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(54) **ENDOLUMINAL STENT**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,304,557 A 2/1967 Polansky
3,500,820 A 3/1970 Almen
3,657,744 A 4/1972 Ersek
3,805,301 A 4/1974 Liebig
3,868,956 A 3/1975 Alfidi et al.

(Continued)

FOREIGN PATENT DOCUMENTS

AU PM 1537 4/1995

(Continued)

OTHER PUBLICATIONS

Search Report.

(Continued)

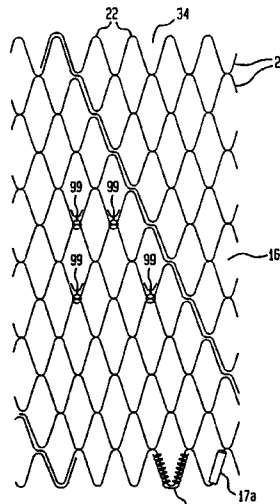
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(57) **ABSTRACT**

A stent is provided comprising a plurality of hoops aligned along a common axis, wherein each of the hoops is oriented in a plane substantially perpendicular to the longitudinal axis of the stent. Each of the hoops includes a plurality of elongate elements joined to one another and forming apices that point in a direction along the axis of the stent. The stent also comprises means for securing an apex of one hoop to a juxtaposed apex of a neighboring hoop.

35 Claims, 23 Drawing Sheets



U.S. PATENT DOCUMENTS							
3,878,565	A	4/1975	Sauvage	5,290,305	A	3/1994	Inoue
3,890,977	A	6/1975	Wilson	5,292,331	A	3/1994	Boneau
3,996,938	A	12/1976	Clark, III	5,304,200	A	4/1994	Spaulding
4,130,904	A	12/1978	Whalen	5,306,294	A	4/1994	Winston et al.
4,140,126	A	2/1979	Choudhury	5,314,472	A	5/1994	Fontaine
4,149,911	A	4/1979	Clabburn	5,330,500	A	7/1994	Song
4,202,349	A	5/1980	Jones	5,342,387	A	8/1994	Summers
4,214,587	A	7/1980	Sakura, Jr.	5,354,308	A	10/1994	Simon et al.
4,306,318	A	12/1981	Mano et al.	5,354,309	A	10/1994	Schnepp-Pesch
4,425,908	A	1/1984	Simon	5,360,443	A	11/1994	Barone et al.
4,494,531	A	1/1985	Gianturco	5,364,354	A	11/1994	Walker et al.
4,503,569	A	3/1985	Dotter	5,366,504	A	11/1994	Anderson et al.
4,512,338	A	4/1985	Balko et al.	5,370,683	A	12/1994	Fontaine
4,530,113	A	7/1985	Matterson	5,370,691	A	12/1994	Samson
4,545,082	A	10/1985	Hood	5,383,892	A	1/1995	Cardon
4,553,545	A	11/1985	Maass et al.	5,383,928	A	1/1995	Scott et al.
4,560,374	A	12/1985	Hammerslag	5,387,235	A	2/1995	Chuter
4,562,596	A	1/1986	Kornberg	5,389,106	A	2/1995	Tower
4,577,631	A	3/1986	Kreamer	5,395,349	A	3/1995	Quiachon et al.
4,580,568	A	4/1986	Gianturco	5,395,390	A	3/1995	Simon et al.
4,617,932	A	10/1986	Kornberg	5,397,345	A	3/1995	Lazarus
4,649,922	A	3/1987	Wiktor	5,405,377	A	4/1995	Cragg
4,655,771	A	4/1987	Wallsten	5,411,552	A *	5/1995	Andersen et al. 623/2.18
4,665,906	A	5/1987	Jervis	5,415,664	A	5/1995	Pinchuk
4,665,918	A	5/1987	Garza et al.	5,419,324	A	5/1995	Dillow
4,681,110	A	7/1987	Wiktor	5,429,144	A	7/1995	Wilk
4,728,328	A	3/1988	Hughes	5,443,496	A	8/1995	Schwartz
4,729,766	A	3/1988	Bergentz et al.	5,443,497	A	8/1995	Venbrux
4,732,152	A	3/1988	Wallsten et al.	5,443,498	A	8/1995	Fontaine
4,733,665	A	3/1988	Palmaz	5,456,713	A	10/1995	Chuter
4,739,762	A	4/1988	Palmaz	5,464,449	A	11/1995	Ryan et al.
4,762,128	A	8/1988	Rosenbluth	5,484,418	A	1/1996	Quiachon et al.
4,768,507	A	9/1988	Fischell et al.	5,489,295	A	2/1996	Piplani et al.
4,772,264	A	9/1988	Cragg	5,507,767	A	4/1996	Maeda
4,776,337	A	10/1988	Palmaz	5,507,771	A	4/1996	Gianturco
4,787,899	A	11/1988	Lazarus	5,522,880	A	6/1996	Barone et al.
4,795,463	A	1/1989	Gerow	5,540,712	A	7/1996	Kleshinski et al.
4,800,882	A	1/1989	Gianturco	5,562,724	A	10/1996	Vorwerk et al.
4,820,298	A	4/1989	Leveen et al.	5,562,726	A	10/1996	Chuter
4,830,003	A	5/1989	Wolff et al.	5,562,727	A	10/1996	Turk et al.
4,856,516	A	8/1989	Hillstead	5,562,728	A	10/1996	Lazarus et al.
4,878,906	A	11/1989	Lindemann et al.	5,571,170	A	11/1996	Palmaz et al.
4,886,062	A	12/1989	Wiktor	5,575,817	A	11/1996	Martin
4,886,065	A	12/1989	Collins, Jr.	5,609,605	A	3/1997	Marshall et al.
4,913,141	A	4/1990	Hillstead	5,609,627	A	3/1997	Goicoechea et al.
4,922,905	A	5/1990	Strecker	5,628,783	A	5/1997	Quiachon et al.
4,969,458	A	11/1990	Wiktor	5,632,772	A	5/1997	Alcime
4,969,890	A	11/1990	Sugita et al.	5,639,278	A	6/1997	Dereume et al.
4,994,032	A	2/1991	Sugiyama et al.	5,662,675	A	9/1997	Polanskyj Stockert et al.
4,994,071	A	2/1991	MacGregor	5,676,697	A	10/1997	McDonald
5,019,085	A	5/1991	Hillstead	5,683,448	A	11/1997	Cragg
5,019,090	A	5/1991	Pinchuk	5,683,450	A	11/1997	Goicoechea et al.
5,035,706	A	7/1991	Giantureo	5,693,086	A	12/1997	Goicoechea et al.
5,037,427	A	8/1991	Harada et al.	5,697,970	A	12/1997	Schmitt
5,041,126	A	8/1991	Gianturco	5,716,365	A	2/1998	Goicoechea et al.
5,047,050	A	9/1991	Arpesani	5,718,724	A	2/1998	Goicoechea et al.
5,057,092	A	10/1991	Webster, Jr.	5,725,572	A	3/1998	Lam
5,064,435	A	11/1991	Porter	5,741,332	A	4/1998	Schmitt
5,067,957	A	11/1991	Jervis	5,776,180	A	7/1998	Goicoechea et al.
5,078,726	A	1/1992	Kreamer	5,800,456	A *	9/1998	Maeda et al. 623/1.15
5,078,736	A	1/1992	Behl	5,800,508	A *	9/1998	Goicoechea et al. 623/1.15
5,085,635	A	2/1992	Cragg	5,824,039	A *	10/1998	Piplani et al. 623/1.11
5,104,399	A	4/1992	Lazarus	5,824,042	A	10/1998	Lombardi
5,104,404	A	4/1992	Wolff	5,871,536	A	2/1999	Lazarus
5,123,917	A	6/1992	Lee	5,876,432	A	3/1999	Lau et al.
5,133,732	A	7/1992	Wiktor	5,916,263	A	6/1999	Goicoechea et al.
5,135,536	A	8/1992	Hillstead	5,938,696	A	8/1999	Goicoechea et al.
5,151,105	A	9/1992	Kwan-Gett	6,051,020	A	4/2000	Goicoechea et al.
5,161,547	A	11/1992	Tower	6,090,137	A	7/2000	Schmitt
5,163,958	A	11/1992	Pinchuk	6,102,938	A	8/2000	Evans et al.
5,183,085	A	2/1993	Timmermans	6,117,167	A	9/2000	Goicoechea et al.
5,192,297	A	3/1993	Hull	6,123,722	A	9/2000	Fogarty et al.
5,192,310	A	3/1993	Herweck et al.	6,129,756	A	10/2000	Kugler et al.
5,201,901	A	4/1993	Harada et al.	6,156,063	A	12/2000	Douglas
5,207,695	A	5/1993	Trout	6,159,239	A	12/2000	Greenhalgh
5,236,446	A	8/1993	Dumon	6,162,246	A	12/2000	Barone
				6,165,213	A	12/2000	Goicoechea et al.

6,200,339	B1	3/2001	Leschinsky et al.	EP	0 656 197	A2	6/1995
6,210,435	B1	4/2001	Piplani et al.	EP	0 657 147	A2	6/1995
6,221,099	B1	4/2001	Andersen et al.	EP	734 235		6/1995
6,221,102	B1	4/2001	Baker et al.	EP	0 662 307	A1	7/1995
6,235,050	B1	5/2001	Quiachon et al.	FR	1602513		1/1971
6,251,133	B1	6/2001	Richter et al.	FR	2 678 508	A1	1/1993
6,251,134	B1	6/2001	Alt et al.	FR	2678508		1/1993
6,261,316	B1	7/2001	Shaolian et al.	GB	1205743		9/1970
6,270,523	B1	8/2001	Herweck et al.	GB	1 491 202		11/1977
6,273,909	B1	8/2001	Kugler et al.	GB	2 106 190	A	4/1983
6,280,467	B1	8/2001	Leonhardt	GB	2269104		2/1994
6,283,991	B1	9/2001	Cox et al.	JP	H02-68052		3/1990
6,287,335	B1	9/2001	Drasler et al.	JP	H02-167178		6/1990
6,302,906	B1	10/2001	Goicoechea et al.	JP	03076554		4/1991
6,312,462	B1	11/2001	McDermott et al.	JP	3133446		6/1991
6,325,819	B1	12/2001	Pavcnik et al.	JP	3151983		6/1991
6,325,826	B1	12/2001	Vardi et al.	JP	4025755		1/1992
6,331,190	B1	12/2001	Shokoohi et al.	JP	H04-500328		1/1992
6,334,869	B1	1/2002	Leonhardt et al.	JP	H05-76554		3/1993
6,344,056	B1	2/2002	Dehdashtian	JP	5305092		11/1993
6,348,066	B1	2/2002	Pinchuk et al.	JP	H05-509008		12/1993
6,361,557	B1	3/2002	Gittings et al.	JP	H06-7454		1/1994
6,395,019	B2	5/2002	Chobotov	JP	6023031		2/1994
6,395,022	B1	5/2002	Piplani et al.	JP	7501476		2/1995
6,398,803	B1	6/2002	Layne et al.	WO	WO 83/03752		11/1983
6,398,807	B1	6/2002	Chouinard et al.	WO	WO89/08433		9/1989
6,409,750	B1	6/2002	Hyodoh et al.	WO	WO 90/15582		12/1990
6,409,756	B1	6/2002	Murphy	WO	WO91/07928		6/1991
6,416,542	B1	7/2002	Marcade et al.	WO	WO 91/17789		11/1991
6,428,565	B1	8/2002	Wisselink	WO	WO92/00043		1/1992
6,440,166	B1	8/2002	Kolluri	WO	WO 92/06734		4/1992
6,454,795	B1	9/2002	Chuter	WO	WO93/13825		7/1993
6,464,721	B1	10/2002	Marcade et al.	WO	WO93/19703		10/1993
6,485,524	B2	11/2002	Strecker	WO	WO94/17754		8/1994
6,517,572	B2	2/2003	Kugler et al.	WO	WO 95/01761		1/1995
6,524,336	B1	2/2003	Papazolgou et al.	WO	WO95/01761		1/1995
6,540,777	B2	4/2003	Stenzel	WO	WO 95/08966		4/1995
6,547,820	B1	4/2003	Staudenmeier	WO	WO 95/16406		6/1995
6,551,350	B1	4/2003	Thornton et al.	WO	WO 97/09008		3/1997
6,565,596	B1	5/2003	White et al.	WO	WO 98/27895		7/1998
6,576,007	B2	6/2003	Dehdashtian et al.				
6,576,009	B2	6/2003	Ryan et al.				
6,582,458	B1	6/2003	White et al.				
6,592,614	B2	7/2003	Lenker et al.				
6,645,242	B1	11/2003	Quinn				
6,652,567	B1	11/2003	Deaton				
6,682,541	B1	1/2004	Gifford, III et al.				

FOREIGN PATENT DOCUMENTS

CA	2086333	4/1991
CA	2158373	10/1994
CA	2 144 305	C 2/1995
DE	3 918 736	A1 12/1990
DE	43 03 181	2/1993
DE	93 19 267.3	U 4/1994
DE	4 303 181	A1 8/1994
EP	0 145 166	B1 6/1985
EP	0 346 564	A1 12/1989
EP	0 357 003	A2 3/1990
EP	0 421 729	A2 4/1991
EP	0 423 619	A1 4/1991
EP	0 423 916	A1 4/1991
EP	461 791	A1 12/1991
EP	0 464 755	1/1992
EP	0 466 518	B1 1/1992
EP	0 480 667	A1 4/1992
EP	0 508 473	A2 10/1992
EP	539 237	A1 4/1993
EP	0 540 290	A2 5/1993
EP	0 551 179	A1 7/1993
EP	0 556 850	A1 8/1993
EP	0 565 251	A1 10/1993
EP	0 579 523	A1 1/1994
EP	0 536 164	B1 3/1994
EP	0 481 365	B1 6/1994
EP	0 621 015	A1 10/1994
EP	0 621 016	A1 10/1994

OTHER PUBLICATIONS

- Dotter et al., "Transluminal Expandable Nitinol Coil Stent Grafting: Preliminary Report", *Technical Developments and Instrumentation, Radiology*, vol. 147, pp. 259-260 (Apr. 1983).
- Schetky, "Shape-Memory Alloys", pp. 74-82.
- K. Otsuka et al., "Shape-Memory Alloys—Pseudoelasticity", *Metals Forum*, vol. 4, No. 3, pp. 142-152 (1981).
- Cragg et al., "Nonsurgical Placement of Arterial Endoprostheses: A New Technique Using Nitinol Wire", *Radiology*, vol. 147, No. 1, pp. 261-263 (Apr. 1983).
- Cragg et al., "Percutaneous Arterial Grafting", *Radiology*, vol. 150, No. 1, pp. 45-49 (1984).
- Cragg, et al., "Stents Vascular Stents", *Interventional Radiology*, pp. 686-692 (1990).
- T.W. Duerig et al., "An Engineer's Perspective of Pseudoelasticity", pp. 369-393.
- Office Action of Canadian Intellectual Property Office for Application No. 2,182,982 dated Jun. 14, 2004.
- Notice of Reasons of Rejection of Japan Patent Office Application No. H07-521275 dated May 18, 2004.
- Notice of Opposition by Scimed Life Sciences, Inc. to European Patent No. 0 676 937 B.
- Opposition by William Cook Aps to European Patent No. 0 676 937 B.
- Verlag, "Interventional Radiology," pp. 692-699 (1990).
- Yoshioka et al., "Self-Expanding Endovascular Graft: An Experimental Study in Dogs," *AJR* 15: pp. 673-676 (1988).
- U.S. Appl. No. 08/051,728.
- Official Action in Canadian Application No. 2,182,982, issued by the Canadian Intellectual Property Office on Mar. 30, 2006.

Notice of Reasons for Rejection of Japan Patent Application No. 2006-104574 dated May 15, 2007.

Notice of Reasons for Rejection of Japan Patent Application No. 2006-104577 dated May 15, 2007.

Decision from United States Court of Appeal for the Federal Circuit for *Boston Scientific Scimed, Inc. v. Medtronic Vascular, Inc. and Eric C. Martin* dated Aug. 8, 2007.

Video cassette allegedly showing operation conducted by Geoffrey H. White on Nov. 26, 1993.

Declaration of Geoffrey H. White executed Feb. 18, 2000.

Declaration of Ian L. Gordon executed Jun. 17, 2000.

Declaration of W. Davis dated Feb. 28, 2000.

Declaration of Mark Dehdashtian dated Jun. 16, 2000.

Communication of a Notice of Opposition dated Jan. 26, 2001 for EP 783 873 (including Notice of Opposition).

Communication of a Notice of Opposition dated Jan. 26, 2001 for EP 783 874 (including Notice of Opposition).

* cited by examiner

FIG. 1A

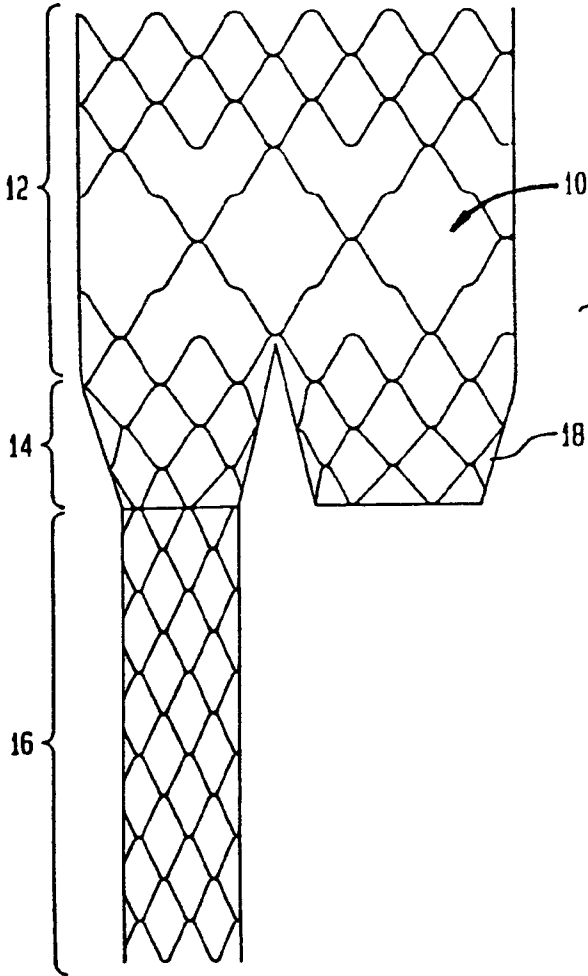
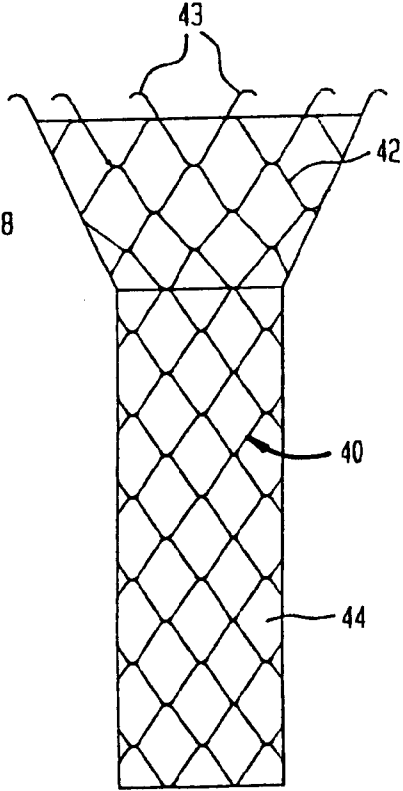


FIG. 1B



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