

**(12) United States Patent
Schreck**

**(10) Patent No.: US 6,454,799 B1
(45) Date of Patent: Sep. 24, 2002**

(54) **MINIMALLY-INVASIVE HEART VALVES AND METHODS OF USE**

5,571,174 A 11/1996 Love et al.
5,582,607 A 12/1996 Lackman

(75) Inventor: **Stefan Schreck**, Vista, CA (US)

(List continued on next page.)

(73) Assignee: **Edwards Lifesciences Corporation**, Irvine, CA (US)

FOREIGN PATENT DOCUMENTS

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

DE 4316971 A1 5/1993
EP 0103546 B1 4/1988
EP 0362113 B1 4/1993

(List continued on next page.)

OTHER PUBLICATIONS

(21) Appl. No.: **09/549,413**

Lane et al., Pub. No. US 2002/0026238 A1, Pub Date Feb. 28, 2002, application 09/982,609.*

(22) Filed: **Apr. 6, 2000**

(List continued on next page.)

(51) **Int. Cl.⁷** **A61F 2/24**

Primary Examiner—Corrine McDermott
Assistant Examiner—Cheryl L. Miller

(52) **U.S. Cl.** **623/2.18; 623/2.1; 623/2.14; 623/2.17; 623/2.28; 623/2.33**

(74) *Attorney, Agent, or Firm*—Debra D. Condino; John Christopher James; Guy L. Cumberbatch

(58) **Field of Search** **623/2.1, 2.14, 623/2.17, 2.18, 2.38, 2.33, 2.23, 2.28**

(56) **References Cited**

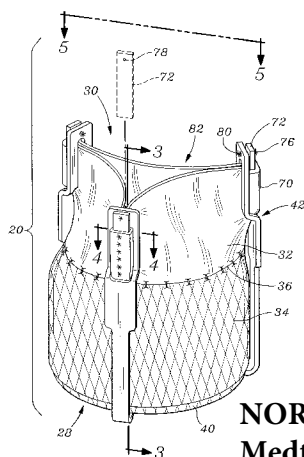
(57) ABSTRACT

U.S. PATENT DOCUMENTS

3,755,823 A	*	9/1973	Hancock	623/2.1
3,839,741 A		10/1974	Haller	
4,056,854 A		11/1977	Boretos et al.	
4,084,268 A		4/1978	Ionescu et al.	
4,477,930 A		10/1984	Totten et al.	
4,506,394 A		3/1985	Bedard	
4,592,340 A		6/1986	Boyles	
4,960,424 A		10/1990	Grooters	
4,994,077 A		2/1991	Dobben	
5,067,957 A		11/1991	Jervis	
5,163,953 A		11/1992	Vince	
5,332,402 A		7/1994	Teitelbaum	
5,370,685 A		12/1994	Stevens	
5,397,351 A		3/1995	Pavcnik et al.	
5,411,552 A		5/1995	Andersen et al.	
5,486,193 A		1/1996	Bourne et al.	
5,489,296 A		2/1996	Love et al.	
5,531,785 A		7/1996	Love et al.	
5,545,209 A		8/1996	Roberts et al.	
5,545,214 A		8/1996	Stevens	
5,549,665 A	*	8/1996	Vesely	623/2.1
5,554,185 A		9/1996	Block et al.	

Expandable heart valves for minimally invasive valve replacement surgeries are disclosed. In a first embodiment, an expandable pre-assembled heart valve includes a plastically-expandable annular base having plurality of upstanding commissure posts. A tubular flexible member including a prosthetic section and a fabric section is provided, with the prosthetic section being connected to the commissure posts and defining leaflets therebetween, and the fabric section being attached to the annular base. In a second embodiment, an expandable heart valve includes an annular tissue-engaging base and a subassembly having an elastic wireform and a plurality of leaflets connected thereto. The annular base and subassembly are separately stored and connected just prior to delivery to the host annulus. Preferably, the leaflet subassembly is stored in its relaxed configuration to avoid deformation of the leaflets. The expandable heart valves may be implanted using a balloon catheter. Preferably, the leaflets of the heart valves are secured to the commissure regions of the expandable stents using a clamping arrangement to reduce stress.

20 Claims, 10 Drawing Sheets



**NORRED EXHIBIT 2098 - Page 1
Medtronic, Inc., Medtronic Vascular, Inc.,
& Medtronic Corevalve, LLC**

U.S. PATENT DOCUMENTS

5,607,465	A	3/1997	Camilli	
5,612,885	A *	3/1997	Love	623/2.1
5,669,919	A	9/1997	Sanders et al.	
5,674,279	A	10/1997	Wright et al.	
5,682,906	A	11/1997	Sterman et al.	
5,695,515	A	12/1997	Orejola	
5,716,370	A	2/1998	Williamson, IV et al.	
5,716,399	A	2/1998	Love	
5,716,417	A *	2/1998	Girard	623/2.1
5,728,153	A	3/1998	Menkis et al.	
5,824,064	A	10/1998	Taheri	
5,840,081	A	11/1998	Andersen et al.	
5,855,601	A	1/1999	Bessler et al.	
5,855,603	A	1/1999	Reif	
5,928,281	A *	7/1999	Huynh	623/2.1
5,935,163	A *	8/1999	Gabbay	623/2.1
5,957,949	A	9/1999	Leonhardt et al.	
5,980,570	A	11/1999	Simpson	
5,984,959	A	11/1999	Robertson et al.	
6,074,418	A	6/2000	Buchanan et al.	
6,092,529	A *	7/2000	Cox	623/2.11
6,264,691	B1 *	6/2001	Gabbay	623/2.14
6,336,937	B1 *	1/2002	Vonesh et al.	623/1.13
6,338,740	B1 *	1/2002	Carpentier	623/2.13
6,350,282	B1 *	2/2002	Eberhardt	623/2.13
2001/0002445	A1	5/2001	Vesely	
2001/0007956	A1	7/2001	Letac et al.	
2001/0021872	A1	9/2001	Bailey et al.	

FOREIGN PATENT DOCUMENTS

EP	0532678	B1	5/1996
EP	0804911	A2	11/1997
EP	0850607	A1	7/1998
EP	1 057 460	A1	12/2000

EP	1 088 529	A2	4/2001
SU	1621912	A1	2/1989
WO	WO 96/19159		6/1996
WO	WO 96/40006		12/1996
WO	WO 97/09947		3/1997
WO	WO 97/09949		3/1997
WO	WO 97/46177		12/1997
WO	WO 99/30646		6/1999
WO	WO 99/33414		7/1999
WO	WO 99/53869		10/1999
WO	WO 99/56665		11/1999
WO	00/41652		7/2000
WO	00/44313		8/2000
WO	00/45874		8/2000
WO	00/47139		8/2000
WO	00/48533		8/2000
WO	01/52775	A1	7/2001
WO	01/54625	A1	8/2001
WO	01/56512	A1	8/2001

OTHER PUBLICATIONS

Ratner et al., *Biomaterials Science, An Introduction to Materials in Medicine*, Academic Press, 1996, p. 289.*
 Grismer, et al.; *A Suture Holder and Separator Attachment to the Starr-Edwards Prosthetic Valve Holders, Surgery, Gynecology & Obstetrics*, pp. 583-584, Mar. 1965.
 Pavcnick, et al.; *Development and Initial Experimental Evaluation of a Prosthetic Aortic Valve for Transcatheter Placement*, *Cardiovascular Radiology*, vol. 183, No. 1, pp. 151-154.
 Bailey *Percutaneous Expandable Prosthetic Valves, VIII—Valvuloplasty, Congenital and Pericardial Heart Disease*, pp. 1269-1276.

* cited by examiner

Fig. 1

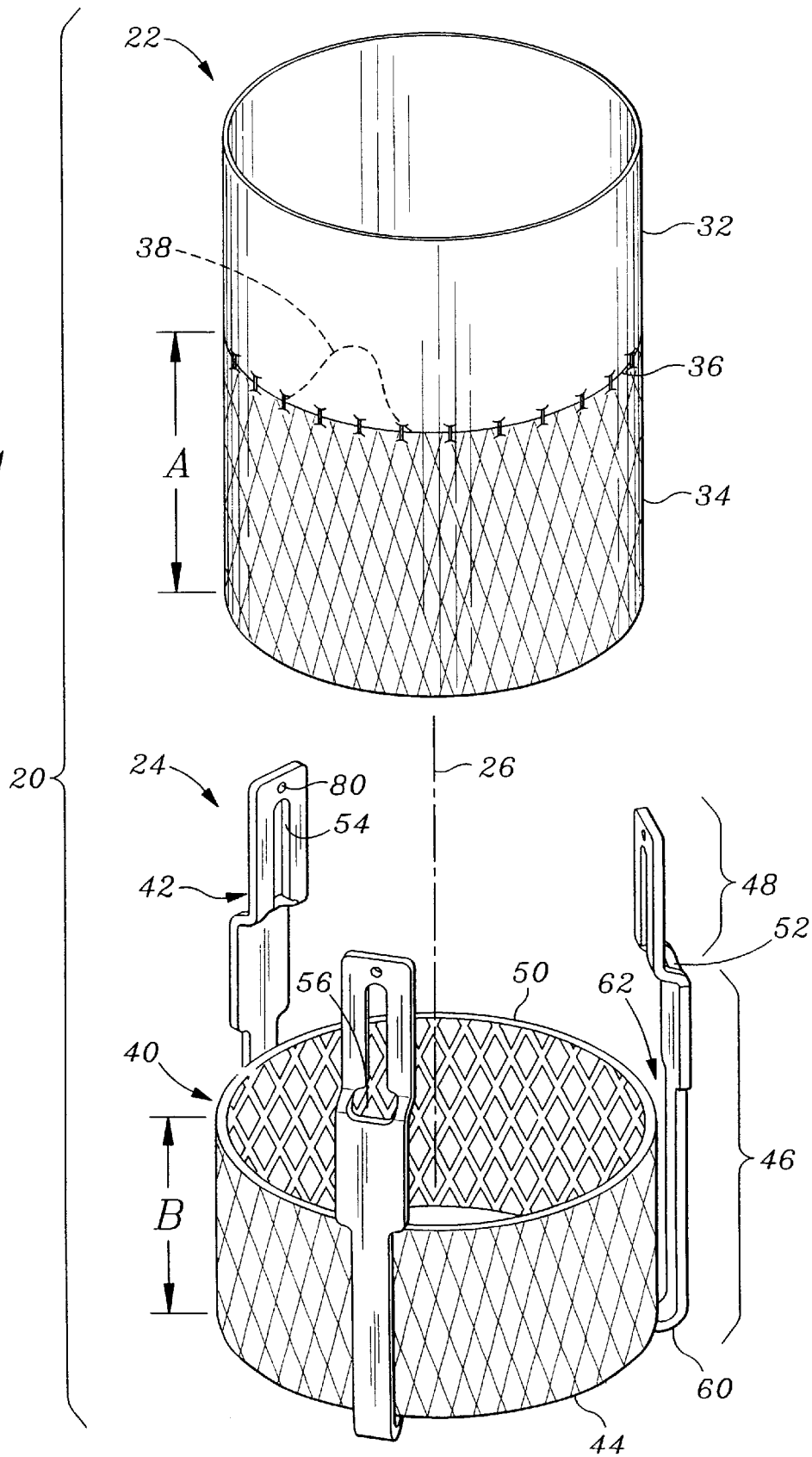


Fig. 4

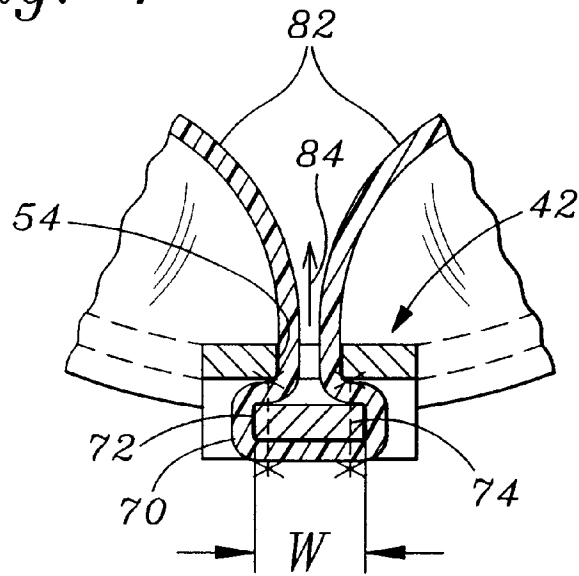
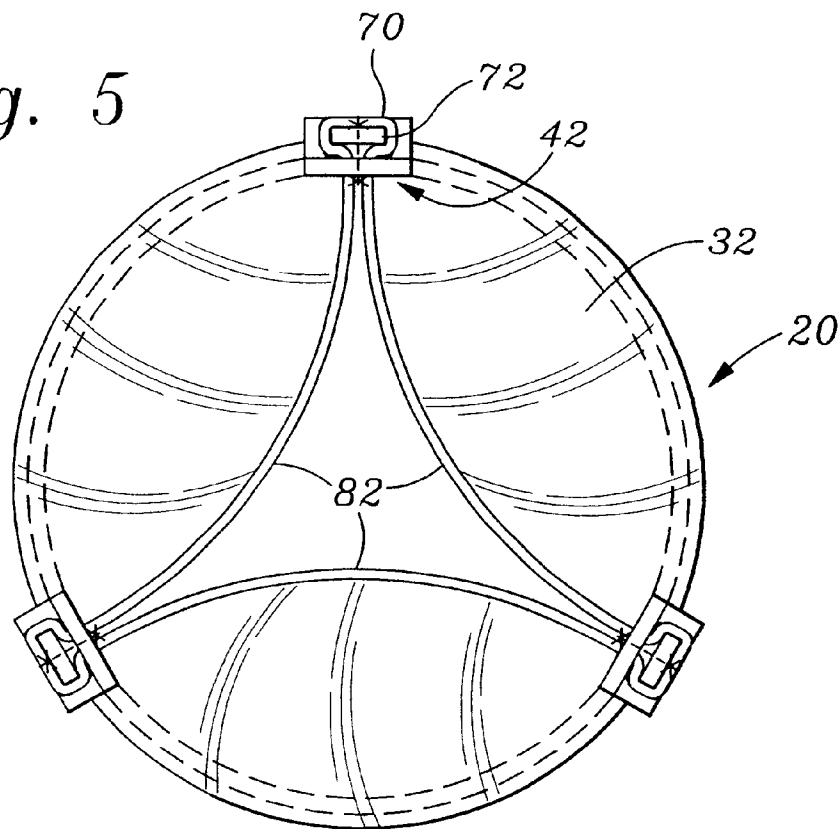


Fig. 5



Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.