



US008361156B2

(12) **United States Patent**
Curran et al.

(10) **Patent No.:** **US 8,361,156 B2**
(45) **Date of Patent:** **Jan. 29, 2013**

(54) **SYSTEMS AND METHODS FOR SPINAL FUSION**

(75) Inventors: **Matthew Curran**, Carlsbad, CA (US);
Mark Peterson, Medford, CA (US)

(73) Assignee: **NuVasive, Inc.**, San Diego, CA (US)

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

(21) Appl. No.: **13/441,092**

(22) Filed: **Apr. 6, 2012**

(65) **Prior Publication Data**

US 2012/0209388 A1 Aug. 16, 2012

Related U.S. Application Data

(63) Continuation of application No. 13/440,062, filed on Apr. 5, 2012, now Pat. No. 8,246,686, which is a continuation of application No. 13/079,645, filed on Apr. 4, 2011, now Pat. No. 8,187,334, which is a continuation of application No. 11/093,409, filed on Mar. 29, 2005, now Pat. No. 7,918,891.

(60) Provisional application No. 60/557,536, filed on Mar. 29, 2004.

(51) **Int. Cl.**
A61F 2/44 (2006.01)

(52) **U.S. Cl.** **623/17.16**

(58) **Field of Classification Search** 623/17.11-17.19
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,486,505 A * 12/1969 Morrison 606/90
3,518,993 A * 7/1970 Blake 606/142
3,604,487 A 9/1971 Gilbert
3,745,995 A * 7/1973 Kraus 602/2

3,848,601 A * 11/1974 Ma et al. 606/86 A
3,867,728 A * 2/1975 Stubstad et al. 623/17.16
4,026,304 A * 5/1977 Levy 607/51
4,026,305 A * 5/1977 Brownlee et al. 607/32
4,349,921 A 9/1982 Kuntz
4,454,374 A * 6/1984 Pollack 174/68.3
4,501,269 A * 2/1985 Bagby 606/279
4,545,374 A 10/1985 Jacobson
4,646,738 A * 3/1987 Trott 606/170
4,657,550 A * 4/1987 Daher 623/17.11
4,743,256 A * 5/1988 Brantigan 128/898
4,781,591 A 11/1988 Allen
4,834,757 A 5/1989 Brantigan
4,877,020 A 10/1989 Vich
4,878,915 A 11/1989 Brantigan
4,932,975 A 6/1990 Main et al.
4,950,296 A 8/1990 McIntyre
4,961,740 A 10/1990 Ray et al.
4,962,766 A 10/1990 Herzon

(Continued)

FOREIGN PATENT DOCUMENTS

CA 2015507 1/1999
EP 369603 5/1990

(Continued)

OTHER PUBLICATIONS

Alleyne et al., "Current and future approaches to lumbar disc surgery: A literature review," *Medscape Orthopedics & Sports Medicine*, 1, [www.medscape.com/Medscape/OrthoSportsMed/1997/v.01.n11/.../mos3057], (1997).

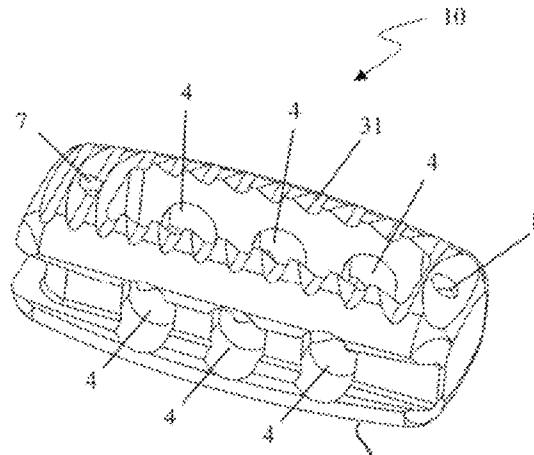
(Continued)

Primary Examiner — Ellen C Hammond
Assistant Examiner — Stuart S Bray
(74) *Attorney, Agent, or Firm* — Fish & Richardson P.C.

(57) **ABSTRACT**

A system and method for spinal fusion comprising a spinal fusion implant of non-bone construction releasably coupled to an insertion instrument dimensioned to introduce the spinal fusion implant into any of a variety of spinal target sites.

27 Claims, 20 Drawing Sheets



U.S. PATENT DOCUMENTS							
5,015,247	A	5/1991	Michelson	5,702,454	A	12/1997	Baumgartner
5,026,373	A	6/1991	Ray et al.	5,702,455	A	12/1997	Saggar
5,047,055	A	9/1991	Bao et al.	5,703,451	A	12/1997	Yamamichi
5,055,104	A	10/1991	Ray	5,707,373	A	1/1998	Sevrain et al.
5,062,845	A	11/1991	Kuslich et al.	5,711,957	A	1/1998	Patat et al.
5,071,437	A	12/1991	Steffee	5,716,415	A	2/1998	Steffee
5,092,572	A	3/1992	Litwak et al.	5,720,748	A	2/1998	Kuslich et al.
5,133,717	A	7/1992	Chopin	5,720,751	A	2/1998	Jackson
5,133,755	A	7/1992	Brekke	5,728,159	A	3/1998	Stroeveer et al.
5,171,278	A	12/1992	Pisharodi	5,741,253	A	4/1998	Michelson
5,192,327	A	3/1993	Brantigan	5,741,261	A	4/1998	Moskovitz et al.
5,217,497	A	6/1993	Mehdian	5,755,797	A	5/1998	Baumgartner
5,263,953	A	11/1993	Bagby	5,766,252	A	6/1998	Henry et al.
5,269,785	A	12/1993	Bonutti	5,772,661	A	6/1998	Michelson
5,284,153	A	2/1994	Raymond et al.	5,775,331	A	7/1998	Raymond et al.
5,290,494	A	3/1994	Coombes et al.	5,775,797	A	7/1998	Henstra
5,300,076	A	4/1994	Leriche	5,779,642	A	7/1998	Nightengale
5,304,210	A	4/1994	Crook	5,782,830	A	7/1998	Farris
5,306,307	A	4/1994	Senter et al.	5,782,919	A	7/1998	Zdeblick et al.
5,306,309	A	4/1994	Wagner et al.	5,785,710	A	7/1998	Michelson
5,322,505	A	6/1994	Krause et al.	5,797,909	A	8/1998	Michelson
5,334,205	A	8/1994	Cain	5,800,549	A	9/1998	Bao et al.
5,336,223	A	8/1994	Rogers	5,800,550	A	9/1998	Sertich
5,364,400	A	11/1994	Rego, Jr. et al.	5,814,084	A	9/1998	Grivas et al.
5,395,372	A	3/1995	Holt et al.	5,851,208	A	12/1998	Trott
5,397,363	A	3/1995	Gelbard	5,860,973	A	1/1999	Michelson
5,397,364	A	3/1995	Kozak	5,865,845	A	2/1999	Thalgott
5,405,391	A	4/1995	Henderson et al.	5,865,848	A	2/1999	Baker
5,413,602	A	5/1995	Metz-Stavenhagen	5,885,299	A	3/1999	Winslow et al.
5,425,772	A	6/1995	Brantigan	5,888,219	A	3/1999	Bonutti
5,431,658	A	7/1995	Moskovich	5,888,224	A	3/1999	Beckers et al.
5,443,514	A	8/1995	Steffee	5,893,890	A	4/1999	Pisharodi
5,443,515	A	8/1995	Cohen et al.	5,904,719	A	5/1999	Errico et al.
5,445,639	A	8/1995	Kuslich et al.	5,910,315	A	6/1999	Stevenson et al.
5,454,811	A	10/1995	Huebner	5,942,698	A	8/1999	Stevens
5,458,638	A	10/1995	Kuslich et al.	5,954,769	A	9/1999	Rosenlicht
5,484,403	A	1/1996	Yoakum et al.	5,968,098	A	10/1999	Winslow
5,484,437	A	1/1996	Michelson	5,993,474	A	11/1999	Ouchi
5,489,307	A	2/1996	Kuslich et al.	6,003,426	A	12/1999	Kobayashi et al.
5,489,308	A	2/1996	Kuslich et al.	6,004,326	A	12/1999	Castro et al.
5,514,180	A	5/1996	Heggeness et al.	6,008,433	A	12/1999	Stone
5,522,879	A	6/1996	Scopelianos	6,015,436	A	1/2000	Schonhoffer
5,522,899	A	6/1996	Michelson	6,033,405	A	3/2000	Winslow et al.
5,524,624	A	6/1996	Tepper et al.	6,039,761	A	3/2000	Li et al.
5,527,312	A	6/1996	Ray	6,042,582	A	3/2000	Ray
5,534,030	A	7/1996	Navarro et al.	6,045,580	A	4/2000	Scarborough et al.
5,540,688	A	7/1996	Navas	6,048,342	A	4/2000	Zucherman et al.
5,545,222	A	8/1996	Bonutti	6,059,829	A	5/2000	Schlapfer et al.
5,562,736	A	10/1996	Ray et al.	6,063,088	A	5/2000	Winslow
5,565,005	A	10/1996	Erickson et al.	6,083,225	A	7/2000	Winslow et al.
5,571,190	A	11/1996	Ulrich et al.	6,096,080	A	8/2000	Nicholson et al.
5,571,192	A	11/1996	Schonhoffer	6,102,948	A	8/2000	Brosnahan, III
5,593,409	A	1/1997	Michelson	6,120,503	A	9/2000	Michelson
5,607,424	A	3/1997	Tropiano	6,120,506	A	9/2000	Kohrs et al.
5,609,636	A	3/1997	Kohrs et al.	6,132,472	A	10/2000	Bonutti
5,611,800	A	3/1997	Davis et al.	6,143,033	A	11/2000	Paul et al.
5,611,810	A	3/1997	Arnold et al.	6,159,211	A	12/2000	Boriani et al.
5,632,747	A	5/1997	Scarborough et al.	6,159,215	A	12/2000	Urbahns et al.
5,645,596	A	7/1997	Kim et al.	6,193,756	B1	2/2001	Studer et al.
5,645,598	A	7/1997	Brosnahan et al.	6,200,347	B1	3/2001	Anderson et al.
5,653,761	A	8/1997	Pisharodi	6,224,607	B1	5/2001	Michelson
5,653,762	A	8/1997	Pisharodi	6,224,631	B1	5/2001	Kohrs
5,658,336	A	8/1997	Pisharodi	6,241,769	B1	6/2001	Nicholson et al.
5,658,337	A	8/1997	Kohrs et al.	6,241,771	B1	6/2001	Gresser et al.
5,662,710	A	9/1997	Bonutti	6,251,140	B1	6/2001	Marino et al.
5,665,122	A	9/1997	Kambin	6,258,125	B1	7/2001	Paul et al.
5,669,909	A	9/1997	Zdeblick et al.	6,277,149	B1	8/2001	Boyle et al.
5,676,703	A	10/1997	Gelbard	6,304,487	B1*	10/2001	Pawletko et al. 365/185.22
5,683,394	A	11/1997	Rinner	6,319,257	B1	11/2001	Carignan et al.
5,683,400	A	11/1997	McGuire	6,371,989	B1	4/2002	Chauvin et al.
5,683,464	A	11/1997	Wagner et al.	6,383,221	B1	5/2002	Scarborough et al.
5,690,629	A	11/1997	Asher et al.	6,409,766	B1	6/2002	Brett
5,700,264	A	12/1997	Zucherman et al.	6,425,772	B1	7/2002	Bernier et al.
5,700,291	A	12/1997	Kuslich et al.	6,432,140	B1	8/2002	Lin
5,700,292	A	12/1997	Margulies	6,440,142	B1	8/2002	Ralph et al.
5,702,449	A	12/1997	McKay	6,442,814	B1	9/2002	Landry et al.
				6,447,547	B1	9/2002	Michelson

6,491,724	B1	12/2002	Ferree	
6,527,773	B1	3/2003	Lin et al.	
D472,634	S	4/2003	Anderson	
D473,650	S	4/2003	Anderson	
6,547,823	B2	4/2003	Scarborough et al.	
6,595,998	B2	7/2003	Johnson et al.	
6,626,905	B1	9/2003	Schmiel et al.	
6,635,086	B2	10/2003	Lin	
6,648,895	B2	11/2003	Burkus et al.	
6,672,019	B1	1/2004	Wenz	
6,676,703	B2	1/2004	Biscup	
6,706,067	B2	3/2004	Shimp et al.	
6,743,255	B2	6/2004	Ferree	
6,746,484	B1	6/2004	Liu et al.	
6,755,841	B2	6/2004	Fraser et al.	
6,761,739	B2	7/2004	Shepard	
6,824,564	B2	11/2004	Crozet	
D503,801	S	4/2005	Jackson	
6,923,814	B1	8/2005	Hildebrand et al.	
6,942,698	B1	9/2005	Jackson	
6,964,687	B1	11/2005	Bernard et al.	
6,979,353	B2	12/2005	Bresina	
6,984,245	B2	1/2006	McGahan et al.	
6,986,788	B2	1/2006	Paul et al.	
6,989,031	B2	1/2006	Michelson	
7,018,416	B2	3/2006	Hanson et al.	
D530,423	S	10/2006	Miles et al.	
8,021,430	B2	9/2011	Michelson	
8,246,686	B1*	8/2012	Curran et al.	623/17.16
2002/0058950	A1	5/2002	Winterbottom et al.	
2003/0105528	A1	6/2003	Shimp et al.	
2003/0139812	A1	7/2003	Garcia et al.	
2004/0153155	A1	8/2004	Chung et al.	
2005/0197702	A1	9/2005	Coppes et al.	
2007/0191945	A1	8/2007	Yu et al.	
2008/0015701	A1*	1/2008	Garcia et al.	623/17.16
2012/0078374	A1*	3/2012	Villiers et al.	623/17.16

FOREIGN PATENT DOCUMENTS

EP	517030	5/1992
EP	667127	8/1995
EP	706876	4/1996
EP	716840	6/1996
EP	737448	10/1996
EP	796593	9/1997
EP	880938	2/1998
EP	809974	4/1998
EP	809975	4/1998
EP	811356	4/1998
WO	90/00037	1/1990
WO	91/06261	5/1991
WO	92/14423	9/1992
WO	93/01771	2/1993
WO	94/04100	3/1994
WO	94/10928	5/1994
WO	95/01810	1/1995
WO	95/08306	3/1995
WO	96/08205	3/1996
WO	96/17564	3/1996
WO	96/41582	12/1996
WO	97/20513	6/1997
WO	97/33525	9/1997

WO	97/37620	10/1997
WO	98/09586	3/1998
WO	98/14142	4/1998
WO	98/17208	4/1998
WO	98/25539	6/1998
WO	99/08627	2/1999
WO	99/38461	8/1999
WO	00/45712	8/2000
WO	00/45713	8/2000
WO	01/41681	6/2001
WO	01/49333	7/2001

OTHER PUBLICATIONS

Benini et al., "Undercutting decompression and posterior fusion with translaminar facet screw fixation in degenerative lumbar spinal stenosis: Technique and results," *Neuro-Orthopedics*, 17/18, 159-172 (1995).

Kambin et al., "History and current status of percutaneous arthroscopic disc surgery," *Spine*, 21(24S):57S-61S (1996).

Stein et al., "Percutaneous facet joint fusion: Preliminary experience," *Journal of Vascular and Interventional Radiology*, 4:69-74 (1993).

Vamvanij et al., "Surgical treatment of internal disc disruption: An outcome study of four fusion techniques," *Journal of Spinal Disorders*, 11(5):375-382 (1998).

Baulot et al., "Complementary anterior spondylosis by thoracoscopy. Technical note regarding an observation," *Lyon Surg.*, 90(5):347-351 (1994).

Bery et al., "A morphometric study of human lumbar and selected thoracic vertebrae, study of selected vertebrae," *Spine* 12(4):362-367 (1996).

Crock, "A Short Practice of Spinal Surgery," Second, revised edition, published by Springer-Verlag/Wein, New York (1993).

Crock, "Anterior Lumbar Interbody Fusion," *Clinical Orthopaedics & Related Research*, Marshall R. Urist, Editor-in-Chief, J. B. Lippincott Company (1982).

Edeland, "Some additional suggestions for an intervertebral disc prosthesis," *Journal of Biomedical Engineering*, 7:57-62 (1985).

Kemp, "Anterior fusion of the spine for infective lesions in adults," *Journal of Bone & Joint Surgery*, 55B(4):715-734 (1973).

NuVasive, Inc., Corrected Final Invalidation Contentions Regarding US 5,860,973, US 6,592,586 and US 6,945,933 filed in the United States District Court, Southern District of California on Jun. 14, 2010 (and 23 appendices).

CoRoent™ Marketing Brochure (9004001 A.0), *NuVasive, Inc.*, 2004, 2 pages.

CoRoent™ Marketing Brochure (9004001 C.0), *NuVasive, Inc.*, 2005, 2 pages.

CoRoent™ XL & XLR Marketing Brochure (9004225 A.0), *NuVasive, Inc.*, 2005, 2 pages.

CoRoent® XL & XLR Marketing Brochure (9004225 B.0), *NuVasive, Inc.*, 2006, 2 pages.

CoRoent® XL & XLR Marketing Brochure (9004225 C.0), *NuVasive, Inc.*, 2007, 2 pages.

CoRoent® XL Marketing Brochure (9500039 A.0), *NuVasive, Inc.*, 2006, 8 pages.

* cited by examiner

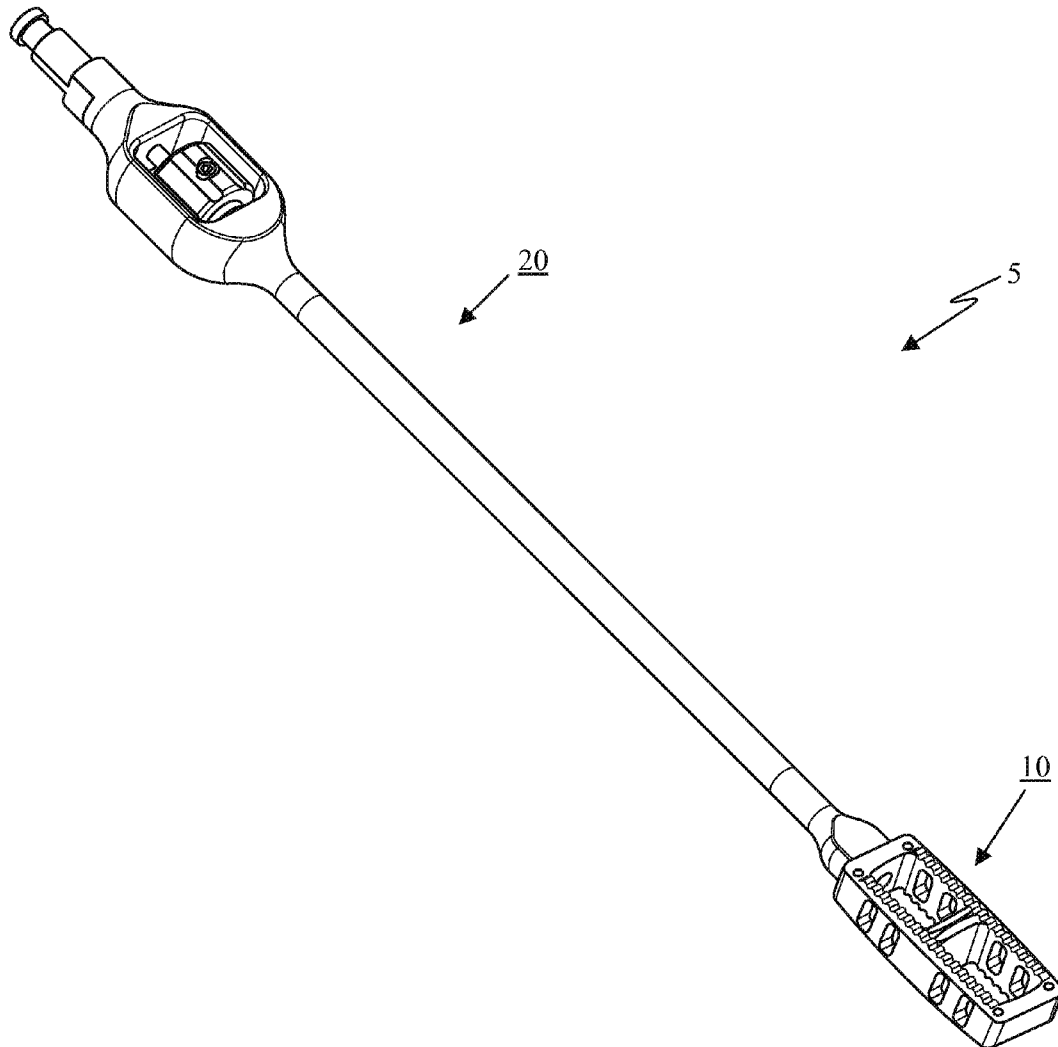


FIG. 1

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.