muscles, and more particularly, to epicardial approaches, intrapericardial approaches, and endocardial approaches with cryoprobes or cryocatheters.

[0021] The device is a closed or semi-closed system in which supercritical, pseudo-fluidic, or pressurized liquid cryogen is contained in both the supply and return stages.

[0021a] In one aspect, there is provided a cryoengine for a cryogenic medical system, said cryoengine comprising:

a dewar that can be filled with liquid cryogen to create a cryogen reservoir;

a pressurization system having a first vessel positioned in the dewar and and being fluidly connected by a line having a control valve to a second vessel positioned outside the dewar, wherein a heater is arranged internal to the first vessel;

a fill valve;

a cryogenic flow actuator positioned in the dewar, wherein activation of the cryogenic flow actuator creates a flow of liquid cryogen from the cryogen reservoir, through the fill valve, into the first vessel;

a vent valve connected to the first vessel; and

one or more cryolines for connecting the cryoengine to one or more cryoinstruments and supplying cryogen to the one or more cryoinstruments;

wherein the first vessel includes a thermocouple that protrudes through the first vessel to measure a liquid cryogen level in the first vessel.

[0021b] In one aspect, there is provided a cryogenic medical system comprising:

the cryoengine as defined above; and

one or more cryoinstruments.

[0021c] In one aspect, there is provided a method of generating supercritical nitrogen comprising the steps of:

a. providing the cryoengine as defined above;

b. filling the dewar of the cryoengine with liquid nitrogen to create a cryogen reservoir, the first vessel being positioned in the cryogen reservoir;

c. activating the cryogenic flow actuator to fill the first vessel with liquid nitrogen and opening the vent valve connected to the first vessel to allow venting of vapor while filling;

d. following filling, closing the vent valve and opening the control valve between the first vessel and the second vessel to create a continuous pressurization system comprising approximately equal volumes of liquid nitrogen and nitrogen vapor; and

e. activating the heater in the first vessel to create a boiling microenvironment in the liquid nitrogen in the first vessel, the first vessel being positioned in the cryogen reservoir, thereby increasing pressure within the pressurization system to create supercritical nitrogen.

[0022] In one embodiment, the cryogenic medical system is used in patient treatment procedures and comprises: at least one cryoengine (530) including a dewar (501) containing a cryogen, a flow generator (509) within said dewar; at least one pressurization system (503) having one or more heaters (512) arranged therein, at least one port 502, one or more control valves (508, 506, 510, 514), a first vessel (505) and a second vessel (507) interconnected, wherein the first vessel is submersed in the cryogen and has a first temperature and the second vessel is positioned outside the cryogen and has a second temperature greater than the first temperature; at least a first attachment (508) connecting the flow generator to the port of the pressurization system, and one or more cryolines (516) connected to the port; and one or more cryoinstruments (175, 265, 300, 400) comprising one or more tubular structures (301, 306) arranged therein, the cryoinstruments each having a proximal end (121) which connects with the cryolines of the cryoengine and a distal end (65, 68, 138, 302, 404) positioned at a treatment site; wherein the pressurization system produces supercritical cryogen, pressurized cryogen, or one or more pseudo-fluids, alone or in combination.

[0023] The cryogenic medical system includes a pressurization system that provides continuous flow of supercritical cryogen to any treatment site, including diseased, cancerous, or undesired tissue, including mammalian cardiac tissue and vessels/vasculature within a mammalian body.

[0024] In one embodiment, the cryolines of the cryogenic medical system include supply tubing connecting the cryoengine to the cryoinstrument and supplying the supercritical cryogen to the fine tubular structures of the cryoinstruments. Return tubing allows the cryogen from the distal end of the cryoinstrument to be recycled to the dewar, or cryogen reservoir. The tubular structures within the cryoinstruments, or within any umbilical or connection tubing leading from the cryoengine to the cryoinstruments comprise at least a first tubing and a second tubing positioned in a coaxial or side-by-side configuration. Such design allows for both supply and return of the cryogen within rigid or flexible integral tubing. Various configurations of the cryoengine in combination with cryoinstruments allow the cryogenic medical system to be used to treat a plurality of treatment sites.

[0025] The cryogenic medical system freezes mammalian cardiac tissue or any treatment site within about 10 seconds to about 180 seconds. In freezing, an iceball is formed having a