential rotational speeds, or the rotational speeds may be the same across some or all elongate members.

(228) As represented in FIG. **11**C, when structure **3002** has been moved into the expanded configuration from the unexpanded configuration (e.g., as shown in FIG. **11**A), at least the respective intermediate portions **3009** (only two called out) of the elongate members **3004** in a first set of the elongate members **3004** (i.e., elongate members **3004***a*, **3004***b*, **3004***c*, **3004***d*, and **3004***e*) each have been rotated in a first rotational direction (e.g., a clockwise rotational direction represented by arrow **3090***a*) and at least the respective intermediate portions **3009** (only two called out) of the elongate members **3004** in a second set of the elongate members **3004** (i.e., elongate members **3004***f*, **3004***g*, **3004***h*, **3004***i* and **3004***j*) each have been rotated in a second rotational direction (e.g., a counter-clockwise rotational direction represented by arrow **3090***b*) opposite to the first rotational direction. In some embodiments, when the structure **3002** is moved between the unexpanded configuration and the expanded configuration, at least the respective intermediate portion **3009** of each elongate member **3004** in the first set is rotated in a first rotational direction about the first axis **3035**, and at least the respective intermediate portion **3009** of each elongate member **3004** in the second set is rotated in a second rotational direction about the first axis **3035**, the second rotational direction opposite to the first rotational direction. As represented in FIG. **11**C, when structure **3002** has been moved into the expanded configuration from the unexpanded configuration (i.e., as best visualized in FIG. **11**A), at least the respective intermediate portion of each elongate member **3004** in the first set of elongate members **3004** has been moved away from the second axis **3037** in a first direction (e.g., represented by arrow **3092***a*) and at least the respective intermediate portion of each elongate member **3004** in the second set of elongate members **3004** has been moved away from the second axis **3037** in a second direction (e.g., represented by arrow **3092***b*). In some embodiments, the first and the second directions are different directions. In some embodiments, the second direction is opposite to the first direction. In

some embodiments, the first direction includes a first rotational direction component (e.g., a clockwise rotational direction component represented by arrow **3094***a*) and the second direction includes a second rotational direction component (e.g., a counter-clockwise rotational direction component represented by arrow **3094***b*) opposite to the first rotational direction component.

(229) In various embodiments, the structure **3002** is operably coupled to at least one actuator, the at least one actuator selectively operable to rotate the intermediate portion **3009** of each of at least some or all of the plurality of elongate members **3004** at least partially about or around at least the first axis **3035** when or while structure **3002** is in the expanded configuration. In various embodiments, the intermediate portion **3009** of each of at least some of the plurality of elongate members **3004** is moved with respect to, or relatively to, at least the second end portion **3010***b* of the shaft member **3010** by the at least one actuator when or while structure **3002** is in the expanded configuration. In various embodiments, the intermediate portions **3009** of all of the plurality of elongate members **3004** are moved with respect to, or relatively to at least the second end portion **3010***b* of the shaft member **3010** by the at least one actuator when structure **3002** is in the expanded configuration. For example, in FIGS. **11**B and **11**C, at least one actuator that includes a rotation actuator **3070** is employed in some embodiments to rotate at least the intermediate portion **3009** of each of at least some or all of the plurality of elongate members **3004** about the first axis **3035** when or while structure **3002** is in the expanded configuration. In various embodiments, at least the intermediate portion **3009** of each of at least some or all of the plurality of elongate members **3004** is moved with respect to, or relatively to, at least the second end portion **3010***b* of the shaft member **3010** by rotation actuator **3070**. In some embodiments, the rotation actuator **3070** is located on handle portion **3003**. In various embodiments, the intermediate portions **3009** of all of the plurality of elongate members **3004** are configured to concurrently move with respect to, or relatively to, the second end portion **3010***b* of the shaft member **3010** and to concurrently rotate about the first axis **3035**. In various embodiments, the intermediate portions **3009** of all of the plurality of elongate members **3004** are configured to concurrently move throughout at least a portion of the duration of their movement with respect to the second end portion **3010***b* of the shaft member **3010** and throughout at least a portion of the duration of their rotation about the first axis **3035**.

(230) In various embodiments, rotation actuator **3070** is selectively operable to rotate the intermediate portion **3009** of each of at least some of the plurality of elongate members **3004** at least partially about or around at least the first axis **3035** when or while structure **3002** is in the expanded configuration. In some of these embodiments, the intermediate portion **3009** of each of the at least some of the plurality of elongate members **3004** rotates at least partially about or around each of the first axis **3035** and the second axis **3037** by different respective angular amounts when the rotation actuator **3070** rotates the intermediate portion **3009** of each of the at least some of the plurality of elongate members **3004** about at least the first axis **3035** when or while structure **3002** is in the expanded configuration. For example, when the intermediate portion **3009** of each of the at least some of the plurality of elongate members **3004** is rotated partially about the first axis **3035** by a respective first angular amount by the rotation actuator **3070** when or while structure **3002** is in the expanded configuration, a secondary rotation of the intermediate portion **3009** of each of the at least some of the plurality of elongate members **3004** by a second angular amount about the second axis **3037** may also occur. In various embodiments, each first angular amount is typically much greater than the corresponding second angular amount. In some embodiments, the intermediate portion **3009** of each of the at least some of the plurality of elongate members **3004** is not rotated about the second axis **3037** when rotation actuator **3070** rotates the intermediate portion **3009** of each of the at least some of the plurality of elongate members **3004** about at least the first axis **3035** when or while structure **3002** is in the expanded configuration.

(231) In various embodiments, the rotation actuator **3070** is operable to manipulate various control members to cause at least the intermediate portion **3009** of each of at least some or all of the plurality of elongate members **3004** to at least partially rotate about the first axis **3035** and move

with respect to, or relative to, the second end portion **3010***b* of the shaft member **3010**. For example, in FIGS. **11**B and **11**C, two control members **3070***a* and **3070***b* are manipulable by rotation actuator **3070** to cause the intermediate portion **3009** of each of at least some or all of the plurality of elongate members **3004** to partially rotate about the first axis **3035** and move with respect or relative to the second end portion **3010***b* of the shaft member **3010**. It is noted that although each of control members **3070***a* and **3070***b* is directly physically coupled to a respective one of elongate members **3004***a* and **3004***j* in FIGS. **11**B and **11**C, movement of any of elongate members **3004***a* and **3004***j* under the influence of corresponding ones of control members **3070***a* and **3070***b* may also result in movement of others of the elongate members **3004** in various embodiments. For example, each of the elongate members **3004** may be physically coupled together by various coupling members (not shown but sometimes similar to coupling members **2858** used in various embodiments associated with device **2800**). In various embodiments, coupling members such as coupling members **2858** may be employed to cause a movement of at least one elongate member **3004** on the basis of a movement of at least another elongate member **3004**.

(232) Control members **3070***a*, **3070***b* may take different forms various embodiments. For example, control members **3070***a*, **3070***b* can include tension force transmission members or compression force transmission members by way of non-limiting example. In various embodiments, a portion of each of at least one of control members **3070***a*, **3070***b* may be conveyed through shaft member **3010** or catheter sheath **3012** to rotation actuator **3070**. In FIGS. **11**B and **11**C, rotation actuator **3070** is operable to selectively apply force (e.g., a tension force) to various ones of the control members **3070***a*, **3070***b* to cause the intermediate portion **3009** of each of at least some or all of the plurality of elongate members **3004** to at least partially rotate about the first axis **3035** and move with respect to, or relative to, the second end portion **3010***b* of the shaft member **3010** when or while structure **3002** is in the expanded configuration. For example, in various embodiments, rotation actuator **3070** may be selectively operable to partially rotate the intermediate portion **3009** of each of at least some or all of the plurality of elongate members **3004** about or around the first axis **3035** in a particular rotational direction when or while structure **3002** is in the expanded configuration. In some of these various embodiments, the particular rotational direction is one of a first rotational direction (e.g., rotational direction represented by arrow **3090***a* or rotational direction component represented by arrow **3094***a*) or a second rotational direction (e.g., rotational direction represented by arrow **3090***b* or rotational direction component represented by arrow **3094***b*) associated with the movement of structure **3002** between the unexpanded configuration and the expanded configuration.

(233) FIG. **11**D is similar to the plan view of FIG. **11**C in which structure **3002** is in the expanded configuration, but in which rotation actuator **3070** has been operated in a first mode in which the intermediate portion **3009** of each of at least some (i.e., all in FIG. **11**D) of the elongate members **3004** have been partially rotated about or around the first axis **3035** in a first rotational direction (e.g., a clockwise rotational direction represented by arrow **3096***a*) according to various embodiments. In some of these various embodiments, the first rotational direction represented by arrow **3096***a* is the same as a first rotational direction (e.g., rotational direction **3090***a* or rotational direction component **3094***a*) associated with a movement of a portion of the structure **3202** between the unexpanded configuration and the expanded configuration. In various embodiments, rotation actuator **3070** may be configured to operate in various ways in the first mode. For example in some embodiments, rotation actuator **3070** may be operated to cause the intermediate portion **3009** of each of at least some (i.e., all in FIG. **11**D) of the elongate members **3004** to partially rotate about or around the first axis **3035** in the first rotational direction represented by arrow **3096***a* by causing control member **3070***a* to apply a greater amount of force (e.g., tension-based force) to elongate member **3004***a* than a force (e.g., tension-based force) applied to elongate member **3004***j* by control member **3070***b*. In some embodiments, rotation actuator **3070** may be operated to cause the

intermediate portion **3009** of each of at least some (i.e., all in FIG. **11**D) of the elongate members **3004** to partially rotate about or around the first axis **3035** in the first rotational direction represented by arrow **3096***a* by causing control members **3070***a*, **3070***b* to apply a suitable force couple or moment to structure **3202**. In some embodiments, a biasing device (e.g., spring, resilient member) is employed to oppose a rotation, when structure **3002** is in the expanded configuration, of the intermediate portion **3009** of each of at least some or all of the elongate members **3004** about the first axis **3035** under the influence of rotation actuator **3070**. For example, a biasing device as described above may be provided at least in part by a respective resilient portion of each of at least some of the elongate members **3004**. In FIGS. **11**B and **11**C, a first portion (e.g., bent portion **3009***a*) of each of at least some of the elongate members **3004** is adjacent a corresponding twisted portion **3009***c*. In various embodiments, a biasing device as described above may be provided at least in part by each bent portion **3009***a*. It is noted each twisted portion **3009***c* may also provide at least part of the biasing device. However, since each twisted portion **3009***c* is typically stiffer than a corresponding bent portion **3009***a*, each bent portion **3009** will preferentially bend during the application of the biasing action in various embodiments.

(234) FIG. **11**E is similar to the plan view of FIG. **11**C in which structure **3002** is in the expanded configuration, but in which rotation actuator **3070** has been operated in a second mode in which the intermediate portion **3009** of each of at least some (i.e., all in FIG. **11**E) of the elongate members **3004** have been rotated about the first axis **3035** in a second rotational direction (e.g., counter-clockwise rotational direction represented by arrow **3096***b*) according to various embodiments. In various embodiments, the second rotational direction represented by arrow **3096***b* is opposite to the first rotational direction represented by arrow **3096***a*. In some of these various embodiments, the second rotational direction represented by arrow **3096***b* is the same as a second rotational directional rotation (e.g., rotational direction represented by arrow **3090***b* or rotational direction component represented by arrow **3094***b*) associated with a movement of a portion of the structure **3002** between the unexpanded configuration and the expanded configuration. In various embodiments, rotation actuator **3070** may be configured to operate in various ways in the second mode. For example in some embodiments, rotation actuator **3070** may be operated to cause the intermediate portion **3009** of each of at least some (i.e., all in FIG. **11**E) of the elongate members **3004** to partially rotate about or around the first axis **3035** in the second rotational direction represented by arrow **3096***b* by causing control member **3070***b* to apply a greater amount of force (e.g., tension-based force) to elongate member **3004***j* than a force (e.g., tension-based force) applied to elongate member **3004***a* by control member **3070***a*. In some embodiments, rotation actuator **3070** is selectively operable in each of the first mode (e.g., represented in FIG. **11**D) and the second mode (e.g., represented in FIG. **11**E). The intermediate portion **3009** of each of at least some or all of the plurality of elongate members **3004** may be controlled to at least partially rotate about or around the first axis **3035** by other angular amounts than those depicted in FIGS. **11**D and **11**E in other embodiments.

(235) Referring back to embodiments represented in FIGS. **7**, each front surface **2618***a* includes, carries or supports (i.e., directly or indirectly) at least one transducer element **2690** (i.e., not shown) that is positionable adjacent to an interior tissue surface in when the first fanned array **2670** is manipulated into the second fanned array **2672** within a bodily cavity having the interior tissue surface. In these example embodiments, once the second fanned array **2672** has been appropriately positioned at a given location within a bodily cavity, determination of the locations of various components of device **2600** (e.g., transducer elements including sensors or electrodes or related support structures such as elongate members **2604**), or the locations of various anatomical features within the bodily cavity can be determined by various methods. In these example embodiments, after the portion of the device **2600** has been appropriately positioned at a given location within a bodily cavity, ablation of various regions of a tissue surface within bodily cavity can commence. The second fanned array **2672** may be removed from the bodily cavity by reconfiguring the portion

of the device **2600** back into the second/bent configuration and then further back into the first/unexpanded configuration. In this example embodiment, the wedged or tapered form of the fanned first portions **2609***a* of the elongate members **2604** allows the elongate members **2604** to be readily drawn into a lumen of catheter sheath **2606** facilitating movement from the deployed configuration to the delivery configuration.

(236) FIG. **8** is a flow diagram representing a method **2700** for forming, fabricating or manufacturing various elongate members employed in various embodiments. For convenience, the various procedures or acts described in method **2700** are made with reference to the elongate members **2604** shown in FIGS. **7**A through **7**M. It is understood that method **2700** may be applied to produce other elongate members employed in other embodiments.

(237) Method **2700** begins with block **2702** in which a plurality of elongate members are provided. For example, FIG. **7**G includes a respective plan view of each of various elongate members including elongate members **2604***a*.sub.int, **2604***b*.sub.int, **2604***C*.sub.int, **2604***d*.sub.int, **2604***e*.sub.int, **2604***f*.sub.int, and **2604***g*.sub.int (collectively **2604**.sub.int) that are provided to form at least a portion of respective ones of the elongate members **2604** employed by the example embodiment shown in FIG. **7**A. In this example embodiment, provided elongate member **2604***a*.sub.int corresponds to elongate member **2604***a*, provided elongate member **2604***b*.sub.int corresponds to elongate member **2604***b*, provided elongate member **2604***C*.sub.int corresponds to elongate member **2604***c*, provided elongate member **2604***d*.sub.int corresponds to elongate member **2604***d*, provided elongate member **2604***e*.sub.int corresponds to elongate member **2604***e*, provided elongate member **2604***f*.sub.int corresponds to elongate member **2604***f*, and provided elongate member **2604***g*.sub.int corresponds to elongate member **2604***g*. As shown in FIG. **7**G, the respective proximal end **2607**, the respective distal end **2605**, the respective length **2611**, and the respective front surface **2618***a* of each one of elongate members **2604***a*, **2604***b*, **2604***c*, **2604***d*, **2604***e*, **2604***f*, and **2604***g* is also represented in a respective one of provided elongate members **2604***a*.sub.int, **2604***b*.sub.int, **2604***c*.sub.int, **2604***d*.sub.int, **2604***e*.sub.int, **2604***f*.sub.int, and **2604***g*.sub.int. Accordingly, the same reference numbers have been employed.

(238) In this example embodiment, each of the elongate members **2604**.sub.int is provided in a strip-like form. In some embodiments, each elongate member **2604**.sub.int is provided in a generally planar form or with material or geometric properties that allow the elongate member **2604**.sub.int to be deformed into assuming a generally planar or flat form under the influence of modest forces. Without limitation, various ones of the provided elongate members **2604**.sub.int may include various metallic compositions, non-metallic compositions or combinations thereof. In some embodiments, the provided elongate members **2604**.sub.int may include a shape memory material, for instance Nitinol. The incorporation of a specific material into various ones of the elongate members **2604**.sub.int may be motivated by various factors. In this example embodiment, various portions of each provided elongate member **2604**.sub.int include material properties and geometric dimensions suitable for undergoing a distortion or deformation process employed by method **2700**. By way of non-limiting example, the distortion or deformation process can include a plastic deformation process. By way of non-limiting example, the distortion or deformation process can include a non-reversible distortion or deformation process in which a given one of the provided elongate members **2604**.sub.int that is distorted or deformed by the application of force does not generally return back to its original shape upon removal of the applied force. In this example embodiment, each provided elongate member **2604**.sub.int includes material properties and geometric dimensions that have been pre-selected to allow for a subsequent manipulation (e.g., during an actual use of device **2600**) of the respective elongate member **2604** that is formed at least in part, from the provided elongate member **2604**.sub.int. Manipulation of various portions **2609** of each resulting elongate member **2604** can include bending, flexing, twisting and combinations thereof by way of non-limiting example. Manipulation of various portions **2609** of each resulting elongate member **2604** can include relatively few manipulations or a relatively large number of

manipulations. In some example embodiments, various ones of the provided elongate members **2604**.sub.int are made from a material whose material properties and geometric dimensions have been preselected so that the resulting elongate members **2604** can withstand cyclic manipulation. In some example embodiments, various ones of the provided elongate members **2604**.sub.int are made from a material having material properties and geometric dimensions that have been preselected such that the resulting elongate members **2604** can withstand anticipated conditions that can lead to possible fatigue failure. The present inventors have employed methods similar to method **2700** that employ provided elongate members **2604**.sub.int made from stainless steel (e.g., 17-7 SS) and having maximum cross-sectional dimensions of 0.127 millimeters by 4 millimeters by way of non-limiting example.

(239) In this example embodiment, each provided elongate member **2604**.sub.int includes a plurality of different portions **2609**.sub.int including first portion **2609***a*.sub.int, second portion **2609***b*.sub.int and a third portion **2609***C*.sub.int positioned between the first and the second portions **2609***a*.sub.int and **2609***b*.sub.int. Each of the various portions **2609**.sub.int corresponds to one of the various portions **2609** of elongate member **2604** that results from processing of the provided elongate member **2604**.sub.int under various processes undertaken in accordance with method **2700**. Accordingly, the respective side edges of each of the portion **2609**.sub.int are identified by the same part numbers of the side edges **2620** of the corresponding portions **2609**. In some embodiments, at least one of the first portion **2609***a*.sub.int, second portion **2609***b*.sub.int and a third portion **2609***C*.sub.int of a provided elongate member **2604**.sub.int may undergo one or more processes to transform the at least one of the first portion **2609***a*.sub.int, second portion **2609***b*.sub.int and third portion **2609***C*.sub.int into a corresponding one of one of the first portion **2609***a*, second portion **2609***b* and third portion **2609***c* of the elongate member **2604** produced by method **2700**. It is noted that in some embodiments, not all of the various portions **2609**.sub.int including first portion **2609***a*.sub.int, second portion **2609***b*.sub.int and third portion **2609***C*.sub.int of a provided elongate member **2604**.sub.int may undergo a process as specified by method **2700** and may be provided substantially unaltered or undergo an alternate process to form the final elongate member **2604**.

(240) In this example embodiment, the respective second portion **2609***b*.sub.int of each provided elongate member **2604**.sub.int of at least some of the plurality of provided elongate members **2604**.sub.int (e.g., provided elongate members **2604***a*.sub.int, **2604***b*.sub.int, **2604***c*.sub.int, **2604***e*.sub.int, **2604***f*.sub.int, and **2604***g*.sub.int) is laterally offset from the respective first portion **2609***a*.sub.int of the provided elongate member **2604**.sub.int across at least a portion of the respective length **2611** of the provided elongate member **2604**.sub.int. In this example embodiment, a center line or midline **2612***b* of the respective second portion **2609***b*.sub.int of each provided elongate member **2604**.sub.int of at least some of the plurality of provided elongate members **2604**.sub.int (e.g., elongate members **2604***a*.sub.int, **2604***b*.sub.int, **2604***c*.sub.int, **2604***e*.sub.int, **2604***f*.sub.int, and **2604***g*.sub.int is laterally offset from a center line or midline **2612***a* of the respective first portion **2609***a*.sub.int of the provided elongate member **2604**.sub.int across at least a portion of the respective length **2611** of the provided elongate member **2604**.sub.int. In some example embodiments, various ones of the midlines **2612***a* and **2612***b* form a line of symmetry of a respective one of the portions **2609**.sub.int. In some example embodiments, various ones of the midlines **2612** extend across a centroid of a respective one of the portions **2609**.sub.int. In this example embodiment, the respective pair of side edges **2620** of each of the first portion **2609***a*.sub.int and second portion **2609***b*.sub.int of each provided elongate member **2604**.sub.int includes a respective first side edge **2620***a* (only one called out for each provided elongate member **2604**.sub.int) arranged on a first side of the provided elongate member **2604**.sub.int and a respective second side edge **2620***b* (only one called out for each provided elongate member **2604**.sub.int) arranged on a second side of the provided elongate member **2604**.sub.int. In various example embodiments, at least one of the first side edge **2620***a* and the second sided edge **2620***b* of

the respective second portion **2609***b*.sub.int of at least one of the provided elongate members **2604**.sub.int (i.e., both of the first and the second side edges **2620***a*, **2620***b* in this illustrated embodiment) is laterally offset from the corresponding one of the first side edge **2620***a* and the second sided edge **2620***b* of the respective first portion **2609***a*.sub.int of the at least one of the provided elongate members **2604**.sub.int across at least a portion of the respective length **2611** of the at least one of the provided elongate members **2604**.sub.int.

(241) In this example embodiment, various ones of the provided elongate members **2604**.sub.int have different amounts of lateral offset between their respective second and first portions **2609***b*.sub.int, **2609***a*.sub.int. For example, the respective second portion **2609***b*.sub.int of provided elongate member **2604***a*.sub.int is laterally offset from the respective first portion **2609***a*.sub.int of provided elongate member **2604***a*.sub.int by a first distance **2623***a* over a portion of the respective length **2611** of provided elongate member **2604***a*.sub.int. The respective second portion **2609***b*.sub.int of provided elongate member **2604***b*.sub.int is laterally offset from the respective first portion **2609***a*.sub.int of provided elongate member **2604***b*.sub.int by a second distance **2623***b* over a portion of the respective length **2611** of provided elongate member **2604***b*.sub.int. In this example embodiment, the second distance **2623***b* is different than the first distance **2623***a*. In this example embodiment, the second distance **2623***b* is less than the first distance **2623***a*. In this example embodiment, the amount of lateral offset between their respective second and first portions **2609***b*.sub.int, **2609***a*.sub.int of the various provided elongate members **2604**.sub.int arranged as shown in FIG. **7**G reduces from top-to-middle and from middle-to-top in the illustrated arrangement. In this example embodiment, the respective second portion **2609***b*.sub.int of each of provided elongate members **2604***C*.sub.int and **2604***e*.sub.int has relatively little lateral offset from the respective first portion **2609***a*.sub.int of each of provided elongate members **2604***C*.sub.int and **2604***e*.sub.int. In this example embodiment, the respective second portion **2609***b*.sub.int of each of provided elongate members **2604***a*.sub.int and **2604***g*.sub.int has the greatest amount of lateral offset from the respective first portion **2609***a*.sub.int of each of the provided elongate members **2604***a*.sub.int and **2604***g*.sub.int. In this example embodiment, the respective second portion **2609***b*.sub.int of provided elongate member **2604***d*.sub.int is not laterally offset from the respective first portion **2609***a*.sub.int of provided elongate member **2604***d*.sub.int. Rather, the respective first, second and third portions **2609***a*.sub.int, **2609***b*.sub.int, and **2609***C*.sub.int of provided elongate member **2604***d*.sub.int are all aligned along a substantially straight path.

(242) As best seen in FIG. **7**G, at least one of the provided elongate members **2604**.sub.int includes at least one corner **2630***a* (only one called out as shown in provided elongate member **2604***a*.sub.int) formed by a convergence of the respective first side edge **2620***a* of the third portion **2609***C*.sub.int of the at least one of the provided elongate members **2604**.sub.int and the respective first side edge **2620***a* of the second portion **2609***b*.sub.int of the at least one of the provided elongate members **2604**.sub.int, the at least one corner **2630***a* enclosing a respective angle "a" extending across the front surface **2618***a* of the at least one of the provided elongate members **2604**.sub.int. In this example embodiment, the enclosed angle α extends towards at least part of the respective second side edge **2620***b* of at least one of the portions **2609**.sub.int of the at least one of the provided elongate members **2604**.sub.int. In this example embodiment, at least one of the provided elongate members **2604**.sub.int includes at least one corner **2630***b* (only one called out as shown in provided elongate member **2604***a*.sub.int) formed by a convergence of the respective second side edge **2620***b* of the third portion **2609***c*.sub.int of the at least one of the provided elongate members **2604**.sub.int and the respective second side edge **2620***b* of the first portion **2609***a*.sub.int of the at least one of the provided elongate members **2604**.sub.int. In this example embodiment at least one corner **2630***b* encloses an angle "B" extending across the front surface **2620***a* of the provided at least one of the provided elongate members **2604**.sub.int. In this example embodiment, each respective enclosed angle β extends towards the respective first side edge **2620***a* of at least one of the portions **2609**.sub.int of the at least one of the provided elongate members

2604.sub.int. In this example embodiment each of corners **2630***a*, **2630***b* encloses an obtuse angle. It is understood that other angles may be enclosed by various ones of corners **2630***a*, **2630***b* in other example embodiments. In this example embodiment, each of corners **2630***a* and **2630***b* is a filleted corner. Other shapes or forms may be employed by various ones of the corners **2630***a* and **2630***b* in other example embodiments.

(243) In some embodiments, various flexible circuit structures are employed to provide at least a signal path between a plurality of transducers employed by a medical device and a transducer controller. In some example embodiments, at least some of the transducer elements are used to sense a physical characteristic of a fluid (i.e., blood) or tissue, or both, that may be used to determine a position or orientation (i.e., pose), or both, of a portion of a device in a bodily cavity (e.g., a left atrium). For example, some transducer elements may be used to determine a location of pulmonary vein ostia or a mitral valve in a left atrium. In some example embodiments, at least some of the transducer elements may be used to selectively ablate portions of a tissue surface within a bodily cavity. For example, some of the transducer elements may be used to ablate a pattern around various bodily openings, ports or pulmonary vein ostia, for instance to reduce or eliminate the occurrence of atrial fibrillation. In various embodiments, transducer elements can include at least one of an electrode and a sensing element. In various embodiments, at least some of the transducer elements are provided on, or by various ones of the flexible circuit structures. The flexible circuit structures the may be mounted or otherwise carried on a frame, or may form an integral component of the frame itself. The frame may be flexible enough to slide within a catheter sheath in order to be deployed percutaneously. FIGS. **1**, **2**, **3**, **4**, **5**, **6**, **7** and **9** discussed previously show various example embodiments of such a frame.

(244) In various example embodiments, the flexible circuit structures form part of a framed structure that is selectively movable between an unexpanded configuration in which respective portions of each of the flexible circuit structures are arranged successively along a first direction in a stacked arrangement sized to be percutaneously delivered through a bodily opening leading to a bodily cavity, and an expanded or fanned configuration in which the respective portions of the flexible circuit structures are angularly spaced with respect to one another about at least one axis. In some of these embodiments, each of the respective portions of at least some of the flexible printed circuit structures revolve, rotate, pivot or turn (used interchangeably herein) about at least one axis when the structure is moved between the unexpanded configuration and the expanded configuration.

(245) In block **2706**, a plurality of flexible circuit structures **2680** are provided and a portion of each of the flexible circuit structures **2680** is secured to a respective one of the plurality of provided elongate members **2604**.sub.int. In this example embodiment, each flexible circuit structure **2680** is a flexible printed circuit board (PCB) structure. FIG. **7**H is an isometric view of a representative one of the flexible circuit structures **2680**. Each flexible circuit structure **2680** includes at least one flexible material layer **2682**. In this example embodiment, each at least one flexible material layer **2682** includes an electrical insulator layer (e.g., polyimide). In a manner similar to each of the provided elongate members **2604**.sub.int, the at least one material layer **2682** includes a first end **2687**, a second end **2685**, a respective length **2681** between the first and the second ends, **2687**, **2685**, a thickness **2683** and a front surface **2684***a* and a back surface **2684***b* opposite across the thickness **2683**. The at least one flexible material layer **2682** further includes a plurality of portions **2689** including a first portion **2689***a*, a second portion **2689***b* and a third portion **2689***c* positioned between the first and the second portions **2689***a*, **2689***b*. In this example embodiment, the second portion **2689***b* is laterally offset from the first portion **2689***a* along at least a portion of the respective length **2681** of the at least one material layer **2682**. In this example embodiment, each of the plurality of portions **2689** includes a respective pair of side edges **2686** including a first side edge **2686***a* (only one called out) arranged on a first side of the at least one material layer **2682** and a second side edge **2686***b* (only one called out) arranged on second opposite side of the at least one

material layer **2682**. Each of the pair of side edges **2686** forms a portion of a periphery of at least one of the front surface and the back surface **2684***a* and **2684***b* of the at least one material layer **2682**. In this example embodiment, a portion of the periphery of at least one of the front surface and the back surface **2684***a*, **2684***b* of the at least one material layer **2682** is similar in shape to the periphery of at least one of the front surface and the back surface **2618***a*, **2618***b* of the provided elongate member **2604**.sub.int to which the flexible circuit structure **2680** is to be secured. In this example embodiment, each of the second and the third portions **2689***b*, **2689***c* of the at least one material layer **2682** have a size and shape substantially similar to the second and the third portions **2609***b*, **2609***c* of the provided elongate member **2604**.sub.int to which the flexible circuit structure **2680** is to be secured. In this example embodiment, the first portion **2689***a* of the at least one material layer **2682** is longer than the first portion **2609***a* of the provided elongate member **2604**.sub.int to which the flexible circuit structure **2680** is to be secured. In other example embodiments, the at least one material layer **2682** may have different shapes and/or sizes than those illustrated. In this example embodiment, the lateral offset between the respective second and first portions **2689***b*, **2689***a* of each of the plurality of flexible circuit structures **2680** is generally similar to the lateral offset between the respective second and first portions **2609***b*.sub.int, **2609***a*.sub.int of a respective one of the provided elongate members **2604**.sub.int to which the flexible circuit structure **2680** is to be secured.

(246) Transducer elements (e.g., electrodes or sensors, or both) may be built on the flexible circuit structure **2680** using conventional printed circuit board processes. In this example embodiment, each of the flexible circuit structures **2680** includes at least one electrically conductive layer **2692**. In this example embodiment, the at least one electrically conductive layer **2692** is patterned to provide a portion of each of a set of transducer elements **2690** (two called out) and at least one electrically conductive trace **2694** on, at or carried by (i.e., directly or indirectly) a surface of the at least one material layer **2682**. In this example embodiment, the at least one electrically conductive trace **2694** is electrically connected to various ones of the transducer elements **2690** (i.e., only one in this illustrated embodiment). It is understood that other electrical traces, each connected to one or more of the plurality of transducer elements **2690** can be present in various embodiments. In this example embodiment, the at least one electrically conductive trace **2694** extends on the front surface **2684***a* of the at least one material layer **2682** along a path across parts of each of the first portion **2689***a*, the third portion **2689***c* and the second portion **2689***b* of the at least one material layer **2682**. In this example embodiment, the at least one electrically conductive trace **2694** includes various jogged portions **2694***a* (one called out) as viewed perpendicularly to a portion of the front surface **2684***a* of the at least one material layer **2682** located at least proximate to a location on the front surface **2684***a* where the path extends across the third portion **2689***c* of the at least one material layer **2682**. In this example embodiment, the jogged portions **2694***a* are formed by a patterning process. In this example embodiment, the jogged portions **2694***a* are formed by employing flexible circuit patterning techniques. In other example embodiments, other techniques may be employed to form a jogged portion **2694***a* in the at least one electrically conductive trace **2694**. By way of non-limiting example, other techniques can include manipulation of the at least one material layer **2682** before, during or after the formation of the at least one electrically conductive trace **2694**.

(247) Each of the flexible circuit structures **2680** can be secured to a respective one of the provided plurality of elongate members **2604**.sub.int by various techniques. For example, in some embodiments, fasteners or fastening devices are employed. In some example embodiments, a flexible circuit structure **2680** is bonded to a respective one of the provided plurality of elongate members **2604**.sub.int with an adhesive. The present inventors have created various assemblages by bonding polyimide and 17-7 stainless steel layers using LOCTITE® 4081 or LOCTITE® 435 medical device adhesives. Various factors such as, but not limited to, sterilization considerations, particulate generation, fastening reliability, etcetera can motivate the selection of a particular

securement technique.

(248) In block **2704**, at least one of the provided elongate members **2604**.sub.int undergoes a first distortion or deformation process. In this particular embodiment, at least one of the provided elongate members **2604**.sub.int is distorted or deformed prior to the securing of a flexible circuit structure **2680** to the at least one of the provided elongate members **2604**.sub.int in block **2706**. The at least one of the provided elongate members **2604**.sub.int may be distorted or deformed in various ways. In this example embodiment, the respective second portion **2609***b* of each of the provided elongate members **2604**.sub.int is distorted or deformed to provide a coiled, scrolled or volute profile as shown in FIG. **7**I. Each respective second portion **2609***b*.sub.int of the provided elongate members **2604**.sub.int can be distorted or deformed using various bending or coiling mechanisms known in the art. For example, a particular second portion **2609***b*.sub.int may be run through a series of rolls arranged to impart a desired profile onto the particular second portion **2609***b*.sub.int, especially when the desired profile is a coiled profile.

(249) FIG. **7**J shows a portion of a flexible circuit structure **2680** that has been secured to the provided elongate member **2604**.sub.int of FIG. **7**I that has been distorted or deformed in accordance with block **2704**. In this example embodiment, a portion of the flexible circuit structure **2680** has been bonded to the provided elongate member **2604**.sub.int. In this example embodiment, a portion of the assemblage of the provided elongate member **2604**.sub.int and flexible circuit structure **2680** provides the second portion **2609***b* generally with the desired coiled, scrolled or volute profile comprised by a respective one of the resulting elongate members **2604** shown in FIG. **7**A. It is noted that when compared with the coiled profile of the provided elongate member **2604**.sub.int shown in FIG. **7**I, the assemblage of the provided elongate member **2604**.sub.int and flexible circuit structure **2680** shown FIG. **7**J has a larger coiled profile. The process of distorting or deforming the provided elongate member **2604**.sub.int can impart significant stress on the elongate member **2604**.sub.int, sometimes deforming the elongate member **2604**.sub.int well beyond a yield point of the elongate member **2604**.sub.int-Various factors may require that the coiled profile that is imparted to the provided elongate member **2604**.sub.int as per block **2704** be made relatively smaller than the coiled profile that the provided elongate member **2604**.sub.int has after the portion of the flexible circuit structure **2680** has been secured to the provided elongate member **2604**.sub.int as shown in FIG. **7**J. For example, various material properties of the provided elongate member **2604**.sub.int may have a bearing. The particular material properties of the provided elongate member **2604**.sub.int can impart a certain amount of “spring-back” to the provided elongate member **2604**.sub.int. Soft materials typically have limited spring-back whereas relatively harder materials (e.g., metals employed in medical devices such as stainless steel, Nitinol) can have a substantially more spring-back. If a provided elongate member **2604**.sub.int that included a material having a relatively high spring-back were to be distorted or deformed after the flexible circuit structure **2680** was bonded to the provided elongate member **2604**.sub.int, the small coiled profile (i.e., similar to that shown in FIG. **7**I) that would be required to be imparted on the provided elongate member **2604**.sub.int/flexible circuit structure **2680** assemblage to account for the spring-back so as to form the coiled profile shown in FIG. **7**J may impart substantially higher stress and strain rates on various features of the flexible circuit structure **2680** (e.g., the at least one electrically conductive trace **2694**) than if the provided elongate member **2604**.sub.int was distorted or deformed prior to the bonding of the at least one flexible circuit structure **2680** to the provided elongate member **2604**.sub.int as per block **2706**. These higher stress and strain rates may increase the risk of failures of various elements of the flexible circuit structure **2680** such as the at least one electrically conductive trace **2694** and thereby result in a less robust and reliable device. Further, these resulting higher stress and strain rates may increase the chances of bonding failures when an adhesive is employed to secure a portion of the flexible circuit structure **2680** to the provided elongate member **2604**.sub.int prior to distortion or deformation of the provided elongate member **2604**.sub.int. Another possible reason for pre-distorting or pre-deforming the provided

elongate member **2604**.sub.int prior to the securement of the flexible circuit structure **2680** is to provide a more uniform coiled profile. In some example embodiments, the stiffness of the flexible circuit structure **2680** may not be consistent along its respective length. For example, regions of the flexible circuit structure **2680** comprising transducer elements **2690** (only one called out in FIG. **7**J) may be stiffer than other regions of the flexible circuit structure **2680** that do not include transducer elements **2690**. Coiling the provided elongate element **2604**.sub.int after flexible circuit structure **2680** has been secured to the provided elongate element **2604**.sub.int may result in an undesired "step-bent" profile along the length of the assemblage.

(250) In block **2708**, at least one of the provided elongate members **2604**.sub.int undergoes at least a second distorting or deforming process after the securement of a flexible circuit structure **2680** to the at least one of the provided elongate members **2604**.sub.int. FIG. **7**K shows the provided elongate member **2604**.sub.int/flexible circuit structure **2680** assemblage of FIG. **7**J additionally processed as per block **2708**. In this example embodiment, the respective third portion **2609***C*.sub.int of each of various ones of the provided elongate members **2604**.sub.int is distorted or deformed to rotationally offset the respective second portion **2609***b*.sub.int of the respective provided elongate member **2604**.sub.int from the respective first portion **2609***a*.sub.int of the respective provided elongate member **2604**.sub.int along the respective length **2611** (not called out) of the provided elongate member **2604**.sub.int. In this example embodiment, the respective third portion **2689***c* of the flexible printed circuit **2680** is also distorted or deformed to rotationally offset the second portion **2689***b* from the first portion **2689***a* of the flexible printed circuit **2680**. In various example embodiments, a distortion or deformation of a particular portion of a provided elongate member **2604**.sub.int as per block **2708** can also result in a corresponding distortion or deformation to a portion of an associated one of the provided flexible circuit structures **2680**.

(251) In this example embodiment, distorting or deforming the respective third portion **2604***C*.sub.int of the provided elongate member **2604**.sub.int to rotationally offset the respective second portion **2609***b*.sub.int from the respective first portion **2609***a*.sub.int along the respective length **2611** of the provided elongate member **2604**.sub.int causes the respective third portion **2609***C*.sub.int of the provided elongate member **2604**.sub.int to have a twisted shape. The twisted shape can be imparted using various methods. In some example embodiments, a stamping or coining operation can be employed to impart the twisted shape onto the third portion **2609***C*.sub.int of the provided elongate member **2604**.sub.int. It is noted that care may need to be taken to not damage components such as the flexible printed circuit structure **2680** during the distorting or deforming. In this example embodiment, distorting or deforming the respective third portion **2604***c*.sub.int of the provided elongate member **2604**.sub.int to rotationally offset the respective second portion **2609***b*.sub.int from the respective first portion **2609***a*.sub.int along the respective length **2611** of the provided elongate member **2604**.sub.int includes twisting the respective third portion **2609***C*.sub.int of the provided elongate member **2604**.sub.int about a respective twist axis **2633** extending across at least part of the respective third portion **2609***C*.sub.int. In this example embodiment, the third portion **2689***c* of the at least one material layer **2682** of the flexible circuit structure **2680** also has a twisted shape. The twisted shape of the at least one third portion **2689***c* of the flexible circuit structure **2680** provides a relatively smooth and gradual transition for the at least one electrically conductive trace **2694** to follow along a path extending across the third portion **2689***c* between the first and the second portions **2689***a*, **2689***b* of the at least one material layer **2682**. In some example embodiments, the jogged portion **2694***a* of the at least one electrically conductive trace **2694** is visible when viewed normally to a portion of the front surface **2684***a* of the at least one material layer **2682** located at least proximate to a location on the front surface **2684***a* of the at least one material layer **2682** where the path extends across the third portion **2689***c*.

(252) In some example embodiments, the twist in the third portion **2609***c*.sub.int of a provided elongate member **2604**.sub.int can be arranged to cause the second portion **2609***b*.sub.int of the provided elongate member **2604**.sub.int to assume a skewed orientation with respect to the first

portion **2609**_b_.sub.int of the provided elongate member **2604**.sub.int similar to that exemplified by the representative elongate member **2604** shown in FIG. **7**B. In some example embodiments, additional or alternate distortions or deformations can also be made to various ones of the provided elongate members **2604**.sub.int. For example, as shown in FIG. **7**K, the respective first portion **2609**_a_.sub.int of the provided elongate member **2604**.sub.int (i.e., including the respective first portion **2689**_a_ of the secured flexible circuit structure **2680**) is bent about a respective bending axis **2631** to cause the second portion **2609**_b_.sub.int of the provided elongate member **2604**.sub.int to assume at least in part, a required fanned orientation as exemplified by the representative elongate member **2604** shown in FIG. **7**B.

(253) In this example embodiment, each respective bending axis **2631** has a skewed orientation with respect to the respective side edges **2620** of the first portion **2609**_a_.sub.int of the provided elongate member **2604**.sub.int. Each respective bending axis **2631** is skewed to cause at least the respective second portions **2609**_b_ of the resulting elongate members **2604** to fan about the one or more fanning axes **2635** which is/are in turn, oriented to intersect the second portions **2609**_b_ of the resulting elongate members **2604** at locations at least proximate to at least some of the number of crossing locations when various ones of the resulting elongate members **2604** are fanned in a manner similar to that shown in FIG. **7**E. If the respective bending axes **2631** were not so oriented, additional forces could be required to distort or deform at least a portion of the stacked elongate members **2604** to accommodate possible fanning misalignment. In such a case, some of the elongate members **2604** may be required to undergo additional bending, twisting or combined bending and twisting to correct for misalignment and produce the desired fanned arrangement. The amount of skew of each bending axis **2631** is typically dependent on the various geometric factors including, but not limited to, the relative lengths of various ones of the portions **2609** of each of the elongate members. The present inventors have produced elongate members **2604** whose first portions **2609**_a_ are bent about a respective bending axis **2631** skewed by approximately 22 degrees in some example embodiments.

(254) The assemblage of the provided elongate member **2604**.sub.int/flexible circuit structure **2680** shown in FIG. **7**K may be processed into an elongate member **2604** as represented in FIG. **7**B. In block **2710**, various ones of the provided elongate member **2604**.sub.int/flexible circuit structure **2680** assemblages are arranged into an arrangement similar to that shown in FIG. **7**A.

(255) In this example embodiment, the twisted shape of the third portion **2609**_c_ of each elongate member **2604** arranged in the initial configuration shown in FIG. **7**A advantageously allows various transducer elements **2690** (not shown in FIG. **7**A) positioned on respective front faces **2618**_a_ of the elongate members **2604** to be appropriately oriented to face an interior tissue surface within a bodily cavity (not shown) when the portion of device **2600** is moved into the third/expanded configuration (i.e., FIGS. **7**E and **7**F). In this example embodiment, the twisted shape of the third portion **2609**_c_ of each elongate member **2604** arranged in the initial configuration shown in FIG. **7**A advantageously orients the respective first portions **2609**_a_ of the elongate members **2604** to act as flexures which allow the respective second portions **2609**_b_ of the elongate members **2604** to fan and distribute the transducer elements **2690** across an interior tissue surface when the portion of device **2600** is moved into the third/expanded configuration (i.e., FIGS. **7**E and **7**F) within a bodily cavity having the interior tissue surface. The bent first portions **2609**_a_ further advantageously allow for some degree of autonomous fanning capability and may possibly reduce the need for additional fanning mechanisms or the complexity thereof. In this example embodiment, the twisted shape of the third portion **2609**_c_ of each elongate member **2604** arranged in the initial configuration shown in FIG. **7**A advantageously allows at least one electrically conductive trace **2694** (not shown in FIG. **7**A) to extend along a path having a relatively smooth and gradual transition between the first and the second portions **2609**_a_, **2609**_b_ of the elongate member **2604** while reducing potentially harmful bending stresses acting on the at least one electrically conductive trace **2694** during the fanning of the elongate member **2604**.

(256) In some example embodiments, each of the third portions **2609***c* has a twisted form sufficient to rotationally offset the respective second portion **2609***b* from the respective first portion **2609***a* by a same angular amount for each of the plurality of the provided elongate members **2604**. In other example embodiments, different ones of the elongate members **2604** employ different rotational offsets along their respective lengths **2611**. The use of different rotational offsets may be motivated by various factors. For example, when skewed bending axes **2631** are employed to cause the fanning of the various portions **2609** as described above, bending about the skewed bending axes **2631** can also impart a twist during the fanning. The twisted form of the respective third portion **2609***c* can be adjusted to compensate for the additional twist that arises during fanning. In some example embodiments, the amount of additional twist typically varies based at least on the position of the elongate member **2604** in the arrayed arrangement of elongate members **2604**. In this example embodiment, a first set of elongate members **2604***a*, **2604***b*, and **2604***c* is fanned along an opposite direction from a second set of elongate members **2604***e*, **2604***f* and **2604***g*. However, since the rotational offsets between the respective first and second portions **2609***a*, **2609***b* of each elongate member **2604** are along the same direction (i.e., each third portion **2609***c* is twisted in a same direction), the additional twist created by the bending about the respective skewed bending axes **2631** will decrease the rotational offset of the elongate members **2604** in one of the first set and the second set while increasing the rotational offset of the elongate members **2604** in the other of the first and second set during the fanning. The present inventors have created arrangements of elongate members **2604** with rotational offsets between the respective first and the second portions **2609***a*, **2609***b* varying from approximately 90 degrees to 70 degrees to compensate for an additional increase or decrease in the rotational offset of each elongate member **2604** that results from bending about the respective skewed bending axes **2631** during fanning.
(257) In this example embodiment, the respective first and second portions **2609***a*, **2609***b* of the elongate members **2604** are arranged in the delivery configuration illustrated in FIG. **7**C by arranging respective first portions **2609***a* of the elongate members **2604** front face **2618***a*-toward-back face **2618***b* along a first direction (i.e., arrow **2616***a*) in a first stacked array **2615***a* and arranging the respective second portions **2604***b* of the elongate members **2604** front surface **2618***a*-toward-back surface **2618***b* along a second direction (i.e., arrow **2616***b*) in a second array **2615***b*. The spatially efficient stacked arrays **2615***a*, **2615***b* advantageously allow for catheter sheaths **2606** of reduced size to be employed while the non-parallel first and second directions (i.e., arrows **2616***a*, **2616***b*) of the stacked array allow for various benefits including those described above. Ideally, the twisted third portions **2609***c* of the elongate members should also be efficiently arrayed, stacked or nested so as to not negate the spatial efficiency advantages provided by each of the first and the second stacked arrays **2615***a*, **2615***b*.
(258) FIG. **7**L is a side elevation view of an arrangement of stacked elongate members **2604** (i.e., in a configuration similar to the delivery configuration shown in FIG. **7**C) in which the third portions **2609***c* (only one called out) of each elongate member **2604** is twisted to allow the third portions **2609***c* to be nested in a stacked arrangement with substantially similar overall cross-sectional stack dimensions as those of the first stacked array **2615***a* and the second stacked array **2615***b*. A cross-sectional view A-A of the stacked elongate members **2604** of FIG. **7**L through first stacked array **2615***a* is provided by FIG. **7**L (A-A). A cross-sectional view B-B of the stacked elongate members **2604** of FIG. **7**L through the twisted third portions **2609***c* is provided by FIG. **7**L (B-B). A cross-sectional view C-C of the stacked elongate members **2604** of FIG. **7**L through second stacked array **2615***b* is provided by FIG. **7**L (C-C). In this example embodiment, second portions **2609***b* (only one called out in FIG. **7**L (C-C) are rotationally offset by less than 90 degrees from their respective first portions **2609***a* (only one called out in FIG. **7**L (A-A). A comparison of each of FIGS. **7**L (A-A), **7**L (B-B), and **7**L (C-C) shows that a reference circle **2625** representing a catheter sheath **2606** dimension sized to just enclose each of the first and second stacked arrays **2615***a*, **2615***b* also advantageously encloses the twisted portions **2609***c*. Each of the elongate members **2604** are shown

spaced from one another in each of FIGS. **7**L (A-A), **7**L (B-B), and **7**L (C-C) for clarity. Ideally, reduced spacings are desired to accommodate the smallest sized catheter sheath possible.
(259) FIG. **7**M provides respective side and end elevation views of each of the elongate members **2604** shown in FIG. **7**L but separated from one another for clarity. Each of the first portions **2609***a* (only one called out) and the second portions **2609***b* (only one called out) is additionally shown unbent for clarity. Center **2625***a* is provided in the end view of each elongate member **2604** to reference a position of each of the elongate members **2604** when stacked as per FIG. **7**L. The respective end views in FIG. **7**M show that the respective first and second portions **2609***a*, **2609***b* of each elongate member **2604** require a different positioning with respect to center **2625***a* based on the required position of the elongate member **2604** in the arrayed arrangement shown in FIG. **7**L. Accordingly, the twisted form of the third portion **2609***c* (only one called out) of each elongate member **2604** will also vary based on the required position of the elongate member **2604** in the arrayed arrangement shown in FIG. **7**L. In this example embodiment, each elongate member **2604** of at least some of the elongate members **2604** (i.e., elongate members **2604***a*, **2604***b*, **2604***c*, **2604***e*, **2604***f* and **2604***g*) has a form that in the absence of the twist in the respective third portion **2609***c* of the elongate member **2604**, the plurality of portions **2609** of the elongate member **2604** are arranged such that the second portion **2609***b* of the elongate member **2604** is laterally offset from the first portion **2609***a* of the elongate member **2604** across at least a portion of the respective length **2611** of the elongate member **2604**. This is best visualized in FIG. **7**G, in which the respective second portions **2609***b*.sub.int of various ones of the provided elongate members **2604**.sub.int (i.e., from which the elongate members **2604** are produced from in this example embodiment) are laterally offset from the respective first portions **2609***a*.sub.int of the provided elongate members **2604**.sub.int. In this example embodiment, the amount of lateral offset varies for each provided elongate member **2604**.sub.int based at least on the intended position of the provided elongate member **2604**.sub.int in the arrayed arrangement shown in FIG. **7**L.
(260) Example embodiments in which an inherent lateral offset exists between the respective second and first portions **2609***b*, **2609***a* of various ones of the elongate members **2604** in the absence of the required twist in the respective third portion **2609***c* allow the respective third portions **2609***c* when actually twisted to be stacked into a stacked array suitably sized to fit within catheters sheaths **2606** of reduced size (e.g., with respect to conventional catheter sheaths used for similar procedures) while still properly arranging the respective first and second portions **2609***a*, **2609***b* of the elongate members **2604** into the corresponding first and second stacked arrays **2615***a*, **2615***b* which are also suitably sized to fit in the catheter sheaths **2606** of reduced size. It is additionally noted that significant departures from these twist forms may cause the third portions **2609***c* of the elongate members to not nest well and thereby adversely impact the ability to pass the stacked third portions **2609***c* through catheter sheaths **2606** of reduced size.
(261) In some example embodiments, the twisted third portions **2609***c* of the elongate members **2604** may be efficiently nested in a stacked arrangement with substantially similar overall cross-sectional stack dimensions as those of the first stacked array **2615***a* and the second stacked array **2615***b* while each twisted third portion **2609***c* maintains a cross-sectional shape having dimensions on the same order as those of the cross-sectional shape of respective ones of the first and the second portions **2609***a*, **2609***b*. This may be motivated for different reasons including employing twisted third portions **2609***c* which maintain a required width dimension sufficient to route the electrically conductive traces **2694** or that provided sufficient strength to address strength considerations while still allowing the stacked arrangement of the third portions **2609***c* to fit within catheter sheaths **2606** of reduced size. In some example embodiments, the cross-sectional shape of each twisted third portion **2609***c* remains fairly uniform, but with a different rotational alignment as the length of the twisted third portion **2609***c* is traversed between the rotationally offset first and second portions **2609***a*, **2609***b*. In some embodiments, each of the twisted third portions **2609***c* of the elongate members **2604** includes a substantially similar twist rate (i.e., turns/unit length). In some

embodiments, each of the twisted third portions **2609***c* of the elongate members **2604** is twisted about a respective twist axis **2633**, with each respective twist axis **2633** being substantially parallel to the each of the other respective twist axes **2633**.

(262) In this example embodiment, the provided elongate members **2604**.sub.int are strip-like members that are twisted to form the respective ones of the elongate members **2604**. As shown in FIG. **7**G, in the absence of the twist, the respective third portion **2609***C*.sub.int of each of the provided elongate members **2604**.sub.int has a serpentine or "S" shape whose form varies depending on the geometry of the final stacked arrangement shown in FIG. **7**L and the intended position of the provided elongate member **2604**.sub.int in the arrayed arrangement shown in FIG. **7**L. This serpentine or "S" shape allows for reduced strain during the distortion or deformation that accompanies the twisting of the provided elongate member **2604**.sub.int. If the respective third portion **2609***C*.sub.int of a provided elongate member **2604**.sub.int included a significantly different shape (e.g., a linear strip with no lateral offset between the respective second and first portions **2609***b*.sub.int, **2609***a*.sub.int) and was distorted or deformed to create the required twist shape (i.e., as described above), much higher strains would be imparted onto the provided elongate member **2604**.sub.int as various additional bending components perpendicular to various ones of the surfaces **2618***a*, **2618***b* of third portion **2609***c*.sub.int would be required to produce the required twisted shape. In some cases, the resulting increased strains may be greater than the provided elongate member **2604**.sub.int can tolerate. These distortion or deformation criteria are especially relevant for the provided elongate members **2604**.sub.int (i.e., elongate members **2604***a*.sub.int, **2604***b*.sub.int, **2604***f*.sub.int and **2604***g*.sub.int) that are provided to form the outermost elongate members **2604** in the arrayed arrangement shown in FIG. **7**L since each of these provided elongate members **2604**.sub.int would require the greater amounts of distortion or deformation to form the required twisted shape. In some cases however, the provided elongate members **2604**.sub.int that are provided to form some of the innermost elongate members **2604** in the arrayed arrangement shown in FIG. **7**L (e.g., provided elongate members **2604***c*.sub.int, **2604***d*.sub.int) may be tolerant to increased strains if the shape of the respective third portions **2609***C*.sub.int of these provided elongate members **2604**.sub.int deviated from the serpentine or "S" shape described above since little lateral offset is required between the respective first and second portions **2609***a*.sub.int, **2609***b*.sub.int of these provided elongate members **2604**.sub.int as shown in FIG. **7**G. In some embodiments, some of the innermost elongate members **2604** such as elongate members **2604***c* and **2604***e* may be formed from relatively straight strip-like members with no lateral offset between their respective second and first portions **2609***b*, **2609***a* as appears to be shown by Redmond et al. in U.S. Pat. Nos. 5,245,987 and 5,390,644. It is noted however that the distortion or deformation of provided elongate members **2604**.sub.int not having laterally offset second and first portions **2609***b*.sub.int, **2609***a*.sub.int would not be suitable for the outermost elongate members **2604** in various arrangements such as those shown in FIG. **7**L. It is noted however that the distortion or deformation of provided elongate members **2604**.sub.int not having laterally offset second and first portions **2609***b*.sub.int, **2609***a*.sub.int would not be suitable for the outermost elongate members **2604** in stacked arrangements having relatively large number of elongate members (e.g., more than three) when it is desired to reduce the overall cross-sectional size of the arrangements.

(263) In some example embodiments, method **2700** employs a subset of the blocks described. In some example embodiments, method **2700** may include additional/and or alternate processes. Method **2700** describes various processes that distort or deform a shape of the third portion **2609***C*.sub.int of various ones of the provided elongate members **2604**.sub.int into a desired twisted shape. The twisted shape of the third portions **2609***c* of elongate members **2604** employed in other example embodiments can be formed by other manufacturing processes including, but are not limited to, materials removal processes (e.g., machining), material joining processes (e.g., welding, brazing, bonding), casting or molding processes, or combination thereof. Regardless of the process employed, the resulting elongate members **2604** are characterized in that in the absence of the twist

in their respective third portions **2609***c*, their respective first, second and third portions **2609***a*, **2609***b* and **2609***c* may combine to form a unitary structure in which each respective second portion **2609***b* is not rotationally offset from the respective first portion **2609***a* along the respective length **2611** of the elongate member **2604** but is laterally offset from the first portion **2609***a* along at least a portion of the respective length **2611** of the elongate member **2604**.
(264) While some of the embodiments disclosed above are described with examples of cardiac mapping, the same or similar embodiments may be used for mapping other bodily organs, for example gastric mapping, bladder mapping, arterial mapping and mapping of any lumen or cavity into which the devices of the present invention may be introduced.
(265) While some of the embodiments disclosed above are described with examples of cardiac ablation, the same or similar embodiments may be used for ablating other bodily organs or any lumen or cavity into which the devices of the present invention may be introduced.
(266) As used herein and in the claims, the term “spatial plane” and variations thereof such as “spatial planes” or “plane” may mean an imaginary plane having either zero or infinitesimal thickness.
(267) Subsets or combinations of various embodiments described above can provide further embodiments. The various embodiments described above can be combined to provide further embodiments. U.S. provisional patent application Ser. No. 61/435,213 filed Jan. 21, 2011; U.S. provisional patent application Ser. No. 61/485,987 filed May 13, 2011; U.S. provisional patent application Ser. No. 61/488,639 filed May 20, 2011; U.S. provisional patent application Ser. No. 61/515,141 filed Aug. 4, 2011; International patent application Serial No. PCT/US2012/022061 with International filing date of Jan. 20, 2012; International patent application Serial No. PCT/US2012/022062 with International filing date of Jan. 20, 2012; U.S. Patent Application Publication 2008/0004534 A1; and U.S. Patent Application Publication 2009/0131930 A1, are each incorporated by reference herein, in their entireties. Aspects of the invention can be modified, if necessary, to employ systems, circuits and concepts of the various patents, applications and publications to provide yet further embodiments of the invention.
(268) These and other changes can be made to the invention in light of the above-detailed description. In general, in the following claims, the terms used should not be construed to limit the invention to the specific embodiments disclosed in the specification and the claims, but should be construed to include all medical treatment devices in accordance with the claims. Accordingly, the invention is not limited by the disclosure, but instead its scope is to be determined entirely by the following claims.

Claims

1. A medical system comprising: a catheter sheath; a catheter shaft member; a frame comprising multiple members, each member of the multiple members comprising a proximal end coupled to the catheter shaft member, a distal end, and a respective length extending between the proximal end and the distal end; and a plurality of transducer elements, a respective set of at least one transducer element of the plurality of transducer elements forming an integral component of each member of the multiple members of the frame, each transducer element of the plurality of transducer elements selectively activatable to transmit energy sufficient to cause tissue ablation, wherein at least part of the catheter shaft member is configured to be moveable through a lumen of the catheter sheath to deliver the frame through the lumen when the frame is percutaneously delivered to an intra-cardiac cavity, wherein the frame is configured to be selectively moveable into a delivery configuration in which the frame is arranged and sized to be deliverable through the lumen of the catheter sheath, wherein the frame is configured to be selectively moveable into an expanded configuration in which the frame is expanded relative to the delivery configuration, in which each member of the multiple members of the frame is radially arranged with respect to one another about a first axis,

and in which each member of the multiple members of the frame is longitudinally arranged with respect to the first axis, wherein at least some of the transducer elements of the plurality of transducer elements are activatable to perform a first cardiac tissue ablation when the frame is in the expanded configuration, wherein the frame is configured to be selectively moveable, via at least an actuator, from the expanded configuration into a changed expanded configuration in which the changed expanded configuration is expanded relative to the delivery configuration, and in which each member of the multiple members of the frame is radially arranged with respect to one another about a second axis, wherein at least some of the transducer elements of the plurality of transducer elements are activatable to perform a second cardiac tissue ablation when the frame is in the changed expanded configuration, and wherein, when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, each particular member of the multiple members of the frame and an adjacent member of the multiple members of the frame that is adjacent the particular member of the multiple members of the frame diverge and then converge between each pair of a respective set of multiple pairs of adjacent spaced apart locations as the respective length of the particular member of the multiple members of the frame is traversed between the proximal end and the distal end of the particular member of the multiple members of the frame.
2. The medical system of claim 1, wherein each member of the multiple members of the frame comprises a front surface and a back surface opposite across a thickness of the member from the front surface, the front surface of each member of the multiple members of the frame arranged to face outwardly when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, and wherein, for each particular member of the multiple members of the frame, and when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, the particular member of the multiple members of the frame overlaps, or is overlapped by, the adjacent member of the multiple members of the frame in a front surface-toward-back surface arrangement at least at each of the spaced apart locations of at least a first pair of the respective set of multiple pairs of adjacent spaced apart locations.
3. The medical system of claim 2, wherein, for each particular member of the multiple members of the frame, and when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, a portion of the particular member of the multiple members of the frame between the adjacent spaced apart locations of the first pair of the respective set of multiple pairs of adjacent spaced apart locations is laterally separated from the adjacent member of the multiple members of the frame.
4. The medical system of claim 1, wherein each member of the multiple members of the frame comprises a front surface and a back surface opposite across a thickness of the member from the front surface, the front surface of each member of the multiple members of the frame arranged to face outwardly when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, wherein the multiple members of the frame include a first member, a second member, and a third member, and wherein, when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration: the first member of the multiple members of the frame, the second member of the multiple members of the frame, and the third member of the multiple members of the frame are adjacent members of the multiple members of the frame with the second member of the multiple members of the frame located between the first member of the multiple members of the frame and the third member of the multiple members of the frame; the second member of the multiple members of the frame is overlapped by the first member of the multiple members of the frame in a front surface-toward-back surface arrangement at least at each of the spaced apart locations of at least a first pair of the

respective set of multiple pairs of adjacent spaced apart locations; and the third member of the multiple members of the frame is overlapped by the second member of the multiple members of the frame in a front surface-toward-back surface arrangement at least at each of the spaced apart locations of at least a second pair of the respective set of multiple pairs of adjacent spaced apart locations.

5. The medical system of claim 4, wherein, when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration: a portion of the first member of the multiple members of the frame is laterally separated from the second member of the multiple members of the frame between the adjacent spaced apart locations of the first pair of the respective set of multiple pairs of adjacent spaced apart locations; and a portion of the second member of the multiple members of the frame is laterally separated from the third member of the multiple members of the frame between the adjacent spaced apart locations of the second pair of the respective set of multiple pairs of adjacent spaced apart locations.

6. The medical system of claim 1, wherein, for each particular member of the multiple members of the frame, and when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, the particular member of the multiple members of the frame is physically coupled by a respective coupler to the adjacent member of the multiple members of the frame at least at each of the spaced apart locations of at least a first pair of the respective set of multiple pairs of adjacent spaced apart locations.

7. The medical system of claim 6, wherein the respective coupler that physically couples at least a first member of the multiple members of the frame and a second member of the multiple members of the frame comprises a pin, the second member of the multiple members of the frame adjacent the first member of the multiple members of the frame when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration.

8. The medical system of claim 6, wherein, for each particular member of the multiple members of the frame, and when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, the particular member of the multiple members of the frame overlaps, or is overlapped by, the adjacent member of the multiple members of the frame at least at each of the spaced apart locations of the first pair of the respective set of multiple pairs of adjacent spaced apart locations.

9. The medical system of claim 8, wherein, for each particular member of the multiple members of the frame, and when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, at least a second pair of the respective set of multiple pairs of adjacent spaced apart locations follows the first pair of the respective set of multiple pairs of adjacent spaced apart locations as the respective length of the particular member of the multiple members of the frame is traversed between the proximal end and the distal end of the particular member of the multiple members of the frame.

10. The medical system of claim 1, wherein, for each particular member of the multiple members of the frame, and when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, the particular member of the multiple members of the frame is physically coupled to the adjacent member of the multiple members of the frame at least at each of the spaced apart locations of the respective set of multiple pairs of adjacent spaced apart locations.

11. The medical system of claim 10, wherein, for each particular member of the multiple members of the frame, and when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, the

particular member of the multiple members of the frame overlaps, or is overlapped by, the adjacent member of the multiple members of the frame at least at each of the spaced apart locations of at least a first pair of the respective set of multiple pairs of adjacent spaced apart locations.

12. The medical system of claim 11, wherein, for each particular member of the multiple members of the frame, and when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, the particular member of the multiple members of the frame is physically coupled to the adjacent member of the multiple members of the frame at least by a respective pin at each of the spaced apart locations of the first pair of the respective set of multiple pairs of adjacent spaced apart locations.

13. The medical system of claim 11, wherein, for each particular member of the multiple members of the frame, and when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, at least a second pair of the respective set of multiple pairs of adjacent spaced apart locations follows the first pair of the respective set of multiple pairs of adjacent spaced apart locations as the respective length of the particular member of the multiple members of the frame is traversed between the proximal end and the distal end of the particular member of the multiple members of the frame.

14. The medical system of claim 1, wherein, when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration, each member of multiple members of the frame includes a curved portion arranged to extend along at least a portion of a respective curved path that intersects a corresponding one of the first axis, when the frame is in the expanded configuration, and the second axis, when the frame is in the changed expanded configuration, at each of a respective at least two spaced apart locations.

15. The medical system of claim 1, comprising a tubular member, wherein the multiple members of the frame are radially arranged about the tubular member when the frame is in the expanded configuration, the changed expanded configuration, or each of the expanded configuration and the changed expanded configuration.

16. The medical system of claim 1, wherein the frame is physically coupled to a distal end portion of the catheter shaft member, and wherein a particular angular orientation of a first portion of the frame relative to the distal end portion of the catheter shaft member when the frame is in the expanded configuration is different than a particular angular orientation of the first portion of the frame relative to the distal end portion of the catheter shaft member when the frame is in the changed expanded configuration.

17. The medical system of claim 1, wherein at least a portion of the frame is configured to undergo a reduction in stored potential energy during a movement of the frame between the expanded configuration and the changed expanded configuration.

18. The medical system of claim 1, wherein each member of the multiple members of the frame includes a metal layer.

19. The medical system of claim 1, wherein each member of the multiple members of the frame includes a patterned electrically conductive layer.

20. The medical system of claim 1, wherein, at least in the changed expanded configuration, each member of the multiple members of the frame is longitudinally arranged with respect to the second axis.

21. The medical system of claim 1, wherein each member of the multiple members of the frame comprises a front surface and a back surface opposite across a thickness of the member from the front surface, each of the back surface and the front surface having a set of side edges, and wherein, for each particular member of the multiple members of the frame, a width of the front surface of the particular member is greater than the thickness of the particular member.