

(12) **United States Patent**  
**Carpentier**

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(54) **FLEXIBLE HEART VALVE LEAFLETS**

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#### Related U.S. Application Data

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(51) Int. Cl.<sup>7</sup> ..... **A61F 2/06**; **A61F 9/00**

(52) U.S. Cl. .... **623/2.13**; **623/212**; **623/904**

(58) Field of Search ..... **623/1.26, 2.1, 623/2.12, 2.13, 2.14, 2.17, 2.18, 904, 910, 929**

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*Primary Examiner*—Bruce Snow

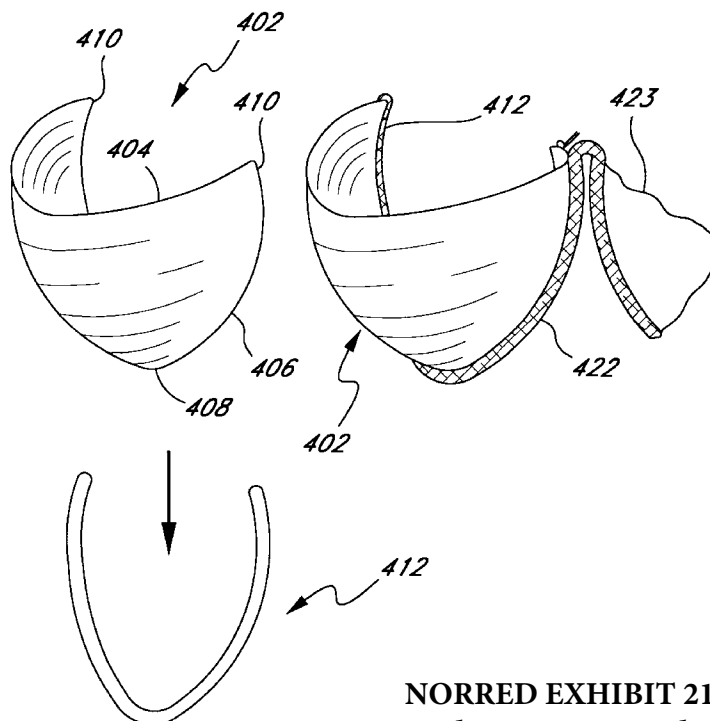
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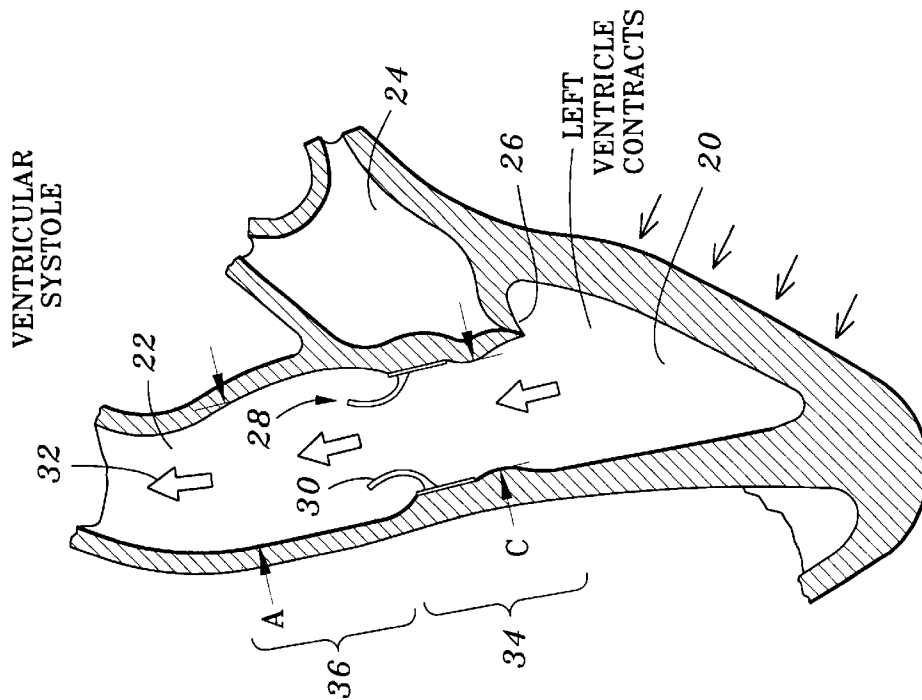
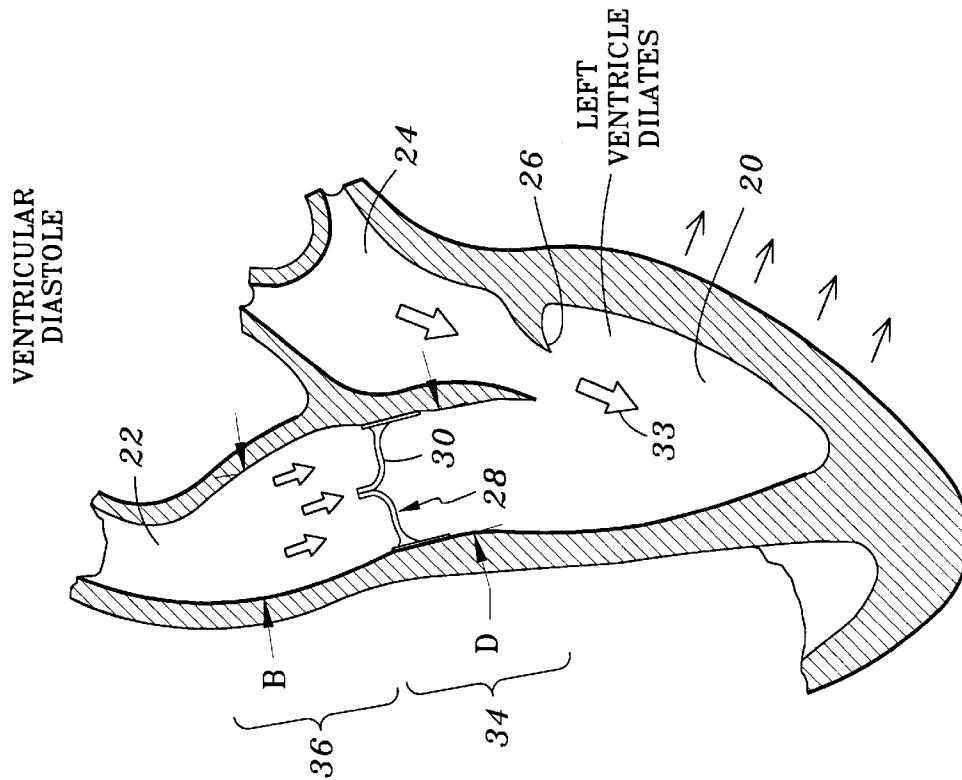
(57) **ABSTRACT**

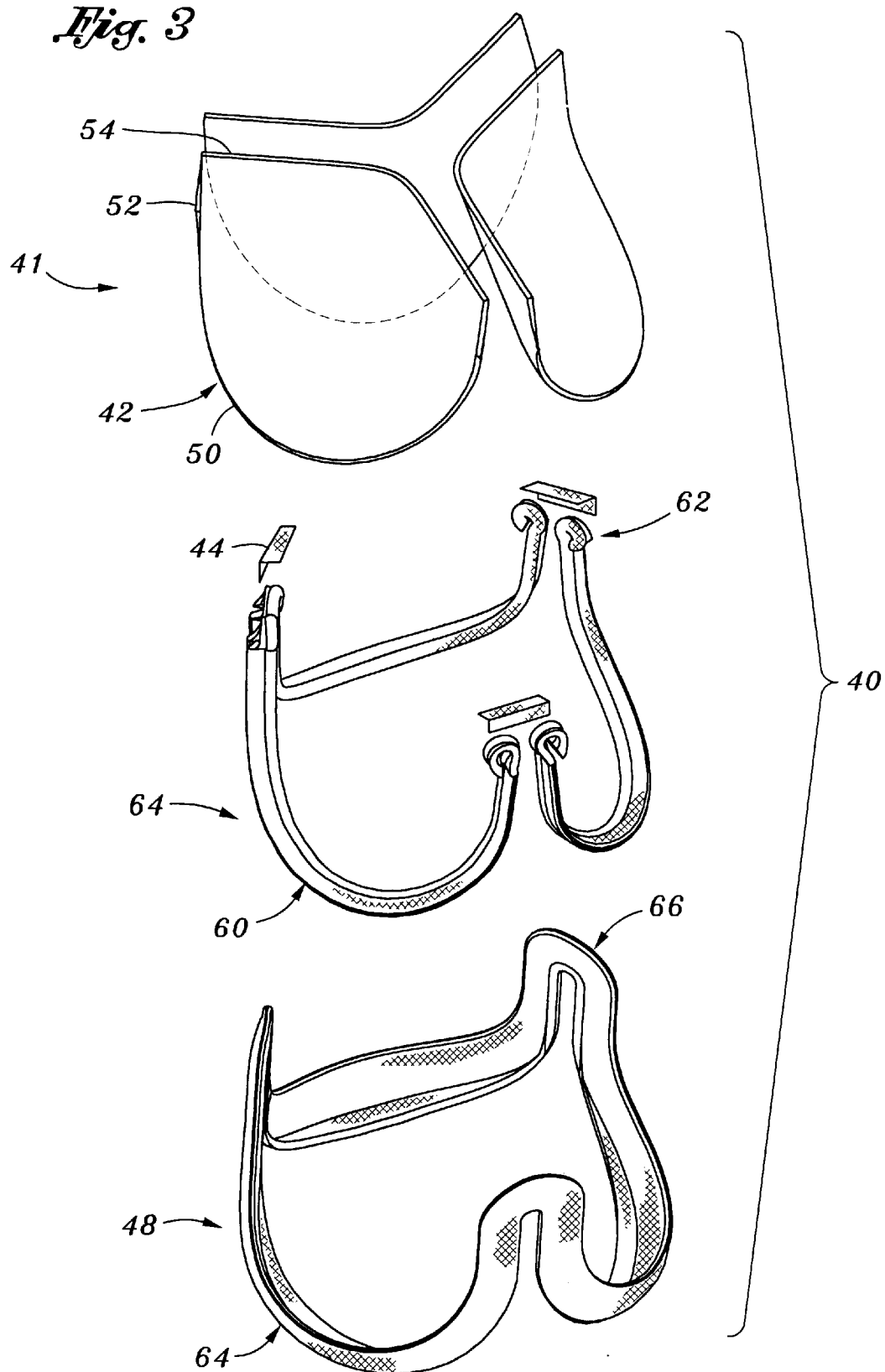
A heart valve with a structural stent and radially moveable cusps and commissures. The stent may be of three separate elements, each having a cusp portion and two commissure portions. The commissures may be pivotally or flexibly coupled, and may separate into independent leaflets. A connecting band may be provided that follows the cusps and commissures and extend outwardly. The valve may be connected to the natural tissue along the undulating connecting band. A multi-legged holder having legs alternating between each cusp and commissure may be used for implantation. A method of implantation is also disclosed, as is a system for implanting independent valve leaflets in the native annulus.

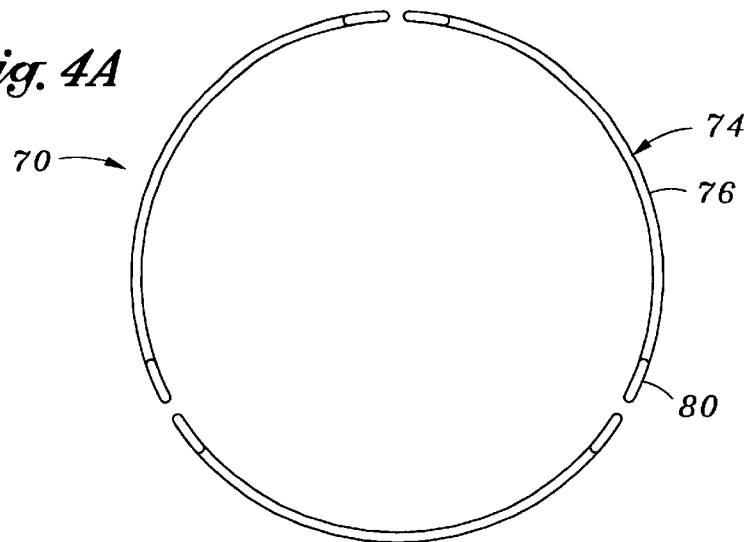
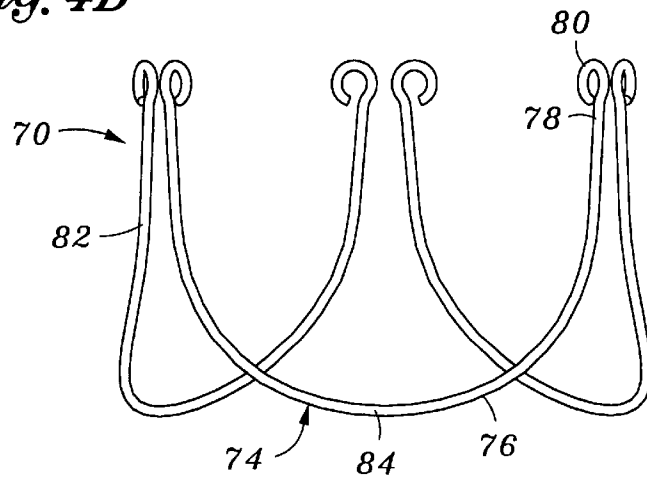
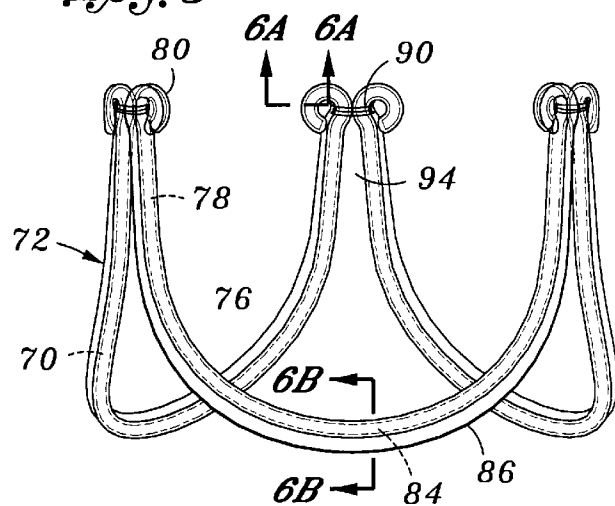
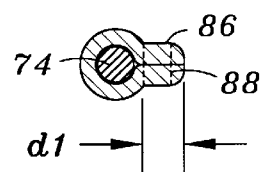
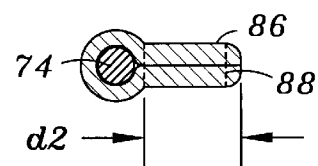
**25 Claims, 18 Drawing Sheets**

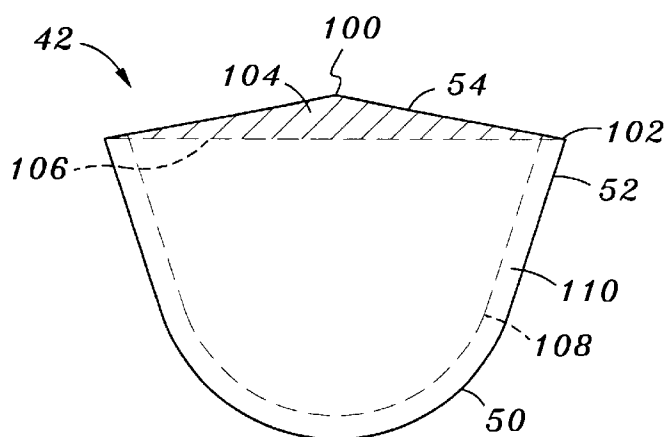
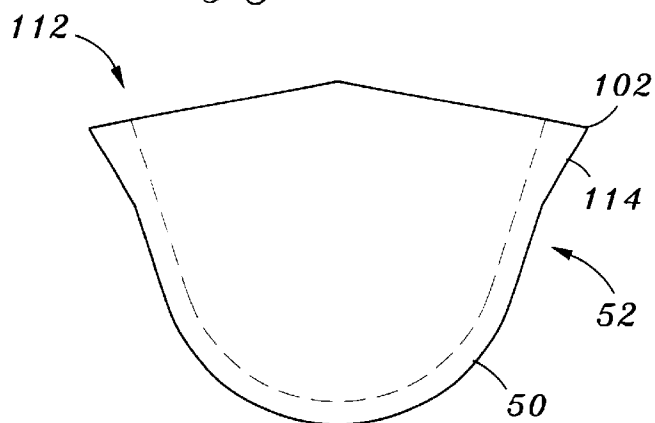
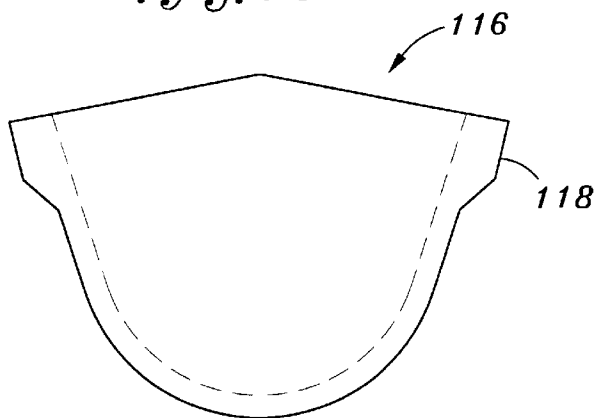


**NORRED EXHIBIT 2109 - Page 1**  
**Medtronic, Inc., Medtronic Vascular, Inc.,**  
**& Medtronic Corevalve LLC**

*Fig. 1**Fig. 2*

*Fig. 3*

*Fig. 4A**Fig. 4B**Fig. 5**Fig. 6A**Fig. 6B*

*Fig. 7A**Fig. 7B**Fig. 7C*

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