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(54) **ARTICULATING SURGICAL STAPLING
INSTRUMENT INCORPORATING A FIRING
MECHANISM**

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(56) **References Cited**

U.S. PATENT DOCUMENTS

66,052 A 6/1867 Smith
662,587 A 11/1900 Blake
(Continued)

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FOREIGN PATENT DOCUMENTS

AU 2008207624 A1 3/2009
AU 2010214687 A1 9/2010
(Continued)

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OTHER PUBLICATIONS

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(63) Continuation of application No. 14/850,030, filed on
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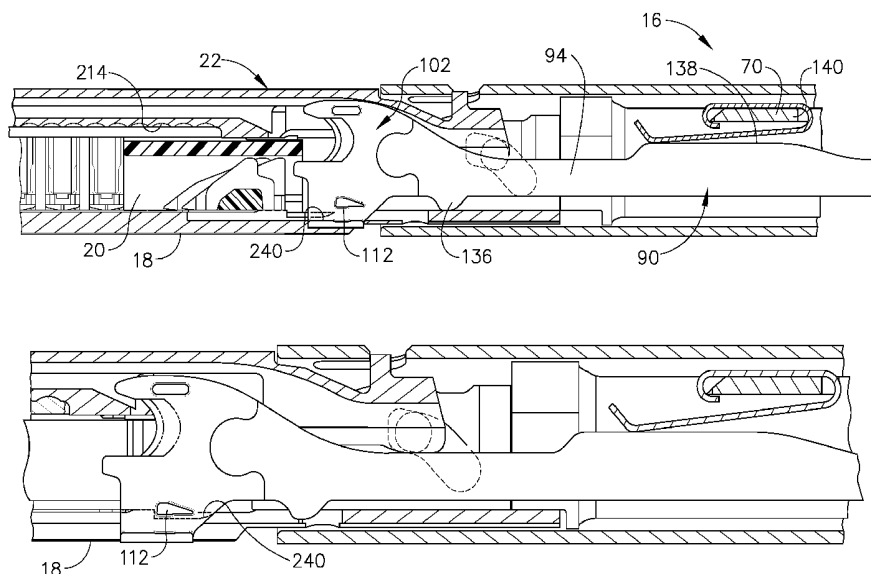
CPC **A61B 17/105** (2013.01); **A61B 17/064**
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(57)

ABSTRACT

A surgical severing and stapling instrument, suitable for
laparoscopic and endoscopic clinical procedures, clamps
tissue within an end effector including an elongate channel
pivottally opposed by an anvil. A firing bar moves distally
through the clamped end effector to sever tissue and to drive
staples on each side of the cut. A firing bar affirmatively
spaces the anvil from the elongate channel to assure properly
formed closed staples.

9 Claims, 13 Drawing Sheets



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continuation of application No. 14/521,748, filed on Oct. 23, 2014, now Pat. No. 9,510,830, which is a continuation of application No. 14/175,148, filed on Feb. 7, 2014, now Pat. No. 9,282,966, which is a continuation of application No. 13/369,601, filed on Feb. 9, 2012, now Pat. No. 8,783,541, which is a continuation of application No. 13/118,246, filed on May 27, 2011, now Pat. No. 9,060,770, which is a continuation-in-part of application No. 11/538,154, filed on Oct. 3, 2006, now abandoned, application No. 15/679,300, filed on Aug. 17, 2017, which is a continuation of application No. 14/850,030, filed on Sep. 10, 2015, now Pat. No. 9,737,303, which is a continuation of application No. 14/521,748, filed on Oct. 23, 2014, now Pat. No. 9,510,830, which is a continuation of application No. 14/175,148, filed on Feb. 7, 2014, now Pat. No. 9,282,966, which is a continuation of application No. 11/141,753, filed on Jun. 1, 2005, now Pat. No. 8,905,977.

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(58) Field of Classification Search

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 See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

670,748 A 3/1901 Weddeler
 719,487 A 2/1903 Minor
 804,229 A 11/1905 Hutchinson
 951,393 A 3/1910 Hahn
 1,306,107 A 6/1919 Elliott
 1,314,601 A 9/1919 McCaskey
 1,677,337 A 7/1928 Grove

1,794,907 A 3/1931 Kelly
 1,849,427 A 3/1932 Hook
 1,944,116 A 1/1934 Stratman
 1,954,048 A 4/1934 Jeffrey et al.
 2,037,727 A 4/1936 La Chapelle
 2,132,295 A 10/1938 Hawkins
 2,161,632 A 6/1939 Nattenheimer
 2,211,117 A 8/1940 Hess
 2,214,870 A 9/1940 West
 2,224,882 A 12/1940 Peck
 2,318,379 A 5/1943 Davis et al.
 2,329,440 A 9/1943 La Place
 2,441,096 A 5/1948 Happe
 2,448,741 A 9/1948 Scott et al.
 2,450,527 A 10/1948 Smith
 2,526,902 A 10/1950 Rublee
 2,527,256 A 10/1950 Jackson
 2,578,686 A 12/1951 Fish
 2,638,901 A 5/1953 Sugarbaker
 2,674,149 A 4/1954 Benson
 2,711,461 A 6/1955 Happe
 2,742,955 A 4/1956 Dominguez
 2,804,848 A 9/1957 O'Farrell et al.
 2,808,482 A 10/1957 Zanichowsky et al.
 2,853,074 A 9/1958 Olson
 2,887,004 A 5/1959 Stewart
 2,957,353 A 10/1960 Lewis
 2,959,974 A 11/1960 Emrick
 3,032,769 A 5/1962 Palmer
 3,060,972 A 10/1962 Sheldon
 3,075,062 A 1/1963 Iaccarino
 3,078,465 A 2/1963 Bobrov
 3,079,606 A 3/1963 Bobrov et al.
 3,080,564 A 3/1963 Strekopitov et al.
 3,166,072 A 1/1965 Sullivan, Jr.
 3,180,236 A 4/1965 Beckett
 3,196,869 A 7/1965 Scholl
 3,204,731 A 9/1965 Bent et al.
 3,266,494 A 8/1966 Brownrigg et al.
 3,269,630 A 8/1966 Fleischer
 3,269,631 A 8/1966 Takaro
 3,275,211 A 9/1966 Hirsch et al.
 3,317,103 A 5/1967 Cullen et al.
 3,317,105 A 5/1967 Astafjev et al.
 3,357,296 A 12/1967 Lefever
 3,359,978 A 12/1967 Smith, Jr.
 3,480,193 A 11/1969 Ralston
 3,490,675 A 1/1970 Green et al.
 3,494,533 A 2/1970 Green et al.
 3,499,591 A 3/1970 Green
 3,503,396 A 3/1970 Pierie et al.
 3,509,629 A 5/1970 Kidokoro
 3,551,987 A 1/1971 Wilkinson
 3,568,675 A 3/1971 Harvey
 3,572,159 A 3/1971 Tschanz
 3,583,393 A 6/1971 Takahashi
 3,589,589 A 6/1971 Akopov
 3,598,943 A 8/1971 Barrett
 3,608,549 A 9/1971 Merrill
 3,618,842 A 11/1971 Bryan
 3,638,652 A 2/1972 Kelley
 3,640,317 A 2/1972 Panfili
 3,643,851 A 2/1972 Green et al.
 3,650,453 A 3/1972 Smith, Jr.
 3,661,666 A 5/1972 Foster et al.
 3,662,939 A 5/1972 Bryan
 3,688,966 A 9/1972 Perkins et al.
 3,695,646 A 10/1972 Mommsen
 3,709,221 A 1/1973 Riely
 3,717,294 A 2/1973 Green
 3,734,207 A 5/1973 Fishbein
 3,740,994 A 6/1973 De Carlo, Jr.
 3,744,495 A 7/1973 Johnson
 3,746,002 A 7/1973 Haller
 3,747,603 A 7/1973 Adler
 3,751,902 A 8/1973 Kingsbury et al.
 3,752,161 A 8/1973 Bent
 3,799,151 A 3/1974 Fukaumi et al.
 3,808,452 A 4/1974 Hutchinson

(56)

References Cited

U.S. PATENT DOCUMENTS

3,815,476 A	6/1974	Green et al.	4,350,151 A	9/1982	Scott
3,819,100 A	6/1974	Noiles et al.	4,353,371 A	10/1982	Cosman
3,821,919 A	7/1974	Knohl	4,357,940 A	11/1982	Muller
3,836,171 A	9/1974	Hayashi et al.	4,361,057 A	11/1982	Kochera
3,837,555 A	9/1974	Green	4,366,544 A	12/1982	Shima et al.
3,841,474 A	10/1974	Maier	4,373,147 A	2/1983	Carlson, Jr.
3,851,196 A	11/1974	Hinds	4,376,380 A	3/1983	Burgess
3,863,639 A	2/1975	Kleaveland	4,379,457 A	4/1983	Gravener et al.
3,883,624 A	5/1975	McKenzie et al.	4,380,312 A	4/1983	Landrus
3,885,491 A	5/1975	Curtis	4,382,326 A	5/1983	Rabuse
3,892,228 A	7/1975	Mitsui	4,383,634 A	5/1983	Green
3,894,174 A	7/1975	Cartun	4,393,728 A	7/1983	Larson et al.
3,902,247 A	9/1975	Fleer et al.	4,396,139 A	8/1983	Hall et al.
3,940,844 A	3/1976	Colby et al.	4,397,311 A	8/1983	Kanshin et al.
3,944,163 A	3/1976	Hayashi et al.	4,402,445 A	9/1983	Green
3,950,686 A	4/1976	Randall	4,406,621 A	9/1983	Bailey
3,952,747 A	4/1976	Kimmell, Jr.	4,408,692 A	10/1983	Sigel et al.
3,955,581 A	5/1976	Spasiano et al.	4,409,057 A	10/1983	Molenda et al.
3,959,879 A	6/1976	Sellers	4,415,112 A	11/1983	Green
RE28,932 E	8/1976	Noiles et al.	4,416,276 A	11/1983	Newton et al.
3,972,734 A	8/1976	King	4,417,890 A	11/1983	Dennehey et al.
3,981,051 A	9/1976	Brumlik	4,423,456 A	12/1983	Zaidenweber
4,025,216 A	5/1977	Hives	4,428,376 A	1/1984	Mericle
4,027,746 A	6/1977	Kine	4,429,695 A	2/1984	Green
4,034,143 A	7/1977	Sweet	4,430,997 A	2/1984	DiGiovanni et al.
4,054,108 A	10/1977	Gill	4,434,796 A	3/1984	Karapetian et al.
4,060,089 A	11/1977	Noiles	4,438,659 A	3/1984	Desplats
4,066,133 A	1/1978	Voss	4,442,964 A	4/1984	Becht
4,100,820 A	7/1978	Evelt	4,448,194 A	5/1984	DiGiovanni et al.
4,106,446 A	8/1978	Yamada et al.	4,451,743 A	5/1984	Suzuki et al.
4,108,211 A	8/1978	Tanaka	4,452,376 A	6/1984	Klieman et al.
4,111,206 A	9/1978	Vishnevsky et al.	4,454,887 A	6/1984	Kruger
4,127,227 A	11/1978	Green	4,461,305 A	7/1984	Cibley
4,129,059 A	12/1978	Van Eck	4,467,805 A	8/1984	Fukuda
4,135,517 A	1/1979	Reale	4,469,481 A	9/1984	Kobayashi
4,154,122 A	5/1979	Severin	4,470,414 A	9/1984	Imagawa et al.
4,169,990 A	10/1979	Lerdman	4,471,780 A	9/1984	Menges et al.
4,180,285 A	12/1979	Reneau	4,471,781 A	9/1984	Di Giovanni et al.
4,185,701 A	1/1980	Boys	4,473,077 A	9/1984	Noiles et al.
4,190,042 A	2/1980	Sinnreich	4,475,679 A	10/1984	Fleury, Jr.
4,198,734 A	4/1980	Brumlik	4,478,220 A	10/1984	Di Giovanni et al.
4,198,982 A	4/1980	Fortner et al.	4,480,641 A	11/1984	Failla et al.
4,207,898 A	6/1980	Becht	4,485,816 A	12/1984	Krumme
4,213,562 A	7/1980	Garrett et al.	4,485,817 A	12/1984	Swiggett
4,226,242 A	10/1980	Jarvik	4,486,928 A	12/1984	Tucker et al.
4,239,431 A	12/1980	Davini	4,488,523 A	12/1984	Shichman
4,241,861 A	12/1980	Fleischer	4,489,875 A	12/1984	Crawford et al.
4,244,372 A	1/1981	Kapitanov et al.	4,493,983 A	1/1985	Taggart
4,250,436 A	2/1981	Weissman	4,499,895 A	2/1985	Takayama
4,261,244 A	4/1981	Becht et al.	4,500,024 A	2/1985	DiGiovanni et al.
4,272,002 A	6/1981	Moshofsky	D278,081 S	3/1985	Green
4,272,662 A	6/1981	Simpson	4,503,842 A	3/1985	Takayama
4,274,304 A	6/1981	Curtiss	4,505,272 A	3/1985	Utyamyshev et al.
4,274,398 A	6/1981	Scott, Jr.	4,505,273 A	3/1985	Braun et al.
4,275,813 A	6/1981	Noiles	4,505,414 A	3/1985	Filipi
4,278,091 A	7/1981	Borzone	4,506,671 A	3/1985	Green
4,289,131 A	9/1981	Mueller	4,512,038 A	4/1985	Alexander et al.
4,289,133 A	9/1981	Rothfuss	4,520,817 A	6/1985	Green
4,290,542 A	9/1981	Fedotov et al.	4,522,327 A	6/1985	Korthoff et al.
D261,356 S	10/1981	Robinson	4,526,174 A	7/1985	Froehlich
4,296,654 A	10/1981	Mercer	4,527,724 A	7/1985	Chow et al.
4,296,881 A	10/1981	Lee	4,530,357 A	7/1985	Pawloski et al.
4,304,236 A	12/1981	Conta et al.	4,530,453 A	7/1985	Green
4,305,539 A	12/1981	Korolkov et al.	4,531,522 A	7/1985	Bedi et al.
4,312,363 A	1/1982	Rothfuss et al.	4,532,927 A	8/1985	Miksza, Jr.
4,312,685 A	1/1982	Riedl	4,540,202 A	9/1985	Amphoux et al.
4,317,451 A	3/1982	Cerwin et al.	4,548,202 A	10/1985	Duncan
4,319,576 A	3/1982	Rothfuss	4,556,058 A	12/1985	Green
4,321,002 A	3/1982	Froehlich	4,560,915 A	12/1985	Soultanian
4,321,746 A	3/1982	Grinage	4,565,109 A	1/1986	Tsay
4,328,839 A	5/1982	Lyons et al.	4,565,189 A	1/1986	Mabuchi
4,331,277 A	5/1982	Green	4,566,620 A	1/1986	Green et al.
4,340,331 A	7/1982	Savino	4,569,346 A	2/1986	Poirier
4,347,450 A	8/1982	Colligan	4,569,469 A	2/1986	Mongeon et al.
4,349,028 A	9/1982	Green	4,571,213 A	2/1986	Ishimoto
			4,573,468 A	3/1986	Conta et al.
			4,573,469 A	3/1986	Golden et al.
			4,573,622 A	3/1986	Green et al.
			4,576,165 A	3/1986	Green et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

4,576,167	A	3/1986	Noiles	4,743,214	A	5/1988	Tai-Cheng
4,580,712	A	4/1986	Green	4,744,363	A	5/1988	Hasson
4,585,153	A	4/1986	Failla et al.	4,747,820	A	5/1988	Hornlein et al.
4,586,501	A	5/1986	Claracq	4,750,902	A	6/1988	Wuchinich et al.
4,586,502	A	5/1986	Bedi et al.	4,752,024	A	6/1988	Green et al.
4,589,416	A	5/1986	Green	4,754,909	A	7/1988	Barker et al.
4,589,870	A	5/1986	Citrin et al.	4,761,326	A	8/1988	Barnes et al.
4,591,085	A	5/1986	Di Giovanni	4,763,669	A	8/1988	Jaeger
RE32,214	E	7/1986	Schramm	4,767,044	A	8/1988	Green
4,597,753	A	7/1986	Turley	4,773,420	A	9/1988	Green
4,600,037	A	7/1986	Hatten	4,777,780	A	10/1988	Holzwarth
4,604,786	A	8/1986	Howie, Jr.	4,781,186	A	11/1988	Simpson et al.
4,605,001	A	8/1986	Rothfuss et al.	4,784,137	A	11/1988	Kulik et al.
4,605,004	A	8/1986	Di Giovanni et al.	4,787,387	A	11/1988	Burbank, III et al.
4,606,343	A	8/1986	Conta et al.	4,790,225	A	12/1988	Moody et al.
4,607,638	A	8/1986	Crainich	4,790,314	A	12/1988	Weaver
4,608,981	A	9/1986	Rothfuss et al.	4,805,617	A	2/1989	Bedi et al.
4,610,250	A	9/1986	Green	4,805,823	A	2/1989	Rothfuss
4,610,383	A	9/1986	Rothfuss et al.	4,807,628	A	2/1989	Peters et al.
4,612,933	A	9/1986	Brinkerhoff et al.	4,809,695	A	3/1989	Gwathmey et al.
D286,180	S	10/1986	Korthoff	4,815,460	A	3/1989	Porat et al.
D286,442	S	10/1986	Korthoff et al.	4,817,643	A	4/1989	Olson
4,617,914	A	10/1986	Ueda	4,817,847	A	4/1989	Redtenbacher et al.
4,619,262	A	10/1986	Taylor	4,819,853	A	4/1989	Green
4,619,391	A	10/1986	Sharkany et al.	4,821,939	A	4/1989	Green
D287,278	S	12/1986	Speckelmeier	4,827,911	A	5/1989	Broadwin et al.
4,628,459	A	12/1986	Shinohara et al.	4,828,542	A	5/1989	Hermann
4,629,107	A	12/1986	Fedotov et al.	4,828,944	A	5/1989	Yabe et al.
4,632,290	A	12/1986	Green et al.	4,830,855	A	5/1989	Stewart
4,633,861	A	1/1987	Chow et al.	4,833,937	A	5/1989	Nagano
4,633,874	A	1/1987	Chow et al.	4,834,720	A	5/1989	Blinkhorn
4,634,419	A	1/1987	Kreizman et al.	4,838,859	A	6/1989	Strassmann
4,635,638	A	1/1987	Weintraub et al.	4,844,068	A	7/1989	Arata et al.
4,641,076	A	2/1987	Linden	4,848,637	A	7/1989	Pruitt
4,642,618	A	2/1987	Johnson et al.	4,856,078	A	8/1989	Konopka
4,643,173	A	2/1987	Bell et al.	4,860,644	A	8/1989	Kohl et al.
4,643,731	A	2/1987	Eckenhoff	4,862,891	A	9/1989	Smith
4,646,722	A	3/1987	Silverstein et al.	4,863,423	A	9/1989	Wallace
4,646,745	A	3/1987	Noiles	4,865,030	A	9/1989	Polyak
4,652,820	A	3/1987	Maresca	4,868,530	A	9/1989	Ahs
4,654,028	A	3/1987	Suma	4,869,414	A	9/1989	Green et al.
4,655,222	A	4/1987	Florez et al.	4,869,415	A	9/1989	Fox
4,662,555	A	5/1987	Thornton	4,873,977	A	10/1989	Avant et al.
4,663,874	A	5/1987	Sano et al.	4,875,486	A	10/1989	Rapoport et al.
4,664,305	A	5/1987	Blake, III et al.	4,880,015	A	11/1989	Nierman
4,665,916	A	5/1987	Green	4,890,613	A	1/1990	Golden et al.
4,667,674	A	5/1987	Korthoff et al.	4,892,244	A	1/1990	Fox et al.
4,669,647	A	6/1987	Storace	4,893,622	A	1/1990	Green et al.
4,671,278	A	6/1987	Chin	4,894,051	A	1/1990	Shiber
4,671,280	A	6/1987	Dorband et al.	4,896,584	A	1/1990	Stoll et al.
4,671,445	A	6/1987	Barker et al.	4,896,678	A	1/1990	Ogawa
4,672,964	A	6/1987	Dee et al.	4,900,303	A	2/1990	Lemelson
4,675,944	A	6/1987	Wells	4,903,697	A	2/1990	Resnick et al.
4,676,245	A	6/1987	Fukuda	4,909,789	A	3/1990	Taguchi et al.
4,679,460	A	7/1987	Yoshigai	4,915,100	A	4/1990	Green
4,679,719	A	7/1987	Kramer	4,919,679	A	4/1990	Averill et al.
4,684,051	A	8/1987	Akopov et al.	4,921,479	A	5/1990	Grayzel
4,688,555	A	8/1987	Wardle	4,925,082	A	5/1990	Kim
4,691,703	A	9/1987	Auth et al.	4,928,699	A	5/1990	Sasai
4,693,248	A	9/1987	Failla	4,930,503	A	6/1990	Pruitt
4,698,579	A	10/1987	Richter et al.	4,930,674	A	6/1990	Barak
4,700,703	A	10/1987	Resnick et al.	4,931,047	A	6/1990	Broadwin et al.
4,705,038	A	11/1987	Sjostrom et al.	4,931,737	A	6/1990	Hishiki
4,708,141	A	11/1987	Inoue et al.	4,932,960	A	6/1990	Green et al.
4,709,120	A	11/1987	Pearson	4,933,800	A	6/1990	Yang
4,715,520	A	12/1987	Roehr, Jr. et al.	4,933,843	A	6/1990	Scheller et al.
4,719,917	A	1/1988	Barrows et al.	D309,350	S	7/1990	Sutherland et al.
4,721,099	A	1/1988	Chikama	4,938,408	A	7/1990	Bedi et al.
4,724,840	A	2/1988	McVay et al.	4,941,623	A	7/1990	Pruitt
4,727,308	A	2/1988	Huljak et al.	4,943,182	A	7/1990	Hoblingre
4,728,020	A	3/1988	Green et al.	4,944,443	A	7/1990	Odds et al.
4,728,876	A	3/1988	Mongeon et al.	4,946,067	A	8/1990	Kelsall
4,729,260	A	3/1988	Dudden	4,948,327	A	8/1990	Crupi, Jr.
4,730,726	A	3/1988	Holzwarth	4,949,707	A	8/1990	LeVahn et al.
4,741,336	A	5/1988	Failla et al.	4,951,860	A	8/1990	Peters et al.
				4,951,861	A	8/1990	Schulze et al.
				4,955,959	A	9/1990	Tompkins et al.
				4,957,212	A	9/1990	Duck et al.
				4,962,877	A	10/1990	Hervas

(56)

References Cited

U.S. PATENT DOCUMENTS

4,964,559 A	10/1990	Deniega et al.	5,156,609 A	10/1992	Nakao et al.
4,964,863 A	10/1990	Kanshin et al.	5,156,614 A	10/1992	Green et al.
4,965,709 A	10/1990	Ngo	5,158,567 A	10/1992	Green
4,973,274 A	11/1990	Hirukawa	D330,699 S	11/1992	Gill
4,973,302 A	11/1990	Armour et al.	5,163,598 A	11/1992	Peters et al.
4,978,049 A	12/1990	Green	5,168,605 A	12/1992	Bartlett
4,978,333 A	12/1990	Broadwin et al.	5,170,925 A	12/1992	Madden et al.
4,979,952 A	12/1990	Kubota et al.	5,171,247 A	12/1992	Hughett et al.
4,984,564 A	1/1991	Yuen	5,171,249 A	12/1992	Stefanchik et al.
4,986,808 A	1/1991	Broadwin et al.	5,171,253 A	12/1992	Klieman
4,987,049 A	1/1991	Komamura et al.	5,173,133 A	12/1992	Morin et al.
4,988,334 A	1/1991	Hornlein et al.	5,176,677 A	1/1993	Wuchinich
4,995,877 A	2/1991	Ams et al.	5,176,688 A	1/1993	Narayan et al.
4,995,959 A	2/1991	Metzner	5,187,422 A	2/1993	Izenbaard et al.
4,996,975 A	3/1991	Nakamura	5,188,102 A	2/1993	Idemoto et al.
5,002,543 A	3/1991	Bradshaw et al.	5,188,111 A	2/1993	Yates et al.
5,002,553 A	3/1991	Shiber	5,190,517 A	3/1993	Zieve et al.
5,005,754 A	4/1991	Van Overloop	5,190,544 A	3/1993	Chapman et al.
5,009,661 A	4/1991	Michelson	5,190,560 A	3/1993	Woods et al.
5,012,411 A	4/1991	Policastro et al.	5,192,288 A	3/1993	Thompson et al.
5,014,898 A	5/1991	Heidrich	5,195,505 A	3/1993	Josefsen
5,014,899 A	5/1991	Presty et al.	5,195,968 A	3/1993	Lundquist et al.
5,015,227 A	5/1991	Broadwin et al.	5,197,648 A	3/1993	Gingold
5,018,515 A	5/1991	Gilman	5,197,649 A	3/1993	Bessler et al.
5,018,657 A	5/1991	Pedlick et al.	5,197,966 A	3/1993	Sommerkamp
5,024,652 A	6/1991	Dumenek et al.	5,197,970 A	3/1993	Green et al.
5,024,671 A	6/1991	Tu et al.	5,200,280 A	4/1993	Karasa
5,025,559 A	6/1991	McCullough	5,201,750 A	4/1993	Hocherl et al.
5,027,834 A	7/1991	Pruitt	5,205,459 A	4/1993	Brinkerhoff et al.
5,030,226 A	7/1991	Green et al.	5,207,697 A	5/1993	Carusillo et al.
5,031,814 A	7/1991	Tompkins et al.	5,209,747 A	5/1993	Knoepfler
5,035,040 A	7/1991	Kerrigan et al.	5,209,756 A	5/1993	Seedhom et al.
5,038,109 A	8/1991	Goble et al.	5,211,649 A	5/1993	Kohler et al.
5,038,247 A	8/1991	Kelley et al.	5,211,655 A	5/1993	Hasson
5,040,715 A	8/1991	Green et al.	5,217,457 A	6/1993	Delahuerga et al.
5,042,707 A	8/1991	Taheri	5,217,478 A	6/1993	Rexroth
5,061,269 A	10/1991	Muller	5,219,111 A	6/1993	Bilotti et al.
5,062,491 A	11/1991	Takeshima et al.	5,220,269 A	6/1993	Chen et al.
5,062,563 A	11/1991	Green et al.	5,221,036 A	6/1993	Takase
5,065,929 A	11/1991	Schulze et al.	5,221,281 A	6/1993	Klicek
5,071,052 A	12/1991	Rodak et al.	5,222,945 A	6/1993	Basnight
5,071,430 A	12/1991	de Salis et al.	5,222,963 A	6/1993	Brinkerhoff et al.
5,074,454 A	12/1991	Peters	5,222,975 A	6/1993	Crainich
5,077,506 A	12/1991	Krause	5,222,976 A	6/1993	Yoon
5,079,006 A	1/1992	Urquhart	5,223,675 A	6/1993	Taft
5,080,556 A	1/1992	Carreno	D338,729 S	8/1993	Sprecklemeier et al.
5,083,695 A	1/1992	Foslien et al.	5,234,447 A	8/1993	Kaster et al.
5,084,057 A	1/1992	Green et al.	5,236,424 A	8/1993	Imran
5,088,979 A	2/1992	Filipi et al.	5,236,440 A	8/1993	Hlavacek
5,088,997 A	2/1992	Delahuerga et al.	5,239,981 A	8/1993	Anapliotis
5,089,606 A	2/1992	Cole et al.	5,240,163 A	8/1993	Stein et al.
5,094,247 A	3/1992	Hernandez et al.	5,242,457 A	9/1993	Akopov et al.
5,098,004 A	3/1992	Kerrigan	5,244,462 A	9/1993	Delahuerga et al.
5,098,360 A	3/1992	Hirota	5,246,156 A	9/1993	Rothfuss et al.
5,100,042 A	3/1992	Gravener et al.	5,246,443 A	9/1993	Mai
5,100,420 A	3/1992	Green et al.	5,253,793 A	10/1993	Green et al.
5,104,025 A	4/1992	Main et al.	5,258,007 A	11/1993	Spetzler et al.
5,104,397 A	4/1992	Vasconcelos et al.	5,258,008 A	11/1993	Wilk
5,104,400 A	4/1992	Berguer et al.	5,258,009 A	11/1993	Connors
5,106,008 A	4/1992	Tompkins et al.	5,258,010 A	11/1993	Green et al.
5,108,368 A	4/1992	Hammerslag et al.	5,258,012 A	11/1993	Luscombe et al.
5,109,722 A	5/1992	Hufnagle et al.	5,259,366 A	11/1993	Reydel et al.
5,111,987 A	5/1992	Moeinzadeh et al.	5,259,835 A	11/1993	Clark et al.
5,116,349 A	5/1992	Aranyi	5,260,637 A	11/1993	Pizzi
D327,323 S	6/1992	Hunt	5,261,877 A	11/1993	Fine et al.
5,119,009 A	6/1992	McCaleb et al.	5,261,922 A	11/1993	Hood
5,122,156 A	6/1992	Granger et al.	5,263,629 A	11/1993	Trumbull et al.
5,124,990 A	6/1992	Williamson	5,263,937 A	11/1993	Shipp
5,129,570 A	7/1992	Schulze et al.	5,263,973 A	11/1993	Cook
5,137,198 A	8/1992	Nobis et al.	5,264,218 A	11/1993	Rogozinski
5,139,513 A	8/1992	Segato	5,268,622 A	12/1993	Philipp
5,141,144 A	8/1992	Foslien et al.	5,271,543 A	12/1993	Grant et al.
5,142,932 A	9/1992	Moya et al.	5,271,544 A	12/1993	Fox et al.
5,155,941 A	10/1992	Takahashi et al.	RE34,519 E	1/1994	Fox et al.
5,156,315 A	10/1992	Green et al.	5,275,322 A	1/1994	Brinkerhoff et al.
			5,275,323 A	1/1994	Schulze et al.
			5,275,608 A	1/1994	Forman et al.
			5,279,416 A	1/1994	Malec et al.
			5,281,216 A	1/1994	Klicek

(56)

References Cited

U.S. PATENT DOCUMENTS

5,282,806 A	2/1994	Haber et al.	5,360,428 A	11/1994	Hutchinson, Jr.
5,282,829 A	2/1994	Hermes	5,364,001 A	11/1994	Bryan
5,284,128 A	2/1994	Hart	5,364,002 A	11/1994	Green et al.
5,285,381 A	2/1994	Iskarous et al.	5,364,003 A	11/1994	Williamson, IV
5,285,945 A	2/1994	Brinkerhoff et al.	5,366,133 A	11/1994	Geiste
5,286,253 A	2/1994	Fucci	5,366,134 A	11/1994	Green et al.
5,289,963 A	3/1994	McGarry et al.	5,366,479 A	11/1994	McGarry et al.
5,290,271 A	3/1994	Jernberg	5,368,015 A	11/1994	Wilk
5,290,310 A	3/1994	Makower et al.	5,368,592 A	11/1994	Stern et al.
5,292,053 A	3/1994	Bilotti et al.	5,369,565 A	11/1994	Chen et al.
5,293,024 A	3/1994	Sugahara et al.	5,370,645 A	12/1994	Kliceck et al.
5,297,714 A	3/1994	Kramer	5,372,124 A	12/1994	Takayama et al.
5,304,204 A	4/1994	Bregen	5,372,596 A	12/1994	Kliceck et al.
D347,474 S	5/1994	Olson	5,372,602 A	12/1994	Burke
5,307,976 A	5/1994	Olson et al.	5,374,277 A	12/1994	Hassler
5,308,576 A	5/1994	Green et al.	5,375,588 A	12/1994	Yoon
5,309,387 A	5/1994	Mori et al.	5,376,095 A	12/1994	Ortiz
5,309,927 A	5/1994	Welch	5,379,933 A	1/1995	Green et al.
5,312,023 A	5/1994	Green et al.	5,381,649 A	1/1995	Webb
5,312,024 A	5/1994	Grant et al.	5,381,782 A	1/1995	DeLaRama et al.
5,312,329 A	5/1994	Beaty et al.	5,381,943 A	1/1995	Allen et al.
5,313,935 A	5/1994	Kortenbach et al.	5,382,247 A	1/1995	Cimino et al.
5,313,967 A	5/1994	Lieber et al.	5,383,880 A	1/1995	Hooven
5,314,424 A	5/1994	Nicholas	5,383,881 A	1/1995	Green et al.
5,314,445 A	5/1994	Heidmueller et al.	5,383,882 A	1/1995	Buess et al.
5,314,466 A	5/1994	Stern et al.	5,383,888 A	1/1995	Zvenyatsky et al.
5,318,221 A	6/1994	Green et al.	5,383,895 A	1/1995	Holmes et al.
5,320,627 A	6/1994	Sorensen et al.	5,388,568 A	2/1995	van der Heide
D348,930 S	7/1994	Olson	5,389,098 A	2/1995	Tsuruta et al.
5,326,013 A	7/1994	Green et al.	5,389,102 A	2/1995	Green et al.
5,329,923 A	7/1994	Lundquist	5,389,104 A	2/1995	Hahnen et al.
5,330,487 A	7/1994	Thornton et al.	5,391,180 A	2/1995	Tovey et al.
5,330,502 A	7/1994	Hassler et al.	5,392,979 A	2/1995	Green et al.
5,331,971 A	7/1994	Bales et al.	5,395,030 A	3/1995	Kuramoto et al.
5,332,142 A	7/1994	Robinson et al.	5,395,033 A	3/1995	Byrne et al.
5,333,422 A	8/1994	Warren et al.	5,395,034 A	3/1995	Allen et al.
5,333,772 A	8/1994	Rothfuss et al.	5,395,312 A	3/1995	Desai
5,333,773 A	8/1994	Main et al.	5,395,384 A	3/1995	Duthoit et al.
5,334,183 A	8/1994	Wuchinich	5,397,046 A	3/1995	Savage et al.
5,336,130 A	8/1994	Ray	5,397,324 A	3/1995	Carroll et al.
5,336,229 A	8/1994	Noda	5,400,267 A	3/1995	Denen et al.
5,336,232 A	8/1994	Green et al.	5,403,276 A	4/1995	Schechter et al.
5,339,799 A	8/1994	Kami et al.	5,403,312 A	4/1995	Yates et al.
5,341,724 A	8/1994	Vatel	5,404,106 A	4/1995	Matsuda
5,341,807 A	8/1994	Nardella	5,404,870 A	4/1995	Brinkerhoff et al.
5,341,810 A	8/1994	Dardel	5,404,960 A	4/1995	Wada et al.
5,342,380 A	8/1994	Hood	5,405,072 A	4/1995	Zlock et al.
5,342,381 A	8/1994	Tidemand	5,405,073 A	4/1995	Porter
5,342,385 A	8/1994	Norelli et al.	5,405,344 A	4/1995	Williamson et al.
5,342,395 A	8/1994	Jarrett et al.	5,405,360 A	4/1995	Tovey
5,342,396 A	8/1994	Cook	5,407,293 A	4/1995	Crainich
5,343,382 A	8/1994	Hale et al.	5,408,409 A	4/1995	Glassman et al.
5,343,391 A	8/1994	Mushabac	5,409,498 A	4/1995	Braddock et al.
5,344,059 A	9/1994	Green et al.	5,409,703 A	4/1995	McAnalley et al.
5,344,060 A	9/1994	Gravener et al.	D357,981 S	5/1995	Green et al.
5,344,454 A	9/1994	Clarke et al.	5,411,481 A	5/1995	Allen et al.
5,346,504 A	9/1994	Ortiz et al.	5,411,508 A	5/1995	Bessler et al.
5,348,259 A	9/1994	Blanco et al.	5,413,107 A	5/1995	Oakley et al.
5,350,355 A	9/1994	Sklar	5,413,267 A	5/1995	Solyntjes et al.
5,350,388 A	9/1994	Epstein	5,413,268 A	5/1995	Green et al.
5,350,391 A	9/1994	Iacovelli	5,413,272 A	5/1995	Green et al.
5,350,400 A	9/1994	Esposito et al.	5,413,573 A	5/1995	Koivukangas
5,352,229 A	10/1994	Goble et al.	5,415,334 A	5/1995	Williamson et al.
5,352,235 A	10/1994	Koros et al.	5,415,335 A	5/1995	Knodell, Jr.
5,352,238 A	10/1994	Green et al.	5,417,203 A	5/1995	Tovey et al.
5,354,250 A	10/1994	Christensen	5,417,361 A	5/1995	Williamson, IV
5,354,303 A	10/1994	Spaeth et al.	5,419,766 A	5/1995	Chang et al.
5,356,006 A	10/1994	Alpern et al.	5,421,829 A	6/1995	Olichney et al.
5,356,064 A	10/1994	Green et al.	5,422,567 A	6/1995	Matsunaga
5,358,506 A	10/1994	Green et al.	5,423,471 A	6/1995	Mastri et al.
5,358,510 A	10/1994	Luscombe et al.	5,423,809 A	6/1995	Kliceck
5,359,231 A	10/1994	Flowers et al.	5,423,835 A	6/1995	Green et al.
D352,780 S	11/1994	Glaeser et al.	5,425,745 A	6/1995	Green et al.
5,359,993 A	11/1994	Slater et al.	5,427,298 A	6/1995	Tegtmeier
5,360,305 A	11/1994	Kerrigan	5,431,322 A	7/1995	Green et al.
			5,431,323 A	7/1995	Smith et al.
			5,431,654 A	7/1995	Nic
			5,431,668 A	7/1995	Burbank, III et al.
			5,433,721 A	7/1995	Hooven et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

5,437,681 A	8/1995	Meade et al.	5,496,312 A	3/1996	Klicek
5,438,302 A	8/1995	Goble	5,496,317 A	3/1996	Goble et al.
5,439,155 A	8/1995	Viola	5,497,933 A	3/1996	DeFonzo et al.
5,439,156 A	8/1995	Grant et al.	5,501,654 A	3/1996	Failla et al.
5,439,479 A	8/1995	Shichman et al.	5,503,320 A	4/1996	Webster et al.
5,441,191 A	8/1995	Linden	5,503,635 A	4/1996	Sauer et al.
5,441,193 A	8/1995	Gravener	5,503,638 A	4/1996	Cooper et al.
5,441,483 A	8/1995	Avitall	5,505,363 A	4/1996	Green et al.
5,441,494 A	8/1995	Ortiz	5,507,426 A	4/1996	Young et al.
5,443,197 A	8/1995	Malis et al.	5,509,596 A	4/1996	Green et al.
5,443,463 A	8/1995	Stern et al.	5,509,916 A	4/1996	Taylor
5,444,113 A	8/1995	Sinclair et al.	5,511,564 A	4/1996	Wilk
5,445,155 A	8/1995	Sieben	5,514,129 A	5/1996	Smith
5,445,304 A	8/1995	Plyley et al.	5,514,149 A	5/1996	Green et al.
5,445,604 A	8/1995	Lang	5,514,157 A	5/1996	Nicholas et al.
5,445,644 A	8/1995	Pietrafitta et al.	5,518,163 A	5/1996	Hooven
5,447,265 A	9/1995	Vidal et al.	5,518,164 A	5/1996	Hooven
5,447,417 A	9/1995	Kuhl et al.	5,520,609 A	5/1996	Moll et al.
5,447,513 A	9/1995	Davison et al.	5,520,634 A	5/1996	Fox et al.
5,449,355 A	9/1995	Rhum et al.	5,520,678 A	5/1996	Heckeke et al.
5,449,365 A	9/1995	Green et al.	5,520,700 A	5/1996	Beyar et al.
5,449,370 A	9/1995	Vaitekunas	5,522,817 A	6/1996	Sander et al.
5,452,836 A	9/1995	Huitema et al.	5,522,831 A	6/1996	Sleister et al.
5,452,837 A	9/1995	Williamson, IV et al.	5,527,264 A	6/1996	Moll et al.
5,454,378 A	10/1995	Palmer et al.	5,527,320 A	6/1996	Carruthers et al.
5,454,822 A	10/1995	Schob et al.	5,529,235 A	6/1996	Boiarski et al.
5,454,827 A	10/1995	Aust et al.	D372,086 S	7/1996	Grasso et al.
5,456,401 A	10/1995	Green et al.	5,531,305 A	7/1996	Roberts et al.
5,456,917 A	10/1995	Wise et al.	5,531,744 A	7/1996	Nardella et al.
5,458,279 A	10/1995	Plyley	5,531,856 A	7/1996	Moll et al.
5,458,579 A	10/1995	Chodorow et al.	5,533,521 A	7/1996	Granger
5,462,215 A	10/1995	Viola et al.	5,533,581 A	7/1996	Barth et al.
5,464,013 A	11/1995	Lemelson	5,533,661 A	7/1996	Main et al.
5,464,144 A	11/1995	Guy et al.	5,535,934 A	7/1996	Boiarski et al.
5,464,300 A	11/1995	Crainich	5,535,935 A	7/1996	Vidal et al.
5,465,819 A	11/1995	Weilant et al.	5,535,937 A	7/1996	Boiarski et al.
5,465,894 A	11/1995	Clark et al.	5,540,375 A	7/1996	Bolanos et al.
5,465,895 A	11/1995	Knodel et al.	5,540,705 A	7/1996	Meade et al.
5,465,896 A	11/1995	Allen et al.	5,541,376 A	7/1996	Ladtchow et al.
5,466,020 A	11/1995	Page et al.	5,541,489 A	7/1996	Dunstan
5,467,911 A	11/1995	Tsuruta et al.	5,542,594 A	8/1996	McKean et al.
5,468,253 A	11/1995	Bezwada et al.	5,542,949 A	8/1996	Yoon
5,470,006 A	11/1995	Rodak	5,543,119 A	8/1996	Sutter et al.
5,470,007 A	11/1995	Plyley et al.	5,543,695 A	8/1996	Culp et al.
5,470,008 A	11/1995	Rodak	5,544,802 A	8/1996	Crainich
5,470,009 A	11/1995	Rodak	5,547,117 A	8/1996	Hamblin et al.
5,470,010 A	11/1995	Rothfuss et al.	5,549,583 A	8/1996	Sanford et al.
5,471,129 A	11/1995	Mann	5,549,621 A	8/1996	Bessler et al.
5,472,132 A	12/1995	Savage et al.	5,549,627 A	8/1996	Kieturakis
5,472,442 A	12/1995	Klicek	5,549,628 A	8/1996	Cooper et al.
5,473,204 A	12/1995	Temple	5,549,637 A	8/1996	Crainich
5,474,057 A	12/1995	Makower et al.	5,551,622 A	9/1996	Yoon
5,474,223 A	12/1995	Viola et al.	5,553,624 A	9/1996	Francesce et al.
5,474,566 A	12/1995	Alesi et al.	5,553,675 A	9/1996	Pitzen et al.
5,476,206 A	12/1995	Green et al.	5,553,765 A	9/1996	Knodel et al.
5,476,479 A	12/1995	Green et al.	5,554,148 A	9/1996	Aebischer et al.
5,476,481 A	12/1995	Schondorf	5,554,169 A	9/1996	Green et al.
5,478,003 A	12/1995	Green et al.	5,556,020 A	9/1996	Hou
5,478,354 A	12/1995	Tovey et al.	5,556,416 A	9/1996	Clark et al.
5,480,089 A	1/1996	Blewett	5,558,533 A	9/1996	Hashizawa et al.
5,480,409 A	1/1996	Riza	5,558,665 A	9/1996	Kieturakis
5,482,197 A	1/1996	Green et al.	5,558,671 A	9/1996	Yates
5,483,952 A	1/1996	Aranyi	5,560,530 A	10/1996	Bolanos et al.
5,484,095 A	1/1996	Green et al.	5,560,532 A	10/1996	DeFonzo et al.
5,484,398 A	1/1996	Stoddard	5,561,881 A	10/1996	Klinger et al.
5,484,451 A	1/1996	Akopov et al.	5,562,239 A	10/1996	Boiarski et al.
5,485,947 A	1/1996	Olson et al.	5,562,241 A	10/1996	Knodel et al.
5,485,952 A	1/1996	Fontayne	5,562,682 A	10/1996	Oberlin et al.
5,487,499 A	1/1996	Sorrentino et al.	5,562,690 A	10/1996	Green et al.
5,487,500 A	1/1996	Knodel et al.	5,562,701 A	10/1996	Huitema et al.
5,489,058 A	2/1996	Plyley et al.	5,562,702 A	10/1996	Huitema et al.
5,489,256 A	2/1996	Adair	5,563,481 A	10/1996	Krause
5,489,290 A	2/1996	Furnish	5,564,615 A	10/1996	Bishop et al.
5,490,819 A	2/1996	Nicholas et al.	5,569,161 A	10/1996	Ebling et al.
5,492,671 A	2/1996	Krafft	5,569,270 A	10/1996	Weng
			5,569,284 A	10/1996	Young et al.
			5,571,090 A	11/1996	Sherts
			5,571,100 A	11/1996	Goble et al.
			5,571,116 A	11/1996	Bolanos et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

5,571,285 A	11/1996	Chow et al.	D381,077 S	7/1997	Hunt
5,571,488 A	11/1996	Beerstecher et al.	5,643,291 A	7/1997	Pier et al.
5,573,169 A	11/1996	Green et al.	5,643,294 A	7/1997	Tovey et al.
5,573,543 A	11/1996	Akopov et al.	5,643,319 A	7/1997	Green et al.
5,574,431 A	11/1996	McKeown et al.	5,645,209 A	7/1997	Green et al.
5,575,054 A	11/1996	Klinzing et al.	5,647,526 A	7/1997	Green et al.
5,575,789 A	11/1996	Bell et al.	5,647,869 A	7/1997	Goble et al.
5,575,799 A	11/1996	Bolanos et al.	5,649,937 A	7/1997	Bito et al.
5,575,803 A	11/1996	Cooper et al.	5,649,956 A	7/1997	Jensen et al.
5,575,805 A	11/1996	Li	5,651,491 A	7/1997	Heaton et al.
5,577,654 A	11/1996	Bishop	5,651,762 A	7/1997	Bridges
5,578,052 A	11/1996	Koros et al.	5,651,821 A	7/1997	Uchida
5,579,978 A	12/1996	Green et al.	5,653,373 A	8/1997	Green et al.
5,580,067 A	12/1996	Hamblin et al.	5,653,374 A	8/1997	Young et al.
5,582,611 A	12/1996	Tsuruta et al.	5,653,677 A	8/1997	Okada et al.
5,582,617 A	12/1996	Klieman et al.	5,653,721 A	8/1997	Knodel et al.
5,583,114 A	12/1996	Barrows et al.	5,655,698 A	8/1997	Yoon
5,584,425 A	12/1996	Savage et al.	5,657,417 A	8/1997	Di Troia
5,586,711 A	12/1996	Plyley et al.	5,657,429 A	8/1997	Wang et al.
5,588,579 A	12/1996	Schnut et al.	5,657,921 A	8/1997	Young et al.
5,588,580 A	12/1996	Paul et al.	5,658,238 A	8/1997	Suzuki et al.
5,588,581 A	12/1996	Conlon et al.	5,658,281 A	8/1997	Heard
5,591,170 A	1/1997	Spievack et al.	5,658,298 A	8/1997	Vincent et al.
5,591,187 A	1/1997	Dekel	5,658,300 A	8/1997	Bito et al.
5,597,107 A	1/1997	Knodel et al.	5,658,307 A	8/1997	Exconde
5,599,151 A	2/1997	Daum et al.	5,662,258 A	9/1997	Knodel et al.
5,599,279 A	2/1997	Slotman et al.	5,662,260 A	9/1997	Yoon
5,599,344 A	2/1997	Paterson	5,662,662 A	9/1997	Bishop et al.
5,599,350 A	2/1997	Schulze et al.	5,662,667 A	9/1997	Knodel
5,599,852 A	2/1997	Scopelianos et al.	5,665,085 A	9/1997	Nardella
5,601,224 A	2/1997	Bishop et al.	5,667,517 A	9/1997	Hooven
5,601,573 A	2/1997	Fogelberg et al.	5,667,526 A	9/1997	Levin
5,601,604 A	2/1997	Vincent	5,667,527 A	9/1997	Cook
5,602,449 A	2/1997	Krause et al.	5,669,544 A	9/1997	Schulze et al.
5,603,443 A	2/1997	Clark et al.	5,669,904 A	9/1997	Platt, Jr. et al.
5,605,272 A	2/1997	Witt et al.	5,669,907 A	9/1997	Platt, Jr. et al.
5,605,273 A	2/1997	Hamblin et al.	5,669,918 A	9/1997	Balazs et al.
5,607,094 A	3/1997	Clark et al.	5,673,840 A	10/1997	Schulze et al.
5,607,095 A	3/1997	Smith et al.	5,673,841 A	10/1997	Schulze et al.
5,607,433 A	3/1997	Polla et al.	5,673,842 A	10/1997	Bittner et al.
5,607,450 A	3/1997	Zvenyatsky et al.	5,674,286 A	10/1997	D'Alessio et al.
5,607,474 A	3/1997	Athanasiou et al.	5,678,748 A	10/1997	Plyley et al.
5,609,285 A	3/1997	Grant et al.	5,680,981 A	10/1997	Mililli et al.
5,609,601 A	3/1997	Kolesa et al.	5,680,982 A	10/1997	Schulze et al.
5,611,709 A	3/1997	McAnulty	5,680,983 A	10/1997	Plyley et al.
5,613,499 A	3/1997	Palmer et al.	5,681,341 A	10/1997	Lunsford et al.
5,613,937 A	3/1997	Garrison et al.	5,683,349 A	11/1997	Makower et al.
5,613,966 A	3/1997	Makower et al.	5,685,474 A	11/1997	Seeber
5,614,887 A	3/1997	Buchbinder	5,686,090 A	11/1997	Schilder et al.
5,615,820 A	4/1997	Viola	5,688,270 A	11/1997	Yates et al.
5,618,294 A	4/1997	Aust et al.	5,690,269 A	11/1997	Bolanos et al.
5,618,303 A	4/1997	Marlow et al.	5,692,668 A	12/1997	Schulze et al.
5,618,307 A	4/1997	Donlon et al.	5,693,020 A	12/1997	Rauh
5,619,992 A	4/1997	Guthrie et al.	5,693,042 A	12/1997	Boiarski et al.
5,620,289 A	4/1997	Curry	5,693,051 A	12/1997	Schulze et al.
5,620,326 A	4/1997	Younker	5,695,494 A	12/1997	Becker
5,620,452 A	4/1997	Yoon	5,695,502 A	12/1997	Pier et al.
5,624,398 A	4/1997	Smith et al.	5,695,504 A	12/1997	Gifford, III et al.
5,624,452 A	4/1997	Yates	5,695,524 A	12/1997	Kelley et al.
5,626,587 A	5/1997	Bishop et al.	5,697,542 A	12/1997	Knodel et al.
5,626,595 A	5/1997	Sklar et al.	5,697,543 A	12/1997	Burdorff
5,628,446 A	5/1997	Geiste et al.	5,697,909 A	12/1997	Eggers et al.
5,628,743 A	5/1997	Cimino	5,697,943 A	12/1997	Sauer et al.
5,628,745 A	5/1997	Bek	5,700,270 A	12/1997	Peyser et al.
5,630,539 A	5/1997	Plyley et al.	5,700,276 A	12/1997	Benecke
5,630,540 A	5/1997	Blewett	5,702,387 A	12/1997	Arts et al.
5,630,541 A	5/1997	Williamson, IV et al.	5,702,408 A	12/1997	Wales et al.
5,630,782 A	5/1997	Adair	5,702,409 A	12/1997	Rayburn et al.
5,632,432 A	5/1997	Schulze et al.	5,704,087 A	1/1998	Strub
5,632,433 A	5/1997	Grant et al.	5,704,534 A	1/1998	Huitema et al.
5,633,374 A	5/1997	Humphrey et al.	5,706,997 A	1/1998	Green et al.
5,634,584 A	6/1997	Okorocho et al.	5,706,998 A	1/1998	Plyley et al.
5,636,779 A	6/1997	Palmer	5,707,392 A	1/1998	Kortenbach
5,636,780 A	6/1997	Green et al.	5,709,334 A	1/1998	Sorrentino et al.
5,639,008 A	6/1997	Gallagher et al.	5,709,335 A	1/1998	Heck
			5,709,680 A	1/1998	Yates et al.
			5,709,706 A	1/1998	Kienzle et al.
			5,711,472 A	1/1998	Bryan
			5,712,460 A	1/1998	Carr et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

5,713,128 A	2/1998	Schrenk et al.	5,797,537 A	8/1998	Oberlin et al.
5,713,505 A	2/1998	Huitema	5,797,538 A	8/1998	Heaton et al.
5,713,895 A	2/1998	Lontine et al.	5,797,637 A	8/1998	Ervin
5,713,896 A	2/1998	Nardella	5,797,906 A	8/1998	Rhum et al.
5,713,920 A	2/1998	Bezwada et al.	5,797,927 A	8/1998	Yoon
5,715,604 A	2/1998	Lanzoni	5,797,941 A	8/1998	Schulze et al.
5,715,987 A	2/1998	Kelley et al.	5,797,959 A	8/1998	Castro et al.
5,715,988 A	2/1998	Palmer	5,799,857 A	9/1998	Robertson et al.
5,716,366 A	2/1998	Yates	5,800,379 A	9/1998	Edwards
5,718,359 A	2/1998	Palmer et al.	5,800,423 A	9/1998	Jensen
5,718,360 A	2/1998	Green et al.	5,804,726 A	9/1998	Geib et al.
5,718,548 A	2/1998	Cotellessa	5,804,936 A	9/1998	Brodsky et al.
5,718,714 A	2/1998	Livneh	5,806,676 A	9/1998	Wasgien
5,720,744 A	2/1998	Eggleston et al.	5,807,376 A	9/1998	Viola et al.
D393,067 S	3/1998	Geary et al.	5,807,378 A	9/1998	Jensen et al.
5,724,025 A	3/1998	Tavori	5,807,393 A	9/1998	Williamson, IV et al.
5,725,536 A	3/1998	Oberlin et al.	5,809,441 A	9/1998	McKee
5,725,554 A	3/1998	Simon et al.	5,810,721 A	9/1998	Mueller et al.
5,728,110 A	3/1998	Vidal et al.	5,810,811 A	9/1998	Yates et al.
5,728,113 A	3/1998	Sherts	5,810,846 A	9/1998	Virnich et al.
5,728,121 A	3/1998	Bimbo et al.	5,810,855 A	9/1998	Rayburn et al.
5,730,758 A	3/1998	Allgeyer	5,813,813 A	9/1998	Daum et al.
5,732,821 A	3/1998	Stone et al.	5,814,055 A	9/1998	Knodel et al.
5,732,871 A	3/1998	Clark et al.	5,814,057 A	9/1998	Oi et al.
5,732,872 A	3/1998	Bolduc et al.	5,816,471 A	10/1998	Plyley et al.
5,733,308 A	3/1998	Daugherty et al.	5,817,084 A	10/1998	Jensen
5,735,445 A	4/1998	Vidal et al.	5,817,091 A	10/1998	Nardella et al.
5,735,848 A	4/1998	Yates et al.	5,817,093 A	10/1998	Williamson, IV et al.
5,735,874 A	4/1998	Measamer et al.	5,817,109 A	10/1998	McGarry et al.
5,738,474 A	4/1998	Blewett	5,817,119 A	10/1998	Klieman et al.
5,738,629 A	4/1998	Moll et al.	5,820,009 A	10/1998	Melling et al.
5,738,648 A	4/1998	Lands et al.	5,823,066 A	10/1998	Huitema et al.
5,741,271 A	4/1998	Nakao et al.	5,824,333 A	10/1998	Scopelianos et al.
5,743,456 A	4/1998	Jones et al.	5,826,776 A	10/1998	Schulze et al.
5,747,953 A	5/1998	Philipp	5,827,271 A	10/1998	Buyse et al.
5,749,889 A	5/1998	Bacich et al.	5,827,298 A	10/1998	Hart et al.
5,749,893 A	5/1998	Vidal et al.	5,829,662 A	11/1998	Allen et al.
5,749,968 A	5/1998	Melanson et al.	5,830,598 A	11/1998	Patterson
5,752,644 A	5/1998	Bolanos et al.	5,833,690 A	11/1998	Yates et al.
5,752,965 A	5/1998	Francis et al.	5,833,695 A	11/1998	Yoon
5,752,970 A	5/1998	Yoon	5,833,696 A	11/1998	Whitfield et al.
5,755,717 A	5/1998	Yates et al.	5,836,503 A	11/1998	Ehrenfels et al.
5,758,814 A	6/1998	Gallagher et al.	5,836,960 A	11/1998	Kolesa et al.
5,762,255 A	6/1998	Chrisman et al.	5,839,369 A	11/1998	Chatterjee et al.
5,762,256 A	6/1998	Mastri et al.	5,839,639 A	11/1998	Sauer et al.
5,766,188 A	6/1998	Igaki	5,843,021 A	12/1998	Edwards et al.
5,766,205 A	6/1998	Zvenyatsky et al.	5,843,096 A	12/1998	Igaki et al.
5,769,303 A	6/1998	Knodel et al.	5,843,097 A	12/1998	Mayenberger et al.
5,769,748 A	6/1998	Eyerly et al.	5,843,122 A	12/1998	Riza
5,769,791 A	6/1998	Benaron et al.	5,843,132 A	12/1998	Ilvento
5,769,892 A	6/1998	Kingwell	5,843,169 A	12/1998	Taheri
5,772,379 A	6/1998	Evensen	5,846,254 A	12/1998	Schulze et al.
5,772,578 A	6/1998	Heimberger et al.	5,847,566 A	12/1998	Marritt et al.
5,772,659 A	6/1998	Becker et al.	5,849,011 A	12/1998	Jones et al.
5,776,130 A	7/1998	Buyse et al.	5,849,020 A	12/1998	Long et al.
5,778,939 A	7/1998	Hok-Yin	5,849,023 A	12/1998	Mericle
5,779,130 A	7/1998	Alesi et al.	5,851,179 A	12/1998	Ritson et al.
5,779,131 A	7/1998	Knodel et al.	5,853,366 A	12/1998	Dowlatsahi
5,779,132 A	7/1998	Knodel et al.	5,855,311 A	1/1999	Hamblin et al.
5,782,396 A	7/1998	Mastri et al.	5,855,583 A	1/1999	Wang et al.
5,782,397 A	7/1998	Koukline	5,860,581 A	1/1999	Robertson et al.
5,782,748 A	7/1998	Palmer et al.	5,860,975 A	1/1999	Goble et al.
5,782,749 A	7/1998	Riza	5,865,361 A	2/1999	Milliman et al.
5,782,859 A	7/1998	Nicholas et al.	5,865,638 A	2/1999	Trafion
5,784,934 A	7/1998	Izumisawa	5,868,361 A	2/1999	Rinderer
5,785,232 A	7/1998	Vidal et al.	5,868,760 A	2/1999	McGuckin, Jr.
5,785,647 A	7/1998	Tompkins et al.	5,868,790 A	2/1999	Vincent et al.
5,787,897 A	8/1998	Kieturakis	5,871,135 A	2/1999	Williamson, IV et al.
5,791,231 A	8/1998	Cohn et al.	5,873,885 A	2/1999	Weidenbenner
5,792,135 A	8/1998	Madhani et al.	5,876,401 A	3/1999	Schulze et al.
5,792,162 A	8/1998	Jolly et al.	5,878,193 A	3/1999	Wang et al.
5,792,165 A	8/1998	Klieman et al.	5,878,607 A	3/1999	Nunes et al.
5,794,834 A	8/1998	Hamblin et al.	5,878,937 A	3/1999	Green et al.
5,796,188 A	8/1998	Bays	5,878,938 A	3/1999	Bittner et al.
5,797,536 A	8/1998	Smith et al.	5,881,777 A	3/1999	Bassi et al.
			5,891,094 A	4/1999	Masterson et al.
			5,891,160 A	4/1999	Williamson, IV et al.
			5,891,558 A	4/1999	Bell et al.
			5,893,506 A	4/1999	Powell

(56)

References Cited

U.S. PATENT DOCUMENTS

5,893,835 A	4/1999	Witt et al.	6,017,356 A	1/2000	Frederick et al.
5,893,878 A	4/1999	Pierce	6,018,227 A	1/2000	Kumar et al.
5,894,979 A	4/1999	Powell	6,019,745 A	2/2000	Gray
5,897,552 A	4/1999	Edwards et al.	6,022,352 A	2/2000	Vandewalle
5,897,562 A	4/1999	Bolanos et al.	6,023,641 A	2/2000	Thompson
5,899,824 A	5/1999	Kurtz et al.	6,024,708 A	2/2000	Bales et al.
5,899,914 A	5/1999	Zirps et al.	6,024,741 A *	2/2000	Williamson, IV
5,901,895 A	5/1999	Heaton et al.			A61B 17/07207
5,902,312 A	5/1999	Frater et al.	6,024,748 A	2/2000	606/40
5,903,117 A	5/1999	Gregory	6,024,750 A	2/2000	Manzo et al.
5,904,647 A	5/1999	Ouchi	6,024,764 A	2/2000	Mastri et al.
5,904,693 A	5/1999	Dicesare et al.	6,027,501 A	2/2000	Schroepfel
5,904,702 A	5/1999	Ek et al.	6,030,384 A	2/2000	Goble et al.
5,906,577 A	5/1999	Beane et al.	6,032,849 A *	3/2000	Nezhat
5,906,625 A	5/1999	Bito et al.			Mastri A61B 17/07207
5,907,211 A	5/1999	Hall et al.	6,033,105 A	3/2000	227/176.1
5,908,402 A	6/1999	Blythe	6,033,378 A	3/2000	Barker et al.
5,908,427 A	6/1999	McKean et al.	6,033,399 A	3/2000	Lundquist et al.
5,909,062 A	6/1999	Krietzman	6,033,427 A	3/2000	Gines
5,911,353 A	6/1999	Bolanos et al.	6,036,667 A	3/2000	Lee
5,915,616 A	6/1999	Viola et al.	6,037,724 A	3/2000	Manna et al.
5,916,225 A	6/1999	Kugel	6,037,927 A	3/2000	Buss et al.
5,918,791 A	7/1999	Sorrentino et al.	6,039,733 A	3/2000	Rosenberg
5,919,198 A	7/1999	Graves, Jr. et al.	6,039,734 A	3/2000	Buyse et al.
5,921,956 A	7/1999	Grinberg et al.	6,042,601 A	3/2000	Goble
5,924,864 A	7/1999	Loge et al.	6,042,607 A	3/2000	Smith
5,928,137 A	7/1999	Green	6,043,626 A	3/2000	Williamson, IV et al.
5,928,256 A	7/1999	Riza	6,045,560 A	4/2000	Snyder et al.
5,931,847 A	8/1999	Bittner et al.	6,047,861 A	4/2000	McKean et al.
5,931,853 A	8/1999	McEwen et al.	6,049,145 A	4/2000	Vidal et al.
5,937,951 A	8/1999	Izuchukwu et al.	6,050,172 A	4/2000	Austin et al.
5,938,667 A	8/1999	Peyser et al.	6,050,472 A	4/2000	Corves et al.
5,941,442 A	8/1999	Geiste et al.	6,050,989 A	4/2000	Shibata
5,941,890 A	8/1999	Voegelé et al.	6,050,990 A	4/2000	Fox et al.
5,944,172 A	8/1999	Hannula	6,050,996 A	4/2000	Tankovich et al.
5,944,715 A	8/1999	Goble et al.	6,053,390 A	4/2000	Schmaltz et al.
5,946,978 A	9/1999	Yamashita	6,053,899 A	4/2000	Green et al.
5,947,984 A	9/1999	Whipple	6,053,922 A	4/2000	Slanda et al.
5,947,996 A	9/1999	Logeman	6,054,142 A	4/2000	Krause et al.
5,948,030 A	9/1999	Miller et al.	RE36,720 E	5/2000	Li et al.
5,948,429 A	9/1999	Bell et al.	6,056,735 A	5/2000	Green et al.
5,951,301 A	9/1999	Yunker	6,056,746 A	5/2000	Okada et al.
5,951,516 A	9/1999	Bunyan	6,059,806 A	5/2000	Goble et al.
5,951,552 A	9/1999	Long et al.	6,062,360 A	5/2000	Hoegerle
5,951,574 A	9/1999	Stefanchik et al.	6,063,025 A	5/2000	Shields
5,951,581 A	9/1999	Saadat et al.	6,063,050 A	5/2000	Bridges et al.
5,954,259 A	9/1999	Viola et al.	6,063,095 A	5/2000	Manna et al.
5,964,394 A	10/1999	Robertson	6,063,097 A	5/2000	Wang et al.
5,964,774 A	10/1999	McKean et al.	6,063,098 A	5/2000	Oi et al.
5,971,916 A	10/1999	Koren	6,065,679 A	5/2000	Houser et al.
5,973,221 A	10/1999	Collyer et al.	6,065,919 A	5/2000	Levie et al.
D416,089 S	11/1999	Barton et al.	6,066,132 A	5/2000	Peck
5,976,122 A	11/1999	Madhani et al.	6,066,151 A	5/2000	Chen et al.
5,977,746 A	11/1999	Hershberger et al.	6,068,627 A	5/2000	Miyawaki et al.
5,980,248 A	11/1999	Kusakabe et al.	6,071,233 A	6/2000	Orszulak et al.
5,984,949 A	11/1999	Levin	6,074,386 A	6/2000	Ishikawa et al.
5,988,479 A	11/1999	Palmer	6,074,401 A	6/2000	Goble et al.
5,990,379 A	11/1999	Gregory	6,077,280 A	6/2000	Gardiner et al.
5,993,466 A	11/1999	Yoon	6,077,286 A	6/2000	Fossum
5,997,528 A	12/1999	Bisch et al.	6,077,290 A	6/2000	Cuschieri et al.
5,997,552 A	12/1999	Person et al.	6,079,606 A	6/2000	Marini
6,001,108 A	12/1999	Wang et al.	6,080,181 A	6/2000	Milliman et al.
6,003,517 A	12/1999	Sheffield et al.	6,082,577 A	6/2000	Jensen et al.
6,004,319 A	12/1999	Goble et al.	6,083,191 A	7/2000	Coates et al.
6,004,335 A	12/1999	Vaitekunas et al.	6,083,223 A	7/2000	Rose
6,007,521 A	12/1999	Bidwell et al.	6,083,234 A	7/2000	Baker
6,010,054 A	1/2000	Johnson et al.	6,083,242 A	7/2000	Nicholas et al.
6,010,513 A	1/2000	Tormala et al.	6,086,544 A	7/2000	Cook
6,010,520 A	1/2000	Pattison	6,086,600 A	7/2000	Hibner et al.
6,012,494 A	1/2000	Balazs	6,090,106 A	7/2000	Kortenbach
6,013,076 A	1/2000	Goble et al.	6,093,186 A	7/2000	Goble et al.
6,015,406 A	1/2000	Goble et al.	6,099,537 A	8/2000	Goble
6,015,417 A	1/2000	Reynolds, Jr.	6,099,551 A	8/2000	Sugai et al.
6,017,322 A	1/2000	Snoke et al.	6,102,271 A	8/2000	Gabbay
6,017,354 A	1/2000	Culp et al.	6,104,162 A	8/2000	Longo et al.
			6,104,304 A	8/2000	Sainsbury et al.
			6,106,511 A	8/2000	Clark et al.
			6,109,500 A	8/2000	Jensen
					Alli et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

6,110,187	A	8/2000	Donlon	6,228,098	B1	5/2001	Kayan et al.
6,113,618	A	9/2000	Nic	6,231,565	B1	5/2001	Tovey et al.
6,117,148	A	9/2000	Ravo et al.	6,234,178	B1	5/2001	Goble et al.
6,117,158	A	9/2000	Measamer et al.	6,237,604	B1	5/2001	Burnside et al.
6,119,913	A	9/2000	Adams et al.	6,238,384	B1	5/2001	Peer
6,120,433	A	9/2000	Mizuno et al.	6,241,139	B1	6/2001	Milliman et al.
6,120,462	A	9/2000	Hibner et al.	6,241,140	B1	6/2001	Adams et al.
6,123,241	A	9/2000	Walter et al.	6,241,723	B1	6/2001	Heim et al.
6,123,701	A	9/2000	Nezhat	6,245,084	B1	6/2001	Mark et al.
H001904	H	10/2000	Yates et al.	6,248,116	B1	6/2001	Chevillon et al.
6,126,058	A	10/2000	Adams et al.	6,248,117	B1	6/2001	Blatter
6,126,359	A	10/2000	Dittrich et al.	6,249,076	B1	6/2001	Madden et al.
6,126,670	A	10/2000	Walker et al.	6,249,105	B1	6/2001	Andrews et al.
6,131,789	A	10/2000	Schulze et al.	6,250,532	B1	6/2001	Green et al.
6,131,790	A	10/2000	Piraka	6,251,485	B1	6/2001	Harris et al.
6,132,368	A	10/2000	Cooper	6,254,534	B1	7/2001	Butler et al.
6,139,546	A	10/2000	Koenig et al.	6,254,619	B1	7/2001	Garabet et al.
6,142,149	A	11/2000	Steen	6,254,642	B1	7/2001	Taylor
6,142,933	A	11/2000	Longo et al.	6,258,107	B1	7/2001	Balazs et al.
6,147,135	A	11/2000	Yuan et al.	6,261,286	B1	7/2001	Goble et al.
6,149,660	A	11/2000	Laufer et al.	6,261,679	B1	7/2001	Chen et al.
6,151,323	A	11/2000	O'Connell et al.	6,264,086	B1	7/2001	McGuckin, Jr.
6,152,935	A	11/2000	Kammerer et al.	6,264,087	B1	7/2001	Whitman
6,155,473	A	12/2000	Tompkins et al.	6,264,617	B1	7/2001	Bales et al.
6,156,056	A	12/2000	Kearns et al.	6,270,508	B1	8/2001	Klieman et al.
6,157,169	A	12/2000	Lee	6,270,916	B1	8/2001	Sink et al.
6,159,146	A	12/2000	El Gazayerli	6,273,876	B1	8/2001	Klima et al.
6,159,200	A	12/2000	Verdura et al.	6,273,897	B1	8/2001	Dallessandro et al.
6,159,224	A	12/2000	Yoon	6,277,114	B1	8/2001	Bullivant et al.
6,162,208	A	12/2000	Hipps	6,280,407	B1	8/2001	Manna et al.
6,162,220	A	12/2000	Nezhat	6,293,927	B1	9/2001	McGuckin, Jr.
6,162,537	A	12/2000	Martin et al.	6,293,942	B1	9/2001	Goble et al.
6,165,175	A	12/2000	Wampler et al.	6,296,640	B1	10/2001	Wampler et al.
6,165,184	A	12/2000	Verdura et al.	6,302,311	B1	10/2001	Adams et al.
6,165,188	A	12/2000	Saadat et al.	6,302,743	B1	10/2001	Chiu et al.
6,167,185	A	12/2000	Smiley et al.	6,305,891	B1	10/2001	Burlingame
6,168,605	B1	1/2001	Measamer et al.	6,306,134	B1	10/2001	Goble et al.
6,171,305	B1	1/2001	Sherman	6,306,149	B1	10/2001	Meade
6,171,316	B1	1/2001	Kovac et al.	6,306,424	B1	10/2001	Vyakarnam et al.
6,171,330	B1	1/2001	Benchetrit	6,309,397	B1	10/2001	Julian et al.
6,173,074	B1	1/2001	Russo	6,309,403	B1	10/2001	Minor et al.
6,174,308	B1	1/2001	Goble et al.	6,312,435	B1	11/2001	Wallace et al.
6,174,309	B1	1/2001	Wrublewski et al.	6,315,184	B1	11/2001	Whitman
6,174,318	B1	1/2001	Bates et al.	6,319,510	B1	11/2001	Yates
6,175,290	B1	1/2001	Forsythe et al.	6,320,123	B1	11/2001	Reimers
6,179,195	B1	1/2001	Adams et al.	6,322,494	B1	11/2001	Bullivant et al.
6,179,776	B1	1/2001	Adams et al.	6,324,339	B1	11/2001	Hudson et al.
6,181,105	B1	1/2001	Cutolo et al.	6,325,799	B1	12/2001	Goble
6,182,673	B1	2/2001	Kindermann et al.	6,325,805	B1	12/2001	Ogilvie et al.
6,185,356	B1	2/2001	Parker et al.	6,325,810	B1	12/2001	Hamilton et al.
6,186,142	B1	2/2001	Schmidt et al.	6,328,498	B1	12/2001	Mersch
6,187,003	B1	2/2001	Buysse et al.	6,330,965	B1	12/2001	Milliman et al.
6,190,386	B1	2/2001	Rydell	6,331,181	B1	12/2001	Tierney et al.
6,193,129	B1	2/2001	Bittner et al.	6,331,761	B1	12/2001	Kumar et al.
6,197,042	B1	3/2001	Ginn et al.	6,333,029	B1	12/2001	Vyakarnam et al.
6,200,330	B1	3/2001	Benderev et al.	6,334,860	B1	1/2002	Dorn
6,202,914	B1	3/2001	Geiste et al.	6,334,861	B1	1/2002	Chandler et al.
6,206,894	B1	3/2001	Thompson et al.	6,336,926	B1	1/2002	Goble
6,206,897	B1	3/2001	Jamiolkowski et al.	6,338,737	B1	1/2002	Toledano
6,206,904	B1	3/2001	Ouchi	6,343,731	B1	2/2002	Adams et al.
6,209,414	B1	4/2001	Uneme	6,346,077	B1	2/2002	Taylor et al.
6,210,403	B1	4/2001	Klicek	6,348,061	B1	2/2002	Whitman
6,213,999	B1	4/2001	Platt, Jr. et al.	D454,951	S	3/2002	Bon
6,214,028	B1	4/2001	Yoon et al.	6,352,503	B1	3/2002	Matsui et al.
6,220,368	B1	4/2001	Ark et al.	6,352,532	B1	3/2002	Kramer et al.
6,221,007	B1	4/2001	Green	6,355,699	B1	3/2002	Vyakarnam et al.
6,221,023	B1	4/2001	Matsuba et al.	6,356,072	B1	3/2002	Chass
6,223,100	B1	4/2001	Green	6,358,224	B1	3/2002	Tims et al.
6,223,835	B1	5/2001	Habedank et al.	6,358,263	B2	3/2002	Mark et al.
6,224,617	B1	5/2001	Saadat et al.	6,358,459	B1	3/2002	Ziegler et al.
6,228,080	B1	5/2001	Gines	6,364,877	B1	4/2002	Goble et al.
6,228,081	B1	5/2001	Goble	6,364,888	B1	4/2002	Niemeyer et al.
6,228,083	B1	5/2001	Lands et al.	6,370,981	B2	4/2002	Watarai
6,228,084	B1	5/2001	Kirwan, Jr.	6,371,114	B1	4/2002	Schmidt et al.
6,228,089	B1	5/2001	Wahrburg	6,373,152	B1	4/2002	Wang et al.
				6,377,011	B1	4/2002	Ben-Ur
				6,383,201	B1	5/2002	Dong
				6,387,092	B1	5/2002	Burnside et al.
				6,387,113	B1	5/2002	Hawkins et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

6,387,114	B2	5/2002	Adams	6,512,360	B1	1/2003	Goto et al.
6,391,038	B2	5/2002	Vargas et al.	6,514,252	B2	2/2003	Nezhat et al.
6,392,854	B1	5/2002	O'Gorman	6,516,073	B1	2/2003	Schulz et al.
6,394,998	B1	5/2002	Wallace et al.	6,517,528	B1	2/2003	Pantages et al.
6,398,779	B1	6/2002	Buyse et al.	6,517,535	B2	2/2003	Edwards
6,398,781	B1	6/2002	Goble et al.	6,517,565	B1	2/2003	Whitman et al.
6,398,797	B2	6/2002	Bombard et al.	6,517,566	B1	2/2003	Hovland et al.
6,402,766	B2	6/2002	Bowman et al.	6,520,971	B1	2/2003	Perry et al.
6,406,440	B1	6/2002	Stefanchik	6,520,972	B2	2/2003	Peters
6,406,472	B1	6/2002	Jensen	6,522,101	B2	2/2003	Malackowski
6,409,724	B1	6/2002	Penny et al.	6,524,180	B1	2/2003	Simms et al.
H002037	H	7/2002	Yates et al.	6,527,782	B2	3/2003	Hogg et al.
6,412,639	B1	7/2002	Hickey	6,527,785	B2	3/2003	Sancoff et al.
6,413,274	B1	7/2002	Pedros	6,532,958	B1	3/2003	Buan et al.
6,416,486	B1	7/2002	Wampler	6,533,157	B1	3/2003	Whitman
6,416,509	B1	7/2002	Goble et al.	6,533,723	B1	3/2003	Lockery et al.
6,419,695	B1	7/2002	Gabbay	6,533,784	B2	3/2003	Truckai et al.
6,423,079	B1	7/2002	Blake, III	6,535,764	B2	3/2003	Imran et al.
RE37,814	E	8/2002	Allgeyer	6,539,816	B2	4/2003	Kogiso et al.
6,428,070	B1	8/2002	Takanashi et al.	6,543,456	B1	4/2003	Freeman
6,428,487	B1	8/2002	Burdorff et al.	6,545,384	B1	4/2003	Pelrine et al.
6,429,611	B1	8/2002	Li	6,547,786	B1	4/2003	Goble
6,430,298	B1	8/2002	Kettl et al.	6,550,546	B2	4/2003	Thurler et al.
6,432,065	B1	8/2002	Burdorff et al.	6,551,333	B2	4/2003	Kuhns et al.
6,436,097	B1	8/2002	Nardella	6,554,861	B2	4/2003	Knox et al.
6,436,107	B1	8/2002	Wang et al.	6,555,770	B2	4/2003	Kawase
6,436,110	B2	8/2002	Bowman et al.	6,558,378	B2	5/2003	Sherman et al.
6,436,122	B1	8/2002	Frank et al.	6,558,379	B1	5/2003	Batchelor et al.
6,439,439	B1	8/2002	Rickard et al.	6,558,429	B2	5/2003	Taylor
6,439,446	B1	8/2002	Perry et al.	6,561,187	B2	5/2003	Schmidt et al.
6,440,146	B2	8/2002	Nicholas et al.	6,565,560	B1	5/2003	Goble et al.
6,441,577	B2	8/2002	Blumenkranz et al.	6,566,619	B2	5/2003	Gillman et al.
D462,758	S	9/2002	Epstein et al.	6,569,085	B2	5/2003	Kortenbach et al.
6,443,973	B1	9/2002	Whitman	6,569,171	B2	5/2003	DeGuillebon et al.
6,445,530	B1	9/2002	Baker	6,578,751	B2	6/2003	Hartwick
6,447,518	B1	9/2002	Krause et al.	6,582,364	B2	6/2003	Butler et al.
6,447,523	B1	9/2002	Middleman et al.	6,582,427	B1	6/2003	Goble et al.
6,447,799	B1	9/2002	Ullman	6,582,441	B1	6/2003	He et al.
6,447,864	B2	9/2002	Johnson et al.	6,583,533	B2	6/2003	Pelrine et al.
6,450,391	B1	9/2002	Kayan et al.	6,585,144	B2	7/2003	Adams et al.
6,450,989	B2	9/2002	Dubrul et al.	6,585,664	B2	7/2003	Burdorff et al.
6,454,781	B1	9/2002	Witt et al.	6,587,750	B2	7/2003	Gerbi et al.
6,458,077	B1	10/2002	Boebel et al.	6,588,643	B2	7/2003	Bolduc et al.
6,458,147	B1	10/2002	Cruise et al.	6,588,931	B2	7/2003	Betzner et al.
6,460,627	B1	10/2002	Below et al.	6,589,118	B1	7/2003	Soma et al.
6,468,275	B1	10/2002	Wampler et al.	6,589,164	B1	7/2003	Flaherty
6,468,286	B2	10/2002	Mastri et al.	6,592,538	B1	7/2003	Hotchkiss et al.
6,471,106	B1	10/2002	Reining	6,592,597	B2	7/2003	Grant et al.
6,471,659	B2	10/2002	Eggers et al.	6,594,552	B1	7/2003	Nowlin et al.
6,478,210	B2	11/2002	Adams et al.	6,596,296	B1	7/2003	Nelson et al.
6,482,200	B2	11/2002	Shippert	6,596,304	B1	7/2003	Bayon et al.
6,482,217	B1	11/2002	Pintor et al.	6,596,432	B2	7/2003	Kawakami et al.
6,485,490	B2	11/2002	Wampler et al.	6,599,323	B2	7/2003	Melican et al.
6,485,503	B2	11/2002	Jacobs et al.	D478,665	S	8/2003	Isaacs et al.
6,485,667	B1	11/2002	Tan	D478,986	S	8/2003	Johnston et al.
6,486,286	B1	11/2002	McGall et al.	6,601,749	B2	8/2003	Sullivan et al.
6,488,196	B1	12/2002	Fenton, Jr.	6,602,252	B2	8/2003	Mollenauer
6,488,197	B1	12/2002	Whitman	6,602,262	B2	8/2003	Griego et al.
6,488,659	B1	12/2002	Rosenman	6,603,050	B2	8/2003	Heaton
6,491,201	B1	12/2002	Whitman	6,605,078	B2	8/2003	Adams
6,491,690	B1	12/2002	Goble et al.	6,605,669	B2	8/2003	Awokola et al.
6,491,701	B2	12/2002	Tierney et al.	6,605,911	B1	8/2003	Klesing
6,492,785	B1	12/2002	Kasten et al.	6,607,475	B2	8/2003	Doyle et al.
6,494,885	B1	12/2002	Dhindsa	6,611,793	B1	8/2003	Burnside et al.
6,494,896	B1	12/2002	D'Alessio et al.	6,613,069	B2	9/2003	Boyd et al.
6,498,480	B1	12/2002	Manara	6,616,686	B2	9/2003	Coleman et al.
6,500,176	B1	12/2002	Truckai et al.	6,619,529	B2	9/2003	Green et al.
6,500,194	B2	12/2002	Benderov et al.	6,620,111	B2	9/2003	Stephens et al.
6,503,139	B2	1/2003	Coral	6,620,166	B1	9/2003	Wenstrom, Jr. et al.
6,503,257	B2	1/2003	Grant et al.	6,625,517	B1	9/2003	Bogdanov et al.
6,503,259	B2	1/2003	Huxel et al.	6,626,834	B2	9/2003	Dunne et al.
6,505,768	B2	1/2003	Whitman	6,629,630	B2	10/2003	Adams
6,506,197	B1	1/2003	Rollero et al.	6,629,974	B2	10/2003	Penny et al.
6,510,854	B2	1/2003	Goble	6,629,988	B2	10/2003	Weadock
6,511,468	B1	1/2003	Cragg et al.	6,635,838	B1	10/2003	Kornelson
				6,636,412	B2	10/2003	Smith
				6,638,108	B2	10/2003	Tachi
				6,638,285	B2	10/2003	Gabbay
				6,638,297	B1	10/2003	Huitema

(56)

References Cited

U.S. PATENT DOCUMENTS

RE38,335 E	11/2003	Aust et al.	6,755,195 B1	6/2004	Lemke et al.
6,641,528 B2	11/2003	Torii	6,755,338 B2	6/2004	Hahnen et al.
6,644,532 B2	11/2003	Green et al.	6,755,843 B2	6/2004	Chung et al.
6,645,201 B1	11/2003	Utley et al.	6,756,705 B2	6/2004	Pulford, Jr.
6,646,307 B1	11/2003	Yu et al.	6,758,846 B2	7/2004	Goble et al.
6,648,816 B2	11/2003	Irion et al.	6,761,685 B2	7/2004	Adams et al.
6,648,901 B2	11/2003	Fleischman et al.	6,762,339 B1	7/2004	Klun et al.
6,652,595 B1	11/2003	Nicolo	6,764,445 B2	7/2004	Ramans et al.
D484,243 S	12/2003	Ryan et al.	6,766,957 B2	7/2004	Matsuura et al.
D484,595 S	12/2003	Ryan et al.	6,767,352 B2	7/2004	Field et al.
D484,596 S	12/2003	Ryan et al.	6,767,356 B2	7/2004	Kanner et al.
6,656,177 B2	12/2003	Truckai et al.	6,769,590 B2	8/2004	Vresh et al.
6,656,193 B2	12/2003	Grant et al.	6,769,594 B2	8/2004	Orban, III
6,659,940 B2	12/2003	Adler	6,770,027 B2	8/2004	Banik et al.
6,663,623 B1	12/2003	Oyama et al.	6,770,070 B1	8/2004	Balbierz
6,663,641 B1	12/2003	Kovac et al.	6,770,072 B1	8/2004	Truckai et al.
6,666,854 B1	12/2003	Lange	6,773,409 B2	8/2004	Truckai et al.
6,666,875 B1	12/2003	Sakurai et al.	6,773,438 B1	8/2004	Knodel et al.
6,667,825 B2	12/2003	Lu et al.	6,775,575 B2	8/2004	Bommannan et al.
6,669,073 B2 *	12/2003	Milliman A61B 17/07207 227/175.2	6,777,838 B2	8/2004	Miekkka et al.
6,670,806 B2	12/2003	Wendt et al.	6,780,151 B2	8/2004	Grabover et al.
6,671,185 B2	12/2003	Duval	6,780,180 B1	8/2004	Goble et al.
D484,977 S	1/2004	Ryan et al.	6,783,524 B2	8/2004	Anderson et al.
6,676,660 B2	1/2004	Wampler et al.	6,786,382 B1	9/2004	Hoffman
6,677,687 B2	1/2004	Ho et al.	6,786,864 B2	9/2004	Matsuura et al.
6,679,269 B2	1/2004	Swanson	6,786,896 B1	9/2004	Madhani et al.
6,679,410 B2	1/2004	Wursch et al.	6,788,018 B1	9/2004	Blumenkranz
6,681,978 B2	1/2004	Geiste et al.	6,790,173 B2	9/2004	Saadat et al.
6,681,979 B2	1/2004	Whitman	6,793,652 B1	9/2004	Whitman et al.
6,682,527 B2	1/2004	Strul	6,793,661 B2	9/2004	Hamilton et al.
6,682,528 B2	1/2004	Frazier et al.	6,793,663 B2	9/2004	Kneifel et al.
6,682,544 B2	1/2004	Mastri et al.	6,793,669 B2	9/2004	Nakamura et al.
6,685,698 B2	2/2004	Morley et al.	6,796,921 B1	9/2004	Buck et al.
6,685,727 B2	2/2004	Fisher et al.	6,802,822 B1	10/2004	Dodge
6,689,153 B1	2/2004	Skiba	6,802,843 B2	10/2004	Truckai et al.
6,692,507 B2	2/2004	Pugsley et al.	6,802,844 B2	10/2004	Ferree
6,692,692 B2	2/2004	Stetzel	6,805,273 B2	10/2004	Bilotti et al.
6,695,198 B2	2/2004	Adams et al.	6,806,808 B1	10/2004	Watters et al.
6,695,199 B2	2/2004	Whitman	6,808,525 B2	10/2004	Latterell et al.
6,695,774 B2	2/2004	Hale et al.	6,810,359 B2	10/2004	Sakaguchi
6,696,814 B2	2/2004	Henderson et al.	6,814,741 B2	11/2004	Bowman et al.
6,697,048 B2	2/2004	Rosenberg et al.	6,817,508 B1	11/2004	Racenet et al.
6,698,643 B2	3/2004	Whitman	6,817,509 B2	11/2004	Geiste et al.
6,699,177 B1	3/2004	Wang et al.	6,817,974 B2	11/2004	Cooper et al.
6,699,214 B2	3/2004	Gellman	6,818,018 B1	11/2004	Sawhney
6,699,235 B2	3/2004	Wallace et al.	6,820,791 B2	11/2004	Adams
6,704,210 B1	3/2004	Myers	6,821,273 B2	11/2004	Mollenauer
6,705,503 B1	3/2004	Pedicini et al.	6,821,282 B2	11/2004	Perry et al.
6,709,445 B2	3/2004	Boebel et al.	6,821,284 B2	11/2004	Sturtz et al.
6,712,773 B1	3/2004	Viola	6,827,246 B2	12/2004	Sullivan et al.
6,716,223 B2	4/2004	Leopold et al.	6,827,712 B2	12/2004	Tovey et al.
6,716,232 B1	4/2004	Vidal et al.	6,827,725 B2	12/2004	Batchelor et al.
6,716,233 B1	4/2004	Whitman	6,828,902 B2	12/2004	Casden
6,720,734 B2	4/2004	Norris	6,830,174 B2	12/2004	Hillstead et al.
6,722,550 B1	4/2004	Ricordi et al.	6,831,629 B2	12/2004	Nishino et al.
6,722,552 B2	4/2004	Fenton, Jr.	6,832,998 B2	12/2004	Goble
6,723,087 B2	4/2004	O'Neill et al.	6,834,001 B2	12/2004	Myono
6,723,091 B2	4/2004	Goble et al.	6,835,173 B2	12/2004	Couvillon, Jr.
6,723,109 B2	4/2004	Solingen	6,835,199 B2	12/2004	McGuckin, Jr. et al.
6,726,697 B2	4/2004	Nicholas et al.	6,835,336 B2	12/2004	Watt
6,726,706 B2	4/2004	Dominguez	6,836,611 B2	12/2004	Popovic et al.
6,729,119 B2	5/2004	Schnipke et al.	6,837,846 B2	1/2005	Jaffe et al.
6,736,825 B2	5/2004	Blatter et al.	6,837,883 B2	1/2005	Moll et al.
6,736,854 B2	5/2004	Vadurro et al.	6,838,493 B2	1/2005	Williams et al.
6,740,030 B2	5/2004	Martone et al.	6,840,423 B2	1/2005	Adams et al.
6,743,230 B2	6/2004	Lutze et al.	6,841,967 B2	1/2005	Kim et al.
6,744,385 B2	6/2004	Kazuya et al.	6,843,403 B2	1/2005	Whitman
6,747,121 B2	6/2004	Gogolewski	6,843,789 B2	1/2005	Goble
6,747,300 B2	6/2004	Nadd et al.	6,843,793 B2	1/2005	Brock et al.
6,749,560 B1	6/2004	Konstorff et al.	6,846,307 B2	1/2005	Whitman et al.
6,749,600 B1	6/2004	Levy	6,846,308 B2	1/2005	Whitman et al.
6,752,768 B2	6/2004	Burdorff et al.	6,846,309 B2	1/2005	Whitman et al.
6,752,816 B2	6/2004	Culp et al.	6,847,190 B2	1/2005	Schaefer et al.
6,754,959 B1	6/2004	Guiette, III et al.	6,849,071 B2	2/2005	Whitman et al.
			6,850,817 B1	2/2005	Green
			6,852,122 B2	2/2005	Rush
			6,852,330 B2	2/2005	Bowman et al.
			6,853,879 B2	2/2005	Sunaoshi
			6,858,005 B2	2/2005	Ohline et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

6,859,882 B2	2/2005	Fung	6,974,462 B2	12/2005	Sater
RE38,708 E	3/2005	Bolanos et al.	6,978,921 B2	12/2005	Shelton, IV et al.
D502,994 S	3/2005	Blake, III	6,978,922 B2	12/2005	Bilotti et al.
6,861,142 B1	3/2005	Wilkie et al.	6,981,628 B2	1/2006	Wales
6,861,954 B2	3/2005	Levin	6,981,941 B2	1/2006	Whitman et al.
6,863,668 B2	3/2005	Gillespie et al.	6,981,978 B2	1/2006	Gannoe
6,863,694 B1	3/2005	Boyce et al.	6,984,203 B2	1/2006	Tartaglia et al.
6,866,178 B2	3/2005	Adams et al.	6,984,231 B2	1/2006	Goble et al.
6,866,671 B2	3/2005	Tierney et al.	6,986,451 B1	1/2006	Mastri et al.
6,867,248 B1	3/2005	Martin et al.	6,988,649 B2	1/2006	Shelton, IV et al.
6,869,430 B2	3/2005	Balbierz et al.	6,988,650 B2	1/2006	Schwemberger et al.
6,869,435 B2	3/2005	Blake, III	6,989,034 B2	1/2006	Hammer et al.
6,872,214 B2	3/2005	Sonnenschein et al.	6,990,731 B2	1/2006	Haytayan
6,874,669 B2	4/2005	Adams et al.	6,990,796 B2	1/2006	Schnipke et al.
6,877,647 B2	4/2005	Green et al.	6,993,200 B2	1/2006	Tastl et al.
6,878,106 B1	4/2005	Herrmann	6,993,413 B2	1/2006	Sunaoshi
6,884,392 B2	4/2005	Malkin et al.	6,994,708 B2	2/2006	Manzo
6,884,428 B2	4/2005	Binette et al.	6,995,729 B2	2/2006	Govari et al.
6,887,710 B2	5/2005	Call et al.	6,996,433 B2	2/2006	Burbank et al.
6,889,116 B2	5/2005	Jinno	6,997,931 B2	2/2006	Sauer et al.
6,893,435 B2	5/2005	Goble	6,997,935 B2	2/2006	Anderson et al.
6,894,140 B2	5/2005	Roby	6,998,736 B2	2/2006	Lee et al.
6,899,538 B2	5/2005	Matoba	6,998,816 B2	2/2006	Wieck et al.
6,899,593 B1	5/2005	Moeller et al.	7,000,818 B2	2/2006	Shelton, IV et al.
6,905,057 B2	6/2005	Swayze et al.	7,000,819 B2	2/2006	Swayze et al.
6,905,497 B2	6/2005	Truckai et al.	7,000,911 B2	2/2006	McCormick et al.
6,905,498 B2	6/2005	Hooven	7,001,380 B2	2/2006	Goble
6,908,472 B2	6/2005	Wiener et al.	7,001,408 B2	2/2006	Knodel et al.
6,911,033 B2	6/2005	de Guillebon et al.	7,004,174 B2	2/2006	Eggers et al.
6,911,916 B1	6/2005	Wang et al.	7,007,176 B2	2/2006	Goodfellow et al.
6,913,579 B2	7/2005	Truckai et al.	7,008,433 B2	3/2006	Voellmicke et al.
6,913,608 B2	7/2005	Liddicoat et al.	7,008,435 B2	3/2006	Cummins
6,913,613 B2	7/2005	Schwarz et al.	7,009,039 B2	3/2006	Yayon et al.
6,921,397 B2	7/2005	Corcoran et al.	7,011,657 B2	3/2006	Truckai et al.
6,921,412 B1	7/2005	Black et al.	7,014,640 B2	3/2006	Kemppainen et al.
6,923,093 B2	8/2005	Ullah	7,018,357 B2	3/2006	Emmons
6,923,803 B2	8/2005	Goble	7,018,390 B2	3/2006	Turovskiy et al.
6,923,819 B2	8/2005	Meade et al.	7,021,669 B1	4/2006	Lindermeir et al.
6,926,716 B2	8/2005	Baker et al.	7,023,159 B2	4/2006	Gorti et al.
6,928,902 B1	8/2005	Eyssallenne	7,025,064 B2	4/2006	Wang et al.
6,929,641 B2	8/2005	Goble et al.	7,025,732 B2	4/2006	Thompson et al.
6,929,644 B2	8/2005	Truckai et al.	7,025,743 B2	4/2006	Mann et al.
6,931,830 B2	8/2005	Liao	7,025,775 B2	4/2006	Gadberry et al.
6,932,218 B2	8/2005	Kosann et al.	7,028,570 B2	4/2006	Ohta et al.
6,932,810 B2	8/2005	Ryan	7,029,435 B2	4/2006	Nakao
6,936,042 B2	8/2005	Wallace et al.	7,029,439 B2	4/2006	Roberts et al.
6,936,948 B2	8/2005	Bell et al.	7,030,904 B2	4/2006	Adair et al.
D509,297 S	9/2005	Wells	7,032,798 B2	4/2006	Whitman et al.
D509,589 S	9/2005	Wells	7,032,799 B2	4/2006	Viola et al.
6,939,358 B2	9/2005	Palacios et al.	7,033,356 B2	4/2006	Latterell et al.
6,942,662 B2	9/2005	Goble et al.	7,035,716 B2	4/2006	Harris et al.
6,942,674 B2	9/2005	Belef et al.	7,035,762 B2	4/2006	Menard et al.
6,945,444 B2	9/2005	Gresham et al.	7,036,680 B1	5/2006	Flannery
6,945,981 B2	9/2005	Donofrio et al.	7,037,314 B2	5/2006	Armstrong
6,951,562 B2	10/2005	Zwirnmann	7,037,344 B2	5/2006	Kagan et al.
6,953,138 B1	10/2005	Dworak et al.	7,041,088 B2	5/2006	Nawrocki et al.
6,953,139 B2	10/2005	Milliman et al.	7,041,102 B2	5/2006	Truckai et al.
6,953,461 B2	10/2005	McClurken et al.	7,041,868 B2	5/2006	Greene et al.
6,958,035 B2	10/2005	Friedman et al.	7,043,852 B2	5/2006	Hayashida et al.
6,959,851 B2	11/2005	Heinrich	7,044,350 B2	5/2006	Kameyama et al.
6,959,852 B2	11/2005	Shelton, IV et al.	7,044,352 B2	5/2006	Shelton, IV et al.
6,960,107 B1	11/2005	Schaub et al.	7,044,353 B2	5/2006	Mastri et al.
6,960,163 B2	11/2005	Ewers et al.	7,046,082 B2	5/2006	Komiya et al.
6,960,220 B2	11/2005	Marino et al.	7,048,687 B1	5/2006	Reuss et al.
6,962,587 B2	11/2005	Johnson et al.	7,048,745 B2	5/2006	Tierney et al.
6,963,792 B1	11/2005	Green	7,052,454 B2	5/2006	Taylor
6,964,363 B2	11/2005	Wales et al.	7,052,494 B2	5/2006	Goble et al.
6,966,907 B2	11/2005	Goble	7,052,499 B2	5/2006	Steger et al.
6,966,909 B2	11/2005	Marshall et al.	7,055,730 B2	6/2006	Ehrenfels et al.
6,968,908 B2	11/2005	Tokunaga et al.	7,055,731 B2	6/2006	Shelton, IV et al.
6,969,385 B2	11/2005	Moreyra	7,056,284 B2	6/2006	Martone et al.
6,969,395 B2	11/2005	Eskuri	7,056,330 B2	6/2006	Gayton
6,971,988 B2	12/2005	Orban, III	7,059,331 B2	6/2006	Adams et al.
6,972,199 B2	12/2005	Lebouitz et al.	7,059,508 B2	6/2006	Shelton, IV et al.
6,974,435 B2	12/2005	Daw et al.	7,063,671 B2	6/2006	Couvillon, Jr.
			7,063,712 B2	6/2006	Vargas et al.
			7,064,509 B1	6/2006	Fu et al.
			7,066,879 B2	6/2006	Fowler et al.
			7,066,944 B2	6/2006	Laufer et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

7,067,038 B2	6/2006	Trokhan et al.	7,147,138 B2	12/2006	Shelton, IV
7,070,083 B2	7/2006	Jankowski	7,147,139 B2	12/2006	Schwemberger et al.
7,070,559 B2	7/2006	Adams et al.	7,147,140 B2	12/2006	Wukusick et al.
7,070,597 B2	7/2006	Truckai et al.	7,147,637 B2	12/2006	Goble
7,071,287 B2	7/2006	Rhine et al.	7,147,648 B2	12/2006	Lin
7,075,770 B1	7/2006	Smith	7,147,650 B2	12/2006	Lee
7,077,856 B2	7/2006	Whitman	7,150,748 B2	12/2006	Ebbutt et al.
7,080,769 B2	7/2006	Vresh et al.	7,153,300 B2	12/2006	Goble
7,081,114 B2	7/2006	Rashidi	7,155,316 B2	12/2006	Sutherland et al.
7,083,073 B2	8/2006	Yoshie et al.	7,156,863 B2	1/2007	Sonnenschein et al.
7,083,075 B2	8/2006	Swayze et al.	7,159,750 B2	1/2007	Racenet et al.
7,083,571 B2	8/2006	Wang et al.	7,160,296 B2	1/2007	Pearson et al.
7,083,615 B2	8/2006	Peterson et al.	7,160,299 B2	1/2007	Baily
7,083,619 B2	8/2006	Truckai et al.	7,161,036 B2	1/2007	Oikawa et al.
7,083,620 B2	8/2006	Jahns et al.	7,161,580 B2	1/2007	Bailey et al.
7,083,626 B2	8/2006	Hart et al.	7,163,563 B2	1/2007	Schwartz et al.
7,087,049 B2	8/2006	Nowlin et al.	7,166,133 B2	1/2007	Evans et al.
7,087,054 B2	8/2006	Truckai et al.	7,168,604 B2	1/2007	Milliman et al.
7,087,071 B2	8/2006	Nicholas et al.	7,170,910 B2	1/2007	Chen et al.
7,090,637 B2	8/2006	Danitz et al.	7,171,279 B2	1/2007	Buckingham et al.
7,090,673 B2	8/2006	Dycus et al.	7,172,104 B2	2/2007	Scirica et al.
7,090,683 B2	8/2006	Brock et al.	7,172,593 B2	2/2007	Trieu et al.
7,090,684 B2	8/2006	McGuckin, Jr. et al.	7,172,615 B2	2/2007	Morriss et al.
7,091,412 B2	8/2006	Wang et al.	7,174,636 B2	2/2007	Lowe
7,094,202 B2	8/2006	Nobis et al.	7,179,223 B2	2/2007	Motoki et al.
7,094,247 B2	8/2006	Monassevitch et al.	7,179,267 B2	2/2007	Nolan et al.
7,094,916 B2	8/2006	DeLuca et al.	7,182,239 B1	2/2007	Myers
7,096,972 B2	8/2006	Orozco, Jr.	7,182,763 B2	2/2007	Nardella
7,097,089 B2	8/2006	Marczyk	7,183,737 B2	2/2007	Kitagawa
7,097,644 B2	8/2006	Long	7,187,960 B2	3/2007	Abreu
7,097,650 B2	8/2006	Weller et al.	7,188,758 B2	3/2007	Viola et al.
7,098,794 B2	8/2006	Lindsay et al.	7,189,207 B2	3/2007	Viola
7,100,949 B2	9/2006	Williams et al.	7,190,147 B2	3/2007	Gileff et al.
7,101,187 B1	9/2006	Deconinck et al.	7,195,627 B2	3/2007	Amoah et al.
7,101,394 B2	9/2006	Hamm et al.	7,196,911 B2	3/2007	Takano et al.
7,104,741 B2	9/2006	Krohn	D541,418 S	4/2007	Schechter et al.
7,108,695 B2	9/2006	Witt et al.	7,199,537 B2	4/2007	Okamura et al.
7,108,701 B2	9/2006	Evens et al.	7,202,576 B1	4/2007	Dechene et al.
7,108,709 B2	9/2006	Cummins	7,202,653 B2	4/2007	Pai
7,111,768 B2	9/2006	Cummins et al.	7,204,404 B2	4/2007	Nguyen et al.
7,111,769 B2	9/2006	Wales et al.	7,204,835 B2	4/2007	Latterell et al.
7,112,214 B2	9/2006	Peterson et al.	7,207,233 B2	4/2007	Wadge
RE39,358 E	10/2006	Goble	7,207,471 B2	4/2007	Heinrich et al.
7,114,642 B2	10/2006	Whitman	7,207,472 B2	4/2007	Wukusick et al.
7,116,100 B1	10/2006	Mock et al.	7,207,556 B2	4/2007	Saitoh et al.
7,118,020 B2	10/2006	Lee et al.	7,208,005 B2	4/2007	Frecker et al.
7,118,528 B1	10/2006	Piskun	7,210,609 B2	5/2007	Leiboff et al.
7,118,563 B2	10/2006	Weckwerth et al.	7,211,081 B2	5/2007	Goble
7,118,582 B1	10/2006	Wang et al.	7,211,084 B2	5/2007	Goble et al.
7,119,534 B2	10/2006	Butzmann	7,211,092 B2	5/2007	Hughett
7,121,446 B2	10/2006	Arad et al.	7,211,979 B2	5/2007	Khatib et al.
7,121,773 B2	10/2006	Mikiya et al.	7,213,736 B2	5/2007	Wales et al.
7,122,028 B2	10/2006	Looper et al.	7,214,224 B2	5/2007	Goble
7,125,403 B2	10/2006	Julian et al.	7,215,517 B2	5/2007	Takamatsu
7,125,409 B2	10/2006	Truckai et al.	7,217,285 B2	5/2007	Vargas et al.
7,126,303 B2	10/2006	Farritor et al.	7,220,260 B2	5/2007	Fleming et al.
7,126,879 B2	10/2006	Snyder	7,220,272 B2	5/2007	Weadock
7,128,253 B2	10/2006	Mastri et al.	7,225,959 B2	6/2007	Patton et al.
7,128,254 B2	10/2006	Shelton, IV et al.	7,225,963 B2	6/2007	Scirica
7,128,748 B2	10/2006	Mooradian et al.	7,225,964 B2	6/2007	Mastri et al.
7,131,445 B2	11/2006	Amoah	7,226,450 B2	6/2007	Athanasίου et al.
7,133,601 B2	11/2006	Phillips et al.	7,229,408 B2	6/2007	Douglas et al.
7,134,587 B2	11/2006	Schwemberger et al.	7,234,624 B2	6/2007	Gresham et al.
7,135,027 B2	11/2006	Delmotte	7,235,072 B2	6/2007	Sartor et al.
7,137,980 B2	11/2006	Buyse et al.	7,235,089 B1	6/2007	McGuckin, Jr.
7,137,981 B2	11/2006	Long	7,235,302 B2	6/2007	Jing et al.
7,139,016 B2	11/2006	Squilla et al.	7,237,708 B1	7/2007	Guy et al.
7,140,527 B2	11/2006	Ehrenfels et al.	7,238,195 B2	7/2007	Viola
7,140,528 B2	11/2006	Shelton, IV	7,238,901 B2	7/2007	Kim et al.
7,141,055 B2	11/2006	Abrams et al.	7,239,657 B1	7/2007	Gunnarsson
7,143,923 B2	12/2006	Shelton, IV et al.	7,241,288 B2	7/2007	Braun
7,143,924 B2	12/2006	Scirica et al.	7,241,289 B2	7/2007	Braun
7,143,925 B2	12/2006	Shelton, IV et al.	7,246,734 B2	7/2007	Shelton, IV
7,143,926 B2	12/2006	Shelton, IV et al.	7,247,161 B2	7/2007	Johnston et al.
7,146,191 B2	12/2006	Kerner et al.	7,249,267 B2	7/2007	Chapuis
			7,252,641 B2	8/2007	Thompson et al.
			7,252,660 B2	8/2007	Kunz
			7,255,012 B2	8/2007	Hedtke
			7,255,696 B2	8/2007	Goble et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

7,256,695	B2	8/2007	Hamel et al.	7,361,168	B2	4/2008	Makower et al.
7,258,262	B2	8/2007	Mastri et al.	7,361,195	B2	4/2008	Schwartz et al.
7,258,546	B2	8/2007	Beier et al.	7,364,060	B2	4/2008	Milliman
7,260,431	B2	8/2007	Libbus et al.	7,364,061	B2	4/2008	Swayze et al.
7,265,374	B2	9/2007	Lee et al.	7,368,124	B2	5/2008	Chun et al.
7,267,677	B2	9/2007	Johnson et al.	7,371,210	B2	5/2008	Brock et al.
7,267,679	B2	9/2007	McGuckin, Jr. et al.	7,371,403	B2	5/2008	McCarthy et al.
7,272,002	B2	9/2007	Drapeau	7,377,918	B2	5/2008	Amoah
7,273,483	B2	9/2007	Wiener et al.	7,377,928	B2	5/2008	Zubik et al.
7,275,674	B2	10/2007	Racenet et al.	7,380,695	B2	6/2008	Doll et al.
7,276,044	B2	10/2007	Ferry et al.	7,380,696	B2	6/2008	Shelton, IV et al.
7,276,068	B2	10/2007	Johnson et al.	7,384,403	B2	6/2008	Sherman
7,278,562	B2	10/2007	Mastri et al.	7,384,417	B2	6/2008	Cucin
7,278,563	B1	10/2007	Green	7,386,365	B2	6/2008	Nixon
7,278,949	B2	10/2007	Bader	7,386,730	B2	6/2008	Uchikubo
7,278,994	B2	10/2007	Goble	7,388,217	B2	6/2008	Buschbeck et al.
7,282,048	B2	10/2007	Goble et al.	7,388,484	B2	6/2008	Hsu
7,286,850	B2	10/2007	Frielink et al.	7,391,173	B2	6/2008	Schena
7,287,682	B1	10/2007	Ezzat et al.	7,394,190	B2	7/2008	Huang
7,289,139	B2	10/2007	Amling et al.	7,396,356	B2	7/2008	Mollenauer
7,293,685	B2	11/2007	Ehrenfels et al.	7,397,364	B2	7/2008	Govari
7,295,893	B2	11/2007	Sunaoshi	7,398,707	B2	7/2008	Morley et al.
7,295,907	B2	11/2007	Lu et al.	7,398,907	B2	7/2008	Racenet et al.
7,296,722	B2	11/2007	Ivanko	7,398,908	B2	7/2008	Holsten et al.
7,296,724	B2	11/2007	Green et al.	7,400,107	B2	7/2008	Schneider et al.
7,297,149	B2	11/2007	Vitali et al.	7,400,752	B2	7/2008	Zacharias
7,300,373	B2	11/2007	Jinno et al.	7,401,000	B2	7/2008	Nakamura
7,300,450	B2	11/2007	Vleugels et al.	7,401,721	B2	7/2008	Holsten et al.
7,303,106	B2	12/2007	Milliman et al.	7,404,449	B2	7/2008	Birmingham et al.
7,303,107	B2	12/2007	Milliman et al.	7,404,508	B2	7/2008	Smith et al.
7,303,108	B2	12/2007	Shelton, IV	7,404,509	B2	7/2008	Ortiz et al.
7,303,502	B2	12/2007	Thompson	7,404,822	B2	7/2008	Viat et al.
7,303,556	B2	12/2007	Metzger	7,407,074	B2	8/2008	Ortiz et al.
7,306,597	B2	12/2007	Manzo	7,407,075	B2	8/2008	Holsten et al.
7,308,998	B2	12/2007	Mastri et al.	7,407,076	B2	8/2008	Racenet et al.
7,311,238	B2	12/2007	Liu	7,407,077	B2	8/2008	Ortiz et al.
7,313,430	B2	12/2007	Urquhart et al.	7,407,078	B2	8/2008	Shelton, IV et al.
7,314,473	B2	1/2008	Jinno et al.	7,408,310	B2	8/2008	Hong et al.
7,322,859	B2	1/2008	Evans	7,410,085	B2	8/2008	Wolf et al.
7,322,975	B2	1/2008	Goble et al.	7,410,086	B2	8/2008	Ortiz et al.
7,322,994	B2	1/2008	Nicholas et al.	7,410,483	B2	8/2008	Danitz et al.
7,324,572	B2	1/2008	Chang	7,413,563	B2	8/2008	Corcoran et al.
7,326,203	B2	2/2008	Papineau et al.	7,416,101	B2	8/2008	Shelton, IV et al.
7,326,213	B2	2/2008	Benderev et al.	7,418,078	B2	8/2008	Blanz et al.
7,328,828	B2	2/2008	Ortiz et al.	RE40,514	E	9/2008	Mastri et al.
7,328,829	B2	2/2008	Arad et al.	7,419,080	B2	9/2008	Smith et al.
7,330,004	B2	2/2008	DeJonge et al.	7,419,081	B2	9/2008	Ehrenfels et al.
7,331,340	B2	2/2008	Barney	7,419,321	B2	9/2008	Tereschouk
7,331,343	B2	2/2008	Schmidt et al.	7,419,495	B2	9/2008	Menn et al.
7,331,403	B2	2/2008	Berry et al.	7,422,136	B1	9/2008	Marczyk
7,331,406	B2	2/2008	Wottreng, Jr. et al.	7,422,138	B2	9/2008	Bilotti et al.
7,331,969	B1	2/2008	Ingnas et al.	7,422,139	B2	9/2008	Shelton, IV et al.
7,334,717	B2	2/2008	Rethy et al.	7,424,965	B2	9/2008	Racenet et al.
7,334,718	B2	2/2008	McAlister et al.	7,427,607	B2	9/2008	Suzuki
7,335,199	B2	2/2008	Goble et al.	D578,644	S	10/2008	Shumer et al.
7,336,045	B2	2/2008	Clermonts	7,431,188	B1	10/2008	Marczyk
7,336,048	B2	2/2008	Lohr	7,431,189	B2	10/2008	Shelton, IV et al.
7,336,184	B2	2/2008	Smith et al.	7,431,694	B2	10/2008	Stefanchik et al.
7,337,774	B2	3/2008	Webb	7,431,730	B2	10/2008	Viola
7,338,505	B2	3/2008	Belson	7,434,715	B2	10/2008	Shelton, IV et al.
7,338,513	B2	3/2008	Lee et al.	7,434,717	B2	10/2008	Shelton, IV et al.
7,341,591	B2	3/2008	Grinberg	7,435,249	B2	10/2008	Buyssse et al.
7,343,920	B2	3/2008	Toby et al.	7,438,209	B1	10/2008	Hess et al.
7,344,532	B2	3/2008	Goble et al.	7,438,718	B2	10/2008	Milliman et al.
7,344,533	B2	3/2008	Pearson et al.	7,439,354	B2	10/2008	Lenges et al.
7,346,344	B2	3/2008	Fontaine	7,441,684	B2	10/2008	Shelton, IV et al.
7,346,406	B2	3/2008	Brotto et al.	7,441,685	B1	10/2008	Boudreaux
7,348,763	B1	3/2008	Reinhart et al.	7,442,201	B2	10/2008	Pugsley et al.
7,348,875	B2	3/2008	Hughes et al.	7,443,547	B2	10/2008	Moreno et al.
RE40,237	E	4/2008	Bilotti et al.	7,448,525	B2	11/2008	Shelton, IV et al.
7,351,258	B2	4/2008	Ricotta et al.	7,451,904	B2	11/2008	Shelton, IV
7,354,447	B2	4/2008	Shelton, IV et al.	7,455,208	B2	11/2008	Wales et al.
7,354,502	B2	4/2008	Polat et al.	7,455,676	B2	11/2008	Holsten et al.
7,357,287	B2	4/2008	Shelton, IV et al.	7,455,682	B2	11/2008	Viola
7,357,806	B2	4/2008	Rivera et al.	7,461,767	B2	12/2008	Viola et al.
				7,462,187	B2	12/2008	Johnston et al.
				7,464,845	B2	12/2008	Chou
				7,464,846	B2	12/2008	Shelton, IV et al.
				7,464,847	B2	12/2008	Viola et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

7,464,849	B2	12/2008	Shelton, IV et al.	7,586,289	B2	9/2009	Andruk et al.
7,467,740	B2	12/2008	Shelton, IV et al.	7,588,174	B2	9/2009	Holsten et al.
7,467,849	B2	12/2008	Silverbrook et al.	7,588,175	B2	9/2009	Timm et al.
7,472,814	B2	1/2009	Mastri et al.	7,588,176	B2	9/2009	Timm et al.
7,472,815	B2	1/2009	Shelton, IV et al.	7,588,177	B2	9/2009	Racenet
7,472,816	B2	1/2009	Holsten et al.	7,591,783	B2	9/2009	Boulais et al.
7,473,221	B2	1/2009	Ewers et al.	7,591,818	B2	9/2009	Bertolero et al.
7,473,253	B2	1/2009	Dycus et al.	7,593,766	B2	9/2009	Faber et al.
7,473,263	B2	1/2009	Johnston et al.	7,597,229	B2	10/2009	Boudreaux et al.
7,476,237	B2	1/2009	Taniguchi et al.	7,597,230	B2	10/2009	Racenet et al.
7,479,608	B2	1/2009	Smith	7,597,693	B2	10/2009	Garrison
7,481,347	B2	1/2009	Roy	7,597,699	B2	10/2009	Rogers
7,481,348	B2	1/2009	Marczyk	7,598,972	B2	10/2009	Tomita
7,481,349	B2	1/2009	Holsten et al.	7,600,663	B2	10/2009	Green
7,481,824	B2	1/2009	Boudreaux et al.	7,604,150	B2	10/2009	Boudreaux
7,485,124	B2	2/2009	Kuhns et al.	7,604,151	B2	10/2009	Hess et al.
7,485,133	B2	2/2009	Cannon et al.	7,604,668	B2	10/2009	Farnsworth et al.
7,485,142	B2	2/2009	Milo	7,607,557	B2	10/2009	Shelton, IV et al.
7,487,899	B2	2/2009	Shelton, IV et al.	7,611,038	B2	11/2009	Racenet et al.
7,489,055	B2	2/2009	Jeong et al.	7,611,474	B2	11/2009	Hibner et al.
7,490,749	B2	2/2009	Schall et al.	7,615,003	B2	11/2009	Stefanchik et al.
7,491,232	B2	2/2009	Bolduc et al.	7,615,067	B2	11/2009	Lee et al.
7,494,039	B2	2/2009	Racenet et al.	7,617,961	B2	11/2009	Viola
7,494,499	B2	2/2009	Nagase et al.	7,624,902	B2	12/2009	Marczyk et al.
7,494,501	B2	2/2009	Ahlberg et al.	7,624,903	B2	12/2009	Green et al.
7,500,979	B2	3/2009	Hueil et al.	7,625,370	B2	12/2009	Hart et al.
7,501,198	B2	3/2009	Barlev et al.	7,630,841	B2	12/2009	Comisky et al.
7,503,474	B2	3/2009	Hillstead et al.	7,631,793	B2	12/2009	Rethy et al.
7,506,790	B2	3/2009	Shelton, IV	7,631,794	B2	12/2009	Rethy et al.
7,506,791	B2	3/2009	Omaits et al.	7,635,074	B2	12/2009	Olson et al.
7,507,202	B2	3/2009	Schoellhorn	7,635,922	B2	12/2009	Becker
7,510,107	B2	3/2009	Timm et al.	7,637,409	B2	12/2009	Marczyk
7,510,534	B2	3/2009	Burdorff et al.	7,637,410	B2	12/2009	Marczyk
7,510,566	B2	3/2009	Jacobs et al.	7,638,958	B2	12/2009	Philipp et al.
7,513,407	B1	4/2009	Chang	7,641,091	B2	1/2010	Olson et al.
7,513,408	B2	4/2009	Shelton, IV et al.	7,641,092	B2	1/2010	Kruszynski et al.
7,517,356	B2	4/2009	Heinrich	7,641,093	B2	1/2010	Doll et al.
7,524,320	B2	4/2009	Tierney et al.	7,641,095	B2	1/2010	Viola
7,527,632	B2	5/2009	Houghton et al.	7,644,783	B2	1/2010	Roberts et al.
7,530,984	B2	5/2009	Sonnenschein et al.	7,644,848	B2	1/2010	Swayze et al.
7,530,985	B2	5/2009	Takemoto et al.	7,645,230	B2	1/2010	Mikkaichi et al.
7,533,906	B2	5/2009	Luetgten et al.	7,648,457	B2	1/2010	Stefanchik et al.
7,534,259	B2	5/2009	Lashinski et al.	7,648,519	B2	1/2010	Lee et al.
7,540,867	B2	6/2009	Jinno et al.	7,650,185	B2	1/2010	Maile et al.
7,542,807	B2	6/2009	Bertolero et al.	7,651,017	B2	1/2010	Ortiz et al.
7,546,939	B2	6/2009	Adams et al.	7,651,498	B2	1/2010	Shifrin et al.
7,546,940	B2	6/2009	Milliman et al.	7,654,431	B2	2/2010	Hueil et al.
7,547,312	B2	6/2009	Bauman et al.	7,655,004	B2	2/2010	Long
7,549,563	B2	6/2009	Mather et al.	7,655,288	B2	2/2010	Bauman et al.
7,549,564	B2	6/2009	Boudreaux	7,655,584	B2	2/2010	Biran et al.
7,549,998	B2	6/2009	Braun	7,656,131	B2	2/2010	Embrey et al.
7,552,854	B2	6/2009	Wixey et al.	7,658,311	B2	2/2010	Boudreaux
7,553,173	B2	6/2009	Kowalick	7,658,312	B2	2/2010	Vidal et al.
7,553,275	B2	6/2009	Padget et al.	7,658,705	B2	2/2010	Melvin et al.
7,554,343	B2	6/2009	Bromfield	7,659,219	B2	2/2010	Biran et al.
7,556,185	B2	7/2009	Viola	7,662,161	B2	2/2010	Briganti et al.
7,556,186	B2	7/2009	Milliman	7,665,646	B2	2/2010	Prommersberger
7,556,647	B2	7/2009	Drews et al.	7,665,647	B2	2/2010	Shelton, IV et al.
7,559,449	B2	7/2009	Viola	7,669,746	B2	3/2010	Shelton, IV
7,559,450	B2	7/2009	Wales et al.	7,669,747	B2	3/2010	Weisenburgh, II et al.
7,559,452	B2	7/2009	Wales et al.	7,670,334	B2	3/2010	Hueil et al.
7,559,937	B2	7/2009	de la Torre et al.	7,673,780	B2	3/2010	Shelton, IV et al.
7,561,637	B2	7/2009	Jonsson et al.	7,673,781	B2	3/2010	Swayze et al.
7,562,910	B2	7/2009	Kertesz et al.	7,673,782	B2	3/2010	Hess et al.
7,563,269	B2	7/2009	Hashiguchi	7,673,783	B2	3/2010	Morgan et al.
7,563,862	B2	7/2009	Sieg et al.	7,674,253	B2	3/2010	Fisher et al.
7,565,993	B2	7/2009	Milliman et al.	7,674,255	B2	3/2010	Braun
7,566,300	B2	7/2009	Devierre et al.	7,674,263	B2	3/2010	Ryan
7,567,045	B2	7/2009	Fristedt	7,674,270	B2	3/2010	Layer
7,568,603	B2	8/2009	Shelton, IV et al.	7,682,307	B2	3/2010	Danitz et al.
7,568,604	B2	8/2009	Ehrenfels et al.	7,682,367	B2	3/2010	Shah et al.
7,568,619	B2	8/2009	Todd et al.	7,682,686	B2	3/2010	Curro et al.
7,575,144	B2	8/2009	Ortiz et al.	7,686,201	B2	3/2010	Csiky
7,578,825	B2	8/2009	Huebner	7,686,804	B2	3/2010	Johnson et al.
7,583,063	B2	9/2009	Dooley	7,686,826	B2	3/2010	Lee et al.
				7,688,028	B2	3/2010	Phillips et al.
				7,691,098	B2	4/2010	Wallace et al.
				7,691,103	B2	4/2010	Fernandez et al.
				7,691,106	B2	4/2010	Schenberger et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

7,694,864 B2	4/2010	Okada et al.	7,770,774 B2	8/2010	Mastri et al.
7,694,865 B2	4/2010	Scirica	7,770,775 B2	8/2010	Shelton, IV et al.
7,695,485 B2	4/2010	Whitman et al.	7,770,776 B2	8/2010	Chen et al.
7,699,204 B2	4/2010	Viola	7,771,396 B2	8/2010	Stefanchik et al.
7,699,835 B2	4/2010	Lee et al.	7,772,720 B2	8/2010	McGee et al.
7,699,844 B2	4/2010	Utley et al.	7,772,725 B2	8/2010	Siman-Tov
7,699,846 B2	4/2010	Ryan	7,775,972 B2	8/2010	Brock et al.
7,699,856 B2	4/2010	Van Wyk et al.	7,776,037 B2	8/2010	Odom
7,699,859 B2	4/2010	Bombard et al.	7,776,060 B2	8/2010	Mooradian et al.
7,699,860 B2	4/2010	Huitema et al.	7,776,065 B2	8/2010	Griffiths et al.
7,703,653 B2	4/2010	Shah et al.	7,778,004 B2	8/2010	Nerheim et al.
7,708,180 B2	5/2010	Murray et al.	7,779,737 B2	8/2010	Newman, Jr. et al.
7,708,181 B2	5/2010	Cole et al.	7,780,054 B2	8/2010	Wales
7,708,182 B2	5/2010	Viola	7,780,055 B2	8/2010	Scirica et al.
7,708,758 B2	5/2010	Lee et al.	7,780,309 B2	8/2010	McMillan et al.
7,712,182 B2	5/2010	Zeiler et al.	7,780,663 B2	8/2010	Yates et al.
7,713,190 B2	5/2010	Brock et al.	7,780,685 B2	8/2010	Hunt et al.
7,714,239 B2	5/2010	Smith	7,784,662 B2	8/2010	Wales et al.
7,714,334 B2	5/2010	Lin	7,784,663 B2	8/2010	Shelton, IV
7,717,312 B2	5/2010	Beetel	7,787,256 B2	8/2010	Chan et al.
7,717,313 B2	5/2010	Criscuolo et al.	7,789,283 B2	9/2010	Shah
7,717,846 B2	5/2010	Zirps et al.	7,789,875 B2	9/2010	Brock et al.
7,717,873 B2	5/2010	Swick	7,789,883 B2	9/2010	Takashino et al.
7,717,915 B2	5/2010	Miyazawa	7,789,889 B2	9/2010	Zubik et al.
7,718,180 B2	5/2010	Karp	7,793,812 B2	9/2010	Moore et al.
7,718,556 B2	5/2010	Matsuda et al.	7,794,475 B2	9/2010	Hess et al.
7,721,930 B2	5/2010	McKenna et al.	7,798,386 B2	9/2010	Schall et al.
7,721,931 B2	5/2010	Shelton, IV et al.	7,799,039 B2	9/2010	Shelton, IV et al.
7,721,933 B2	5/2010	Ehrenfels et al.	7,799,044 B2	9/2010	Johnston et al.
7,721,934 B2	5/2010	Shelton, IV et al.	7,799,965 B2	9/2010	Patel et al.
7,721,936 B2	5/2010	Shalton, IV et al.	7,803,151 B2	9/2010	Whitman
7,722,527 B2	5/2010	Bouchier et al.	7,806,871 B2	10/2010	Li et al.
7,722,607 B2	5/2010	Dumbauld et al.	7,806,891 B2	10/2010	Nowlin et al.
7,722,610 B2	5/2010	Viola et al.	7,810,690 B2	10/2010	Bilotti et al.
7,725,214 B2	5/2010	Diolaiti	7,810,691 B2	10/2010	Boyden et al.
7,726,171 B2	6/2010	Langlotz et al.	7,810,692 B2	10/2010	Hall et al.
7,726,537 B2	6/2010	Olson et al.	7,810,693 B2	10/2010	Broehl et al.
7,726,538 B2	6/2010	Holsten et al.	7,811,275 B2	10/2010	Birk et al.
7,726,539 B2	6/2010	Holsten et al.	7,814,816 B2	10/2010	Alberti et al.
7,727,954 B2	6/2010	McKay	7,815,092 B2	10/2010	Whitman et al.
7,728,553 B2	6/2010	Carrier et al.	7,815,565 B2	10/2010	Stefanchik et al.
7,729,742 B2	6/2010	Govari	7,815,662 B2	10/2010	Spivey et al.
7,731,072 B2	6/2010	Timm et al.	7,819,296 B2	10/2010	Hueil et al.
7,731,073 B2	6/2010	Wixey et al.	7,819,297 B2	10/2010	Doll et al.
7,731,724 B2	6/2010	Huitema et al.	7,819,298 B2	10/2010	Hall et al.
7,735,703 B2	6/2010	Morgan et al.	7,819,299 B2	10/2010	Shelton, IV et al.
7,736,254 B2	6/2010	Schena	7,819,799 B2	10/2010	Merril et al.
7,736,306 B2	6/2010	Brustad et al.	7,819,884 B2	10/2010	Lee et al.
7,736,374 B2	6/2010	Vaughan et al.	7,819,886 B2	10/2010	Whitfield et al.
7,738,971 B2	6/2010	Swayze et al.	7,823,592 B2	11/2010	Bettuchi et al.
7,740,159 B2	6/2010	Shelton, IV et al.	7,823,760 B2	11/2010	Zemlok et al.
7,742,036 B2	6/2010	Grant et al.	7,824,401 B2	11/2010	Manzo et al.
7,743,960 B2	6/2010	Whitman et al.	7,824,422 B2	11/2010	Benchetrit
7,744,624 B2	6/2010	Bettuchi	7,824,426 B2	11/2010	Racenet et al.
7,744,627 B2	6/2010	Orban, III et al.	7,828,189 B2	11/2010	Holsten et al.
7,744,628 B2	6/2010	Viola	7,828,794 B2	11/2010	Sartor
7,747,146 B2	6/2010	Milano et al.	7,828,808 B2	11/2010	Hinman et al.
7,748,587 B2	7/2010	Haramiishi et al.	7,831,292 B2	11/2010	Quaid et al.
7,748,632 B2	7/2010	Coleman et al.	7,832,408 B2	11/2010	Shelton, IV et al.
7,749,204 B2	7/2010	Dhanaraj et al.	7,832,611 B2	11/2010	Boyden et al.
7,751,870 B2	7/2010	Whitman	7,832,612 B2	11/2010	Baxter, III et al.
7,753,245 B2	7/2010	Boudreaux et al.	7,833,234 B2	11/2010	Bailly et al.
7,753,246 B2	7/2010	Scirica	7,835,823 B2	11/2010	Sillman et al.
7,753,904 B2	7/2010	Shelton, IV et al.	7,836,400 B2	11/2010	May et al.
7,757,924 B2	7/2010	Gerbi et al.	7,837,079 B2	11/2010	Holsten et al.
7,758,612 B2	7/2010	Shipp	7,837,080 B2	11/2010	Schwemberger
7,762,462 B2	7/2010	Gelbman	7,837,081 B2	11/2010	Holsten et al.
7,762,998 B2	7/2010	Birk et al.	7,837,425 B2	11/2010	Saeki et al.
7,766,207 B2	8/2010	Mather et al.	7,837,685 B2	11/2010	Weinberg et al.
7,766,209 B2	8/2010	Baxter, III et al.	7,837,694 B2	11/2010	Tethrake et al.
7,766,210 B2	8/2010	Shelton, IV et al.	7,838,789 B2	11/2010	Stoffers et al.
7,766,821 B2	8/2010	Brunnen et al.	7,839,109 B2	11/2010	Carmen, Jr. et al.
7,766,894 B2	8/2010	Weitzner et al.	7,841,503 B2	11/2010	Sonnenschein et al.
7,770,658 B2	8/2010	Ito et al.	7,842,025 B2	11/2010	Coleman et al.
7,770,773 B2	8/2010	Whitman et al.	7,842,028 B2	11/2010	Lee
			7,843,158 B2	11/2010	Prisco
			7,845,533 B2	12/2010	Marczyk et al.
			7,845,534 B2	12/2010	Viola et al.
			7,845,535 B2	12/2010	Scirica

(56)

References Cited

U.S. PATENT DOCUMENTS

7,845,536	B2	12/2010	Viola et al.	7,923,144	B2	4/2011	Kohn et al.
7,845,537	B2	12/2010	Shelton, IV et al.	7,926,691	B2	4/2011	Viola et al.
7,846,085	B2	12/2010	Silverman et al.	7,927,328	B2	4/2011	Orszulak et al.
7,846,149	B2	12/2010	Jankowski	7,928,281	B2	4/2011	Augustine
7,848,066	B2	12/2010	Yanagishima	7,930,040	B1	4/2011	Kelsch et al.
7,850,623	B2	12/2010	Griffin et al.	7,930,065	B2	4/2011	Larkin et al.
7,850,642	B2	12/2010	Moll et al.	7,931,660	B2	4/2011	Aranyi et al.
7,850,982	B2	12/2010	Stopek et al.	7,931,695	B2	4/2011	Ringeisen
7,854,735	B2	12/2010	Houser et al.	7,931,877	B2	4/2011	Steffens et al.
7,854,736	B2	12/2010	Ryan	7,934,630	B2	5/2011	Shelton, IV et al.
7,857,183	B2	12/2010	Shelton, IV	7,934,631	B2	5/2011	Balbierz et al.
7,857,184	B2	12/2010	Viola	7,935,773	B2	5/2011	Hadba et al.
7,857,185	B2	12/2010	Swayze et al.	7,936,142	B2	5/2011	Otsuka et al.
7,857,186	B2	12/2010	Baxter, III et al.	7,938,307	B2	5/2011	Bettuchi
7,857,813	B2	12/2010	Schmitz et al.	7,941,865	B2	5/2011	Seman, Jr. et al.
7,861,906	B2	1/2011	Doll et al.	7,942,303	B2	5/2011	Shah
7,862,502	B2	1/2011	Pool et al.	7,942,890	B2	5/2011	D'Agostino et al.
7,862,546	B2	1/2011	Conlon et al.	7,944,175	B2	5/2011	Mori et al.
7,862,579	B2	1/2011	Ortiz et al.	7,945,792	B2	5/2011	Cherpanier
7,866,525	B2	1/2011	Scirica	7,945,798	B2	5/2011	Carlson et al.
7,866,527	B2	1/2011	Hall et al.	7,946,453	B2	5/2011	Voegel et al.
7,866,528	B2	1/2011	Olson et al.	7,947,011	B2	5/2011	Birk et al.
7,870,989	B2	1/2011	Viola et al.	7,950,560	B2	5/2011	Zemlok et al.
7,871,418	B2	1/2011	Thompson et al.	7,950,561	B2	5/2011	Aranyi
7,871,440	B2	1/2011	Schwartz et al.	7,951,071	B2	5/2011	Whitman et al.
7,875,055	B2	1/2011	Cichocki, Jr.	7,951,166	B2	5/2011	Orban, III et al.
7,879,063	B2	2/2011	Khosravi	7,954,682	B2	6/2011	Giordano et al.
7,879,070	B2	2/2011	Ortiz et al.	7,954,684	B2	6/2011	Boudreaux
7,883,461	B2	2/2011	Albrecht et al.	7,954,685	B2	6/2011	Viola
7,883,465	B2	2/2011	Donofrio et al.	7,954,686	B2	6/2011	Baxter, III et al.
7,886,951	B2	2/2011	Hessler	7,954,687	B2	6/2011	Zemlok et al.
7,886,952	B2	2/2011	Scirica et al.	7,955,253	B2	6/2011	Ewers et al.
7,887,530	B2	2/2011	Zemlok et al.	7,955,257	B2	6/2011	Frasier et al.
7,887,535	B2	2/2011	Lands et al.	7,955,322	B2	6/2011	Devengenzo et al.
7,887,536	B2	2/2011	Johnson et al.	7,955,327	B2	6/2011	Sartor et al.
7,887,563	B2	2/2011	Cummins	7,955,380	B2	6/2011	Chu et al.
7,891,531	B1	2/2011	Ward	7,959,050	B2	6/2011	Smith et al.
7,891,532	B2	2/2011	Mastri et al.	7,959,051	B2	6/2011	Smith et al.
7,892,200	B2	2/2011	Birk et al.	7,959,052	B2	6/2011	Sonnenschein et al.
7,892,245	B2	2/2011	Liddicoat et al.	7,963,432	B2	6/2011	Knodel et al.
7,893,586	B2	2/2011	West et al.	7,963,433	B2	6/2011	Whitman et al.
7,896,214	B2	3/2011	Farascioni	7,963,913	B2	6/2011	Devengenzo et al.
7,896,215	B2	3/2011	Adams et al.	7,963,963	B2	6/2011	Francischelli et al.
7,896,869	B2	3/2011	DiSilvestro et al.	7,963,964	B2	6/2011	Santilli et al.
7,896,877	B2	3/2011	Hall et al.	7,964,206	B2	6/2011	Suokas et al.
7,896,895	B2	3/2011	Boudreaux et al.	7,966,236	B2	6/2011	Noriega et al.
7,896,897	B2	3/2011	Gresham et al.	7,966,799	B2	6/2011	Morgan et al.
7,898,198	B2	3/2011	Murphree	7,967,178	B2	6/2011	Scirica et al.
7,900,805	B2	3/2011	Shelton, IV et al.	7,967,179	B2	6/2011	Olson et al.
7,900,806	B2	3/2011	Chen et al.	7,967,180	B2	6/2011	Scirica
7,901,381	B2	3/2011	Birk et al.	7,967,181	B2	6/2011	Viola et al.
7,905,380	B2	3/2011	Shelton, IV et al.	7,967,791	B2	6/2011	Franer et al.
7,905,381	B2	3/2011	Baxter, III et al.	7,967,839	B2	6/2011	Flock et al.
7,905,881	B2	3/2011	Masuda et al.	7,972,298	B2	7/2011	Wallace et al.
7,905,889	B2	3/2011	Catanese, III et al.	7,972,315	B2	7/2011	Birk et al.
7,905,902	B2	3/2011	Huitema et al.	7,976,213	B2	7/2011	Bertolotti et al.
7,909,039	B2	3/2011	Hur	7,976,563	B2	7/2011	Summerer
7,909,191	B2	3/2011	Baker et al.	7,979,137	B2	7/2011	Tracey et al.
7,909,220	B2	3/2011	Viola	7,980,443	B2	7/2011	Scheib et al.
7,909,221	B2	3/2011	Viola et al.	7,981,132	B2	7/2011	Dubrul et al.
7,909,224	B2	3/2011	Prommersberger	7,987,405	B2	7/2011	Turner et al.
7,913,891	B2	3/2011	Doll et al.	7,988,015	B2	8/2011	Mason, II et al.
7,913,893	B2	3/2011	Mastri et al.	7,988,026	B2	8/2011	Knodel et al.
7,914,543	B2	3/2011	Roth et al.	7,988,027	B2	8/2011	Olson et al.
7,914,551	B2	3/2011	Ortiz et al.	7,988,028	B2	8/2011	Farascioni et al.
7,918,230	B2	4/2011	Whitman et al.	7,988,779	B2	8/2011	Disalvo et al.
7,918,376	B1	4/2011	Knodel et al.	7,992,757	B2	8/2011	Wheeler et al.
7,918,377	B2	4/2011	Measamer et al.	7,993,360	B2	8/2011	Hacker et al.
7,918,845	B2	4/2011	Saadat et al.	7,994,670	B2	8/2011	Ji
7,918,848	B2	4/2011	Lau et al.	7,997,054	B2	8/2011	Bertsch et al.
7,918,861	B2	4/2011	Brock et al.	7,997,468	B2	8/2011	Farascioni
7,918,867	B2	4/2011	Dana et al.	7,997,469	B2	8/2011	Olson et al.
7,922,061	B2	4/2011	Shelton, IV et al.	8,002,696	B2	8/2011	Suzuki
7,922,063	B2	4/2011	Zemlok et al.	8,002,784	B2	8/2011	Jinno et al.
7,922,743	B2	4/2011	Heinrich et al.	8,002,785	B2	8/2011	Weiss et al.
				8,002,795	B2	8/2011	Beetel
				8,006,365	B2	8/2011	Levin et al.
				8,006,885	B2	8/2011	Marczyk
				8,006,889	B2	8/2011	Adams et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

8,007,370 B2	8/2011	Hirsch et al.	8,083,120 B2	12/2011	Shelton, IV et al.
8,007,465 B2	8/2011	Birk et al.	8,084,001 B2	12/2011	Burns et al.
8,007,479 B2	8/2011	Birk et al.	8,084,969 B2	12/2011	David et al.
8,007,511 B2	8/2011	Brock et al.	8,085,013 B2	12/2011	Wei et al.
8,007,513 B2	8/2011	Nalagatla et al.	8,087,563 B2	1/2012	Milliman et al.
8,011,550 B2	9/2011	Aranyi et al.	8,089,509 B2	1/2012	Chatenever et al.
8,011,551 B2	9/2011	Marczyk et al.	8,091,753 B2	1/2012	Viola
8,011,553 B2	9/2011	Mastri et al.	8,091,756 B2	1/2012	Viola
8,011,555 B2	9/2011	Tarinelli et al.	8,092,443 B2	1/2012	Bischoff
8,012,170 B2	9/2011	Whitman et al.	8,092,932 B2	1/2012	Phillips et al.
8,016,176 B2	9/2011	Kasvikis et al.	8,093,572 B2	1/2012	Kuduvalli
8,016,177 B2	9/2011	Bettuchi et al.	8,096,458 B2	1/2012	Hessler
8,016,178 B2	9/2011	Olson et al.	8,097,017 B2	1/2012	Viola
8,016,849 B2	9/2011	Wenchell	8,100,310 B2	1/2012	Zemlok
8,016,855 B2	9/2011	Whitman et al.	8,100,824 B2	1/2012	Hegeman et al.
8,016,858 B2	9/2011	Whitman	8,100,872 B2	1/2012	Patel
8,016,881 B2	9/2011	Furst	8,102,278 B2	1/2012	Deck et al.
8,020,742 B2	9/2011	Marczyk	8,105,350 B2	1/2012	Lee et al.
8,020,743 B2	9/2011	Shelton, IV	8,107,925 B2	1/2012	Natsuno et al.
8,021,375 B2	9/2011	Aldrich et al.	8,108,033 B2	1/2012	Drew et al.
8,025,199 B2	9/2011	Whitman et al.	8,108,072 B2	1/2012	Zhao et al.
8,025,896 B2	9/2011	Malaviya et al.	8,109,426 B2	2/2012	Milliman et al.
8,028,882 B2	10/2011	Viola	8,110,208 B1	2/2012	Hen
8,028,883 B2	10/2011	Stopek	8,113,405 B2	2/2012	Milliman
8,028,884 B2	10/2011	Sniffin et al.	8,113,408 B2	2/2012	Wenchell et al.
8,028,885 B2	10/2011	Smith et al.	8,113,410 B2	2/2012	Hall et al.
8,029,510 B2	10/2011	Hoegerle	8,114,100 B2	2/2012	Smith et al.
8,031,069 B2	10/2011	Cohn et al.	8,118,206 B2	2/2012	Zand et al.
8,033,438 B2	10/2011	Scirica	8,118,207 B2	2/2012	Racenet et al.
8,033,439 B2	10/2011	Racenet et al.	8,120,301 B2	2/2012	Goldberg et al.
8,033,440 B2	10/2011	Wenchell et al.	8,122,128 B2	2/2012	Burke, II et al.
8,034,077 B2	10/2011	Smith et al.	8,123,103 B2	2/2012	Milliman
8,034,337 B2	10/2011	Simard	8,123,523 B2	2/2012	Carron et al.
8,034,363 B2	10/2011	Li et al.	8,123,766 B2	2/2012	Bauman et al.
8,035,487 B2	10/2011	Malackowski	8,123,767 B2	2/2012	Bauman et al.
8,037,591 B2	10/2011	Spivey et al.	8,125,168 B2	2/2012	Johnson et al.
8,038,045 B2	10/2011	Bettuchi et al.	8,127,975 B2	3/2012	Olson et al.
8,038,046 B2	10/2011	Smith et al.	8,127,976 B2	3/2012	Scirica et al.
8,038,686 B2	10/2011	Huitema et al.	8,128,624 B2	3/2012	Couture et al.
8,043,207 B2	10/2011	Adams	8,128,643 B2	3/2012	Aranyi et al.
8,043,328 B2	10/2011	Hahnen et al.	8,128,645 B2	3/2012	Sonnenschein et al.
8,044,536 B2	10/2011	Nguyen et al.	8,128,662 B2	3/2012	Altarac et al.
8,044,604 B2	10/2011	Hagino et al.	8,132,703 B2	3/2012	Milliman et al.
8,047,236 B2	11/2011	Perry	8,132,705 B2	3/2012	Viola et al.
8,048,503 B2	11/2011	Farnsworth et al.	8,132,706 B2	3/2012	Marczyk et al.
8,052,636 B2	11/2011	Moll et al.	8,134,306 B2	3/2012	Drader et al.
8,056,787 B2	11/2011	Boudreaux et al.	8,136,711 B2	3/2012	Beardsley et al.
8,056,788 B2	11/2011	Mastri et al.	8,136,712 B2	3/2012	Zingman
8,056,789 B1	11/2011	White et al.	8,136,713 B2	3/2012	Hathaway et al.
8,057,508 B2	11/2011	Shelton, IV	8,137,339 B2	3/2012	Jinno et al.
8,058,771 B2	11/2011	Giordano et al.	8,140,417 B2	3/2012	Shibata
8,060,250 B2	11/2011	Reiland et al.	8,141,762 B2	3/2012	Bedi et al.
8,061,014 B2	11/2011	Smith et al.	8,141,763 B2	3/2012	Milliman
8,061,576 B2	11/2011	Cappola	8,142,200 B2	3/2012	Crunkilton et al.
8,062,236 B2	11/2011	Soltz	8,142,425 B2	3/2012	Eggers
8,062,330 B2	11/2011	Prommersberger et al.	8,142,461 B2	3/2012	Houser et al.
8,063,619 B2	11/2011	Zhu et al.	8,142,515 B2	3/2012	Therin et al.
8,066,158 B2	11/2011	Vogel et al.	8,143,520 B2	3/2012	Cutler
8,066,166 B2	11/2011	Demmy et al.	8,146,790 B2	4/2012	Milliman
8,066,167 B2	11/2011	Measamer et al.	8,147,421 B2	4/2012	Farquhar et al.
8,066,168 B2	11/2011	Vidal et al.	8,147,456 B2	4/2012	Fisher et al.
8,066,720 B2	11/2011	Knodel et al.	8,147,485 B2	4/2012	Wham et al.
D650,074 S	12/2011	Hunt et al.	8,152,041 B2	4/2012	Kostrzewski
8,070,033 B2	12/2011	Milliman et al.	8,152,756 B2	4/2012	Webster et al.
8,070,035 B2	12/2011	Holsten et al.	8,154,239 B2	4/2012	Katsuki et al.
8,070,743 B2	12/2011	Kagan et al.	8,157,145 B2	4/2012	Shelton, IV et al.
8,074,858 B2	12/2011	Marczyk	8,157,148 B2	4/2012	Scirica
8,074,861 B2	12/2011	Ehrenfels et al.	8,157,151 B2	4/2012	Ingmanson et al.
8,075,476 B2	12/2011	Vargas	8,157,152 B2	4/2012	Holsten et al.
8,075,571 B2	12/2011	Vitali et al.	8,157,153 B2	4/2012	Shelton, IV et al.
8,079,950 B2	12/2011	Stern et al.	8,157,793 B2	4/2012	Omori et al.
8,079,989 B2	12/2011	Birk et al.	8,161,977 B2	4/2012	Shelton, IV et al.
8,080,004 B2	12/2011	Downey et al.	8,162,138 B2	4/2012	Bettenhausen et al.
8,083,118 B2	12/2011	Milliman et al.	8,162,197 B2	4/2012	Mastri et al.
8,083,119 B2	12/2011	Prommersberger	8,162,668 B2	4/2012	Toly
			8,162,933 B2	4/2012	Francischelli et al.
			8,162,965 B2	4/2012	Reschke et al.
			8,167,185 B2	5/2012	Shelton, IV et al.
			8,167,622 B2	5/2012	Zhou

(56)

References Cited

U.S. PATENT DOCUMENTS

8,167,895 B2	5/2012	D'Agostino et al.	8,256,654 B2	9/2012	Bettuchi et al.
8,167,898 B1	5/2012	Schaller et al.	8,256,655 B2	9/2012	Sniffin et al.
8,170,241 B2	5/2012	Roe et al.	8,256,656 B2	9/2012	Milliman et al.
8,172,004 B2	5/2012	Ho	8,257,251 B2	9/2012	Shelton, IV et al.
8,172,120 B2	5/2012	Boyden et al.	8,257,356 B2	9/2012	Bleich et al.
8,172,122 B2	5/2012	Kasvikis et al.	8,257,386 B2	9/2012	Lee et al.
8,172,124 B2	5/2012	Shelton, IV et al.	8,257,391 B2	9/2012	Orban, III et al.
8,177,776 B2	5/2012	Humayun et al.	8,257,634 B2	9/2012	Scirica
8,177,797 B2	5/2012	Shimoji et al.	8,258,745 B2	9/2012	Smith et al.
8,179,705 B2	5/2012	Chapuis	8,262,655 B2	9/2012	Ghabrial et al.
8,180,458 B2	5/2012	Kane et al.	8,267,300 B2	9/2012	Boudreaux
8,181,839 B2	5/2012	Beetel	8,267,924 B2	9/2012	Zemlok et al.
8,181,840 B2	5/2012	Milliman	8,267,946 B2	9/2012	Whitfield et al.
8,182,422 B2	5/2012	Bayer et al.	8,267,951 B2	9/2012	Wayne et al.
8,183,807 B2	5/2012	Tsai et al.	8,269,121 B2	9/2012	Smith
8,186,555 B2	5/2012	Shelton, IV et al.	8,272,553 B2	9/2012	Mastri et al.
8,186,556 B2	5/2012	Viola	8,272,554 B2	9/2012	Whitman et al.
8,186,558 B2	5/2012	Sapienza	8,272,918 B2	9/2012	Lam
8,186,560 B2	5/2012	Hess et al.	8,273,404 B2	9/2012	Dave et al.
8,191,752 B2	6/2012	Scirica	8,276,801 B2	10/2012	Zemlok et al.
8,192,460 B2	6/2012	Orban, III et al.	8,276,802 B2	10/2012	Kostrzewski
8,192,651 B2	6/2012	Young et al.	8,277,473 B2	10/2012	Sunaoshi et al.
8,196,795 B2	6/2012	Moore et al.	8,281,446 B2	10/2012	Moskovich
8,196,796 B2	6/2012	Shelton, IV et al.	8,281,973 B2	10/2012	Wenchell et al.
8,197,501 B2	6/2012	Shadeck et al.	8,281,974 B2	10/2012	Hessler et al.
8,197,502 B2	6/2012	Smith et al.	8,282,654 B2	10/2012	Ferrari et al.
8,197,837 B2	6/2012	Jamiolkowski et al.	8,285,367 B2	10/2012	Hyde et al.
8,201,720 B2	6/2012	Hessler	8,286,723 B2	10/2012	Puzio et al.
8,201,721 B2	6/2012	Zemlok et al.	8,286,845 B2	10/2012	Perry et al.
8,202,549 B2	6/2012	Stucky et al.	8,286,846 B2	10/2012	Smith et al.
8,205,779 B2	6/2012	Ma et al.	8,287,522 B2	10/2012	Moses et al.
8,205,780 B2	6/2012	Sorrentino et al.	8,287,561 B2	10/2012	Nunez et al.
8,205,781 B2	6/2012	Baxter, III et al.	8,292,147 B2	10/2012	Viola
8,210,411 B2	7/2012	Yates et al.	8,292,150 B2	10/2012	Bryant
8,210,414 B2	7/2012	Bettuchi et al.	8,292,151 B2	10/2012	Viola
8,210,415 B2	7/2012	Ward	8,292,152 B2	10/2012	Milliman et al.
8,210,416 B2	7/2012	Milliman et al.	8,292,155 B2	10/2012	Shelton, IV et al.
8,210,721 B2	7/2012	Chen et al.	8,292,157 B2	10/2012	Smith et al.
8,211,125 B2	7/2012	Spivey	8,292,888 B2	10/2012	Whitman
8,214,019 B2	7/2012	Govari et al.	8,298,161 B2	10/2012	Vargas
8,215,531 B2	7/2012	Shelton, IV et al.	8,298,189 B2	10/2012	Fisher et al.
8,215,532 B2	7/2012	Marczyk	8,298,233 B2	10/2012	Mueller
8,215,533 B2	7/2012	Viola et al.	8,298,677 B2	10/2012	Wiesner et al.
8,220,468 B2	7/2012	Cooper et al.	8,302,323 B2	11/2012	Fortier et al.
8,220,688 B2	7/2012	Laurent et al.	8,308,040 B2	11/2012	Huang et al.
8,220,690 B2	7/2012	Hess et al.	8,308,042 B2	11/2012	Aranyi
8,221,424 B2	7/2012	Cha	8,308,043 B2	11/2012	Bindra et al.
8,225,799 B2	7/2012	Bettuchi	8,308,046 B2	11/2012	Prommersberger
8,225,979 B2	7/2012	Farascioni et al.	8,308,659 B2	11/2012	Scheibe et al.
8,226,553 B2	7/2012	Shelton, IV et al.	8,308,725 B2	11/2012	Bell et al.
8,226,635 B2	7/2012	Petrie et al.	8,310,188 B2	11/2012	Nakai
8,226,675 B2	7/2012	Houser et al.	8,313,496 B2	11/2012	Sauer et al.
8,226,715 B2	7/2012	Hwang et al.	8,313,509 B2	11/2012	Kostrzewski
8,227,946 B2	7/2012	Kim	8,317,070 B2	11/2012	Hueil et al.
8,228,048 B2	7/2012	Spencer	8,317,071 B1	11/2012	Knodel
8,229,549 B2	7/2012	Whitman et al.	8,317,074 B2	11/2012	Ortiz et al.
8,231,040 B2	7/2012	Zemlok et al.	8,317,437 B2	11/2012	Merkley et al.
8,231,042 B2	7/2012	Hessler et al.	8,317,744 B2	11/2012	Kirschenman
8,231,043 B2	7/2012	Tarinelli et al.	8,317,790 B2	11/2012	Bell et al.
8,235,272 B2	8/2012	Nicholas et al.	8,319,002 B2	11/2012	Daniels et al.
8,236,010 B2	8/2012	Ortiz et al.	8,322,455 B2	12/2012	Shelton, IV et al.
8,236,020 B2	8/2012	Smith et al.	8,322,589 B2	12/2012	Boudreaux
8,237,388 B2	8/2012	Jinno et al.	8,322,590 B2	12/2012	Patel et al.
8,240,537 B2	8/2012	Marczyk	8,322,901 B2	12/2012	Michelotti
8,241,271 B2	8/2012	Millman et al.	8,323,789 B2	12/2012	Rozhin et al.
8,241,284 B2	8/2012	Dycus et al.	8,328,061 B2	12/2012	Kasvikis
8,241,308 B2	8/2012	Kortenbach et al.	8,328,062 B2	12/2012	Viola
8,241,322 B2	8/2012	Whitman et al.	8,328,063 B2	12/2012	Milliman et al.
8,245,594 B2	8/2012	Rogers et al.	8,328,064 B2	12/2012	Racenet et al.
8,245,898 B2	8/2012	Smith et al.	8,328,802 B2	12/2012	Deville et al.
8,245,899 B2	8/2012	Swensgard et al.	8,328,823 B2	12/2012	Aranyi et al.
8,245,900 B2	8/2012	Scirica	8,333,313 B2	12/2012	Boudreaux et al.
8,245,901 B2	8/2012	Stopek	8,333,691 B2	12/2012	Schaaf
8,246,608 B2	8/2012	Omori et al.	8,333,764 B2	12/2012	Francischelli et al.
8,246,637 B2	8/2012	Viola et al.	8,333,779 B2	12/2012	Smith et al.
			8,334,468 B2	12/2012	Palmer et al.
			8,336,753 B2	12/2012	Olson et al.
			8,336,754 B2	12/2012	Cappola et al.
			8,342,377 B2	1/2013	Milliman et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

8,342,378	B2	1/2013	Marczyk et al.	8,418,906	B2	4/2013	Farascioni et al.
8,342,379	B2	1/2013	Whitman et al.	8,418,908	B1	4/2013	Beardsley
8,343,150	B2	1/2013	Artale	8,418,909	B2	4/2013	Kostrzewski
8,347,978	B2	1/2013	Forster et al.	8,419,717	B2	4/2013	Diolaiti et al.
8,348,123	B2	1/2013	Scirica et al.	8,419,747	B2	4/2013	Hinman et al.
8,348,124	B2	1/2013	Scirica	8,419,754	B2	4/2013	Laby et al.
8,348,125	B2	1/2013	Viola et al.	8,423,182	B2	4/2013	Robinson et al.
8,348,126	B2	1/2013	Olson et al.	8,424,737	B2	4/2013	Scirica
8,348,127	B2	1/2013	Marczyk	8,424,739	B2	4/2013	Racenet et al.
8,348,129	B2	1/2013	Bedi et al.	8,424,740	B2	4/2013	Shelton, IV et al.
8,348,130	B2	1/2013	Shah et al.	8,424,741	B2	4/2013	McGuckin, Jr. et al.
8,348,131	B2	1/2013	Omaits et al.	8,425,600	B2	4/2013	Maxwell
8,348,837	B2	1/2013	Wenchell	8,427,430	B2	4/2013	Lee et al.
8,348,959	B2	1/2013	Wolford et al.	8,430,292	B2	4/2013	Patel et al.
8,348,972	B2	1/2013	Soltz et al.	8,430,892	B2	4/2013	Bindra et al.
8,349,987	B2	1/2013	Kapiamba et al.	8,430,898	B2	4/2013	Wiener et al.
8,352,004	B2	1/2013	Mannheimer et al.	8,435,257	B2	5/2013	Smith et al.
8,353,437	B2	1/2013	Boudreaux	8,439,246	B1	5/2013	Knodel
8,353,438	B2	1/2013	Baxter, III et al.	8,444,036	B2	5/2013	Shelton, IV
8,353,439	B2	1/2013	Baxter, III et al.	8,444,037	B2	5/2013	Nicholas et al.
8,356,740	B1	1/2013	Knodel	8,444,549	B2	5/2013	Viola et al.
8,357,144	B2	1/2013	Whitman et al.	8,453,904	B2	6/2013	Eskaros et al.
8,357,161	B2	1/2013	Mueller	8,453,906	B2	6/2013	Huang et al.
8,360,296	B2	1/2013	Zingman	8,453,907	B2	6/2013	Laurent et al.
8,360,297	B2	1/2013	Shelton, IV et al.	8,453,908	B2	6/2013	Bedi et al.
8,360,298	B2	1/2013	Farascioni et al.	8,453,912	B2	6/2013	Mastri et al.
8,360,299	B2	1/2013	Zemlok et al.	8,453,914	B2	6/2013	Laurent et al.
8,361,501	B2	1/2013	DiTizio et al.	8,454,495	B2	6/2013	Kawano et al.
8,365,973	B1	2/2013	White et al.	8,454,628	B2	6/2013	Smith et al.
8,365,975	B1	2/2013	Manoux et al.	8,454,640	B2	6/2013	Johnston et al.
8,365,976	B2	2/2013	Hess et al.	8,457,757	B2	6/2013	Cauller et al.
8,366,559	B2	2/2013	Papenfuss et al.	8,459,520	B2	6/2013	Giordano et al.
8,366,787	B2	2/2013	Brown et al.	8,459,521	B2	6/2013	Zemlok et al.
8,371,393	B2	2/2013	Higuchi et al.	8,459,525	B2	6/2013	Yates et al.
8,371,491	B2	2/2013	Huitema et al.	8,464,922	B2	6/2013	Marczyk
8,371,492	B2	2/2013	Aranyi et al.	8,464,923	B2	6/2013	Shelton, IV
8,371,493	B2	2/2013	Aranyi et al.	8,464,924	B2	6/2013	Gresham et al.
8,371,494	B2	2/2013	Racenet et al.	8,464,925	B2	6/2013	Hull et al.
8,372,094	B2	2/2013	Bettuchi et al.	8,465,475	B2	6/2013	Isbell, Jr.
8,376,865	B2	2/2013	Forster et al.	8,465,502	B2	6/2013	Zergiebel
8,377,029	B2	2/2013	Nagao et al.	8,465,515	B2	6/2013	Drew et al.
8,377,044	B2	2/2013	Coe et al.	8,469,946	B2	6/2013	Sugita
8,382,773	B2	2/2013	Whitfield et al.	8,469,973	B2	6/2013	Meade et al.
8,382,790	B2	2/2013	Uenohara et al.	8,470,355	B2	6/2013	Skalla et al.
8,387,848	B2	3/2013	Johnson et al.	8,474,677	B2	7/2013	Woodard, Jr. et al.
8,388,633	B2	3/2013	Rousseau et al.	8,475,453	B2	7/2013	Marczyk et al.
8,389,588	B2	3/2013	Ringeisen et al.	8,475,454	B1	7/2013	Alshemari
8,393,513	B2	3/2013	Jankowski	8,475,474	B2	7/2013	Bombard et al.
8,393,514	B2	3/2013	Shelton, IV et al.	8,479,968	B2	7/2013	Hodgkinson et al.
8,393,516	B2	3/2013	Kostrzewski	8,479,969	B2	7/2013	Shelton, IV
8,397,971	B2	3/2013	Yates et al.	8,480,703	B2	7/2013	Nicholas et al.
8,397,973	B1	3/2013	Hausen	8,485,412	B2	7/2013	Shelton, IV et al.
8,398,633	B2	3/2013	Mueller	8,485,413	B2	7/2013	Scheib et al.
8,398,669	B2	3/2013	Kim	8,485,970	B2	7/2013	Widenhouse et al.
8,398,673	B2	3/2013	Hinchliffe et al.	8,487,199	B2	7/2013	Palmer et al.
8,400,851	B2	3/2013	Byun	8,490,853	B2	7/2013	Criscuolo et al.
8,403,138	B2	3/2013	Weissaupt et al.	8,491,581	B2	7/2013	Deville et al.
8,403,198	B2	3/2013	Sorrentino et al.	8,491,603	B2	7/2013	Yeung et al.
8,403,832	B2	3/2013	Cunningham et al.	8,496,154	B2	7/2013	Marczyk et al.
8,403,945	B2	3/2013	Whitfield et al.	8,496,156	B2	7/2013	Sniffin et al.
8,403,946	B2	3/2013	Whitfield et al.	8,496,683	B2	7/2013	Prommersberger et al.
8,403,950	B2	3/2013	Palmer et al.	8,499,992	B2	8/2013	Whitman et al.
8,408,439	B2	4/2013	Huang et al.	8,499,993	B2	8/2013	Shelton, IV et al.
8,408,442	B2	4/2013	Racenet et al.	8,500,721	B2	8/2013	Jinno
8,409,079	B2	4/2013	Okamoto et al.	8,500,762	B2	8/2013	Sholev et al.
8,409,174	B2	4/2013	Omori	8,502,091	B2	8/2013	Palmer et al.
8,409,175	B2	4/2013	Lee et al.	8,505,799	B2	8/2013	Viola et al.
8,409,222	B2	4/2013	Whitfield et al.	8,505,801	B2	8/2013	Ehrenfels et al.
8,409,223	B2	4/2013	Sorrentino et al.	8,506,555	B2	8/2013	Ruiz Morales
8,411,500	B2	4/2013	Gapihan et al.	8,506,557	B2	8/2013	Zemlok et al.
8,413,870	B2	4/2013	Pastorelli et al.	8,506,580	B2	8/2013	Zergiebel et al.
8,413,871	B2	4/2013	Racenet et al.	8,506,581	B2	8/2013	Wingardner, III et al.
8,413,872	B2	4/2013	Patel	8,511,308	B2	8/2013	Hecox et al.
8,414,577	B2	4/2013	Boudreaux et al.	8,512,359	B2	8/2013	Whitman et al.
8,418,073	B2	4/2013	Mohr et al.	8,512,402	B2	8/2013	Marczyk et al.
				8,517,239	B2	8/2013	Scheib et al.
				8,517,241	B2	8/2013	Nicholas et al.
				8,517,243	B2	8/2013	Giordano et al.
				8,517,244	B2	8/2013	Shelton, IV et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

8,518,024 B2	8/2013	Williams et al.	8,628,545 B2	1/2014	Cabrera et al.
8,521,273 B2	8/2013	Kliman	8,631,987 B2	1/2014	Shelton, IV et al.
8,523,043 B2	9/2013	Ullrich et al.	8,631,992 B1	1/2014	Hausen et al.
8,523,881 B2	9/2013	Cabiri et al.	8,631,993 B2	1/2014	Kostrzewski
8,523,900 B2	9/2013	Jinno et al.	8,632,462 B2	1/2014	Yoo et al.
8,529,588 B2	9/2013	Ahlberg et al.	8,632,525 B2	1/2014	Kerr et al.
8,529,600 B2	9/2013	Woodard, Jr. et al.	8,632,535 B2	1/2014	Shelton, IV et al.
8,529,819 B2	9/2013	Ostapoff et al.	8,632,563 B2	1/2014	Nagase et al.
8,532,747 B2	9/2013	Nock et al.	8,636,187 B2	1/2014	Hueil et al.
8,534,528 B2	9/2013	Shelton, IV	8,636,191 B2	1/2014	Meagher
8,535,304 B2	9/2013	Sklar et al.	8,636,193 B2	1/2014	Whitman et al.
8,535,340 B2	9/2013	Allen	8,636,736 B2	1/2014	Yates et al.
8,540,128 B2	9/2013	Shelton, IV et al.	8,636,766 B2	1/2014	Milliman et al.
8,540,129 B2	9/2013	Baxter, III et al.	8,639,936 B2	1/2014	Hu et al.
8,540,130 B2	9/2013	Moore et al.	8,640,788 B2	2/2014	Dachs, II et al.
8,540,131 B2	9/2013	Swayze	8,646,674 B2	2/2014	Schulte et al.
8,540,133 B2	9/2013	Bedi et al.	8,647,258 B2	2/2014	Aranyi et al.
8,540,733 B2	9/2013	Whitman et al.	8,652,120 B2	2/2014	Giordano et al.
8,540,735 B2	9/2013	Mitelberg et al.	8,652,151 B2	2/2014	Lehman et al.
8,550,984 B2	10/2013	Takemoto	8,657,174 B2	2/2014	Yates et al.
8,551,076 B2	10/2013	Duval et al.	8,657,175 B2	2/2014	Sonnenschein et al.
8,555,660 B2	10/2013	Takenaka et al.	8,657,176 B2	2/2014	Shelton, IV et al.
8,556,151 B2	10/2013	Viola	8,657,177 B2	2/2014	Scirica et al.
8,556,918 B2	10/2013	Bauman et al.	8,657,178 B2	2/2014	Hueil et al.
8,556,935 B1	10/2013	Knodel et al.	8,657,482 B2	2/2014	Malackowski et al.
8,560,147 B2	10/2013	Taylor et al.	8,657,808 B2	2/2014	McPherson et al.
8,561,617 B2	10/2013	Lindh et al.	8,657,814 B2	2/2014	Werneth et al.
8,561,870 B2	10/2013	Baxter, III et al.	8,657,821 B2	2/2014	Palermo
8,561,871 B2	10/2013	Rajappa et al.	8,662,370 B2	3/2014	Takei
8,561,873 B2	10/2013	Ingmanson et al.	8,663,106 B2	3/2014	Stivoric et al.
8,562,598 B2	10/2013	Falkenstein et al.	8,663,192 B2	3/2014	Hester et al.
8,567,656 B2	10/2013	Shelton, IV et al.	8,663,245 B2	3/2014	Francischelli et al.
8,568,416 B2	10/2013	Schmitz et al.	8,663,262 B2	3/2014	Smith et al.
8,568,425 B2	10/2013	Ross et al.	8,663,270 B2	3/2014	Donnigan et al.
8,573,459 B2	11/2013	Smith et al.	8,664,792 B2	3/2014	Rebsdorf
8,573,461 B2	11/2013	Shelton, IV et al.	8,668,129 B2	3/2014	Olson
8,573,462 B2	11/2013	Smith et al.	8,668,130 B2	3/2014	Hess et al.
8,573,465 B2	11/2013	Shelton, IV	8,672,206 B2	3/2014	Aranyi et al.
8,574,199 B2	11/2013	von Bulow et al.	8,672,207 B2	3/2014	Shelton, IV et al.
8,574,263 B2	11/2013	Mueller	8,672,208 B2	3/2014	Hess et al.
8,575,880 B2	11/2013	Grantz	8,672,922 B2	3/2014	Loh et al.
8,579,176 B2	11/2013	Smith et al.	8,672,935 B2	3/2014	Okada et al.
8,579,178 B2	11/2013	Holsten et al.	8,672,951 B2	3/2014	Smith et al.
8,579,897 B2	11/2013	Vakharia et al.	8,673,210 B2	3/2014	Deshays
8,579,937 B2	11/2013	Gresham	8,675,820 B2	3/2014	Baic et al.
8,584,919 B2	11/2013	Hueil et al.	8,678,263 B2	3/2014	Viola
8,584,920 B2	11/2013	Hodgkinson	8,679,093 B2	3/2014	Farra
8,584,921 B2	11/2013	Scirica	8,679,098 B2	3/2014	Hart
8,585,583 B2	11/2013	Sakaguchi et al.	8,679,137 B2	3/2014	Bauman et al.
8,585,721 B2	11/2013	Kirsch	8,679,154 B2	3/2014	Smith et al.
8,590,760 B2	11/2013	Cummins et al.	8,679,156 B2	3/2014	Smith et al.
8,590,762 B2	11/2013	Hess et al.	8,679,454 B2	3/2014	Guire et al.
8,590,764 B2	11/2013	Hartwick et al.	8,684,248 B2	4/2014	Milliman
8,596,515 B2	12/2013	Okoniewski	8,684,249 B2	4/2014	Racenet et al.
8,597,745 B2	12/2013	Farnsworth et al.	8,684,250 B2	4/2014	Bettuchi et al.
8,599,450 B2	12/2013	Kubo et al.	8,684,253 B2	4/2014	Giordano et al.
8,602,287 B2	12/2013	Yates et al.	8,684,962 B2	4/2014	Kirschenman et al.
8,602,288 B2	12/2013	Shelton, IV et al.	8,685,004 B2	4/2014	Zemlock et al.
8,603,077 B2	12/2013	Cooper et al.	8,685,020 B2	4/2014	Weizman et al.
8,603,089 B2	12/2013	Viola	8,695,866 B2	4/2014	Leimbach et al.
8,603,110 B2	12/2013	Maruyama et al.	8,696,665 B2	4/2014	Hunt et al.
8,603,135 B2	12/2013	Mueller	8,701,958 B2	4/2014	Shelton, IV et al.
8,608,043 B2	12/2013	Scirica	8,701,959 B2	4/2014	Shah
8,608,044 B2	12/2013	Hueil et al.	8,708,210 B2	4/2014	Zemlok et al.
8,608,045 B2	12/2013	Smith et al.	8,708,211 B2	4/2014	Zemlok et al.
8,608,046 B2	12/2013	Laurent et al.	8,708,213 B2	4/2014	Shelton, IV et al.
8,608,745 B2	12/2013	Guzman et al.	8,714,352 B2	5/2014	Farascioni et al.
8,613,383 B2	12/2013	Beckman et al.	8,714,429 B2	5/2014	Demmy
8,616,427 B2	12/2013	Viola	8,714,430 B2	5/2014	Natarajan et al.
8,616,431 B2	12/2013	Timm et al.	8,715,256 B2	5/2014	Greener
8,622,274 B2	1/2014	Yates et al.	8,715,302 B2	5/2014	Ibrahim et al.
8,622,275 B2	1/2014	Baxter, III et al.	8,720,766 B2	5/2014	Hess et al.
8,627,993 B2	1/2014	Smith et al.	8,721,630 B2	5/2014	Ortiz et al.
8,627,995 B2	1/2014	Smith et al.	8,721,666 B2	5/2014	Schroeder et al.
8,628,518 B2	1/2014	Blumenkranz et al.	8,727,197 B2	5/2014	Hess et al.
			8,727,199 B2	5/2014	Wenchell
			8,727,200 B2	5/2014	Roy
			8,727,961 B2	5/2014	Ziv
			8,728,099 B2	5/2014	Cohn et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

8,728,119 B2	5/2014	Cummins	8,808,308 B2	8/2014	Boukhny et al.
8,733,470 B2	5/2014	Matthias et al.	8,808,311 B2	8/2014	Heinrich et al.
8,733,612 B2	5/2014	Ma	8,808,325 B2	8/2014	Hess et al.
8,733,613 B2	5/2014	Huitema et al.	8,810,197 B2	8/2014	Juergens
8,733,614 B2	5/2014	Ross et al.	8,811,017 B2	8/2014	Fujii et al.
8,734,336 B2	5/2014	Bonadio et al.	8,813,866 B2	8/2014	Suzuki
8,734,359 B2	5/2014	Ibanez et al.	8,814,024 B2	8/2014	Woodard, Jr. et al.
8,734,478 B2	5/2014	Widenhouse et al.	8,814,025 B2	8/2014	Miller et al.
8,739,033 B2	5/2014	Rosenberg	8,820,603 B2	9/2014	Shelton, IV et al.
8,739,417 B2	6/2014	Tokunaga et al.	8,820,605 B2	9/2014	Shelton, IV
8,740,034 B2	6/2014	Morgan et al.	8,820,606 B2	9/2014	Hodgkinson
8,740,037 B2	6/2014	Shelton, IV et al.	8,820,607 B2	9/2014	Marczyk
8,740,038 B2	6/2014	Shelton, IV et al.	8,822,934 B2	9/2014	Sayeh et al.
8,740,987 B2	6/2014	Geremakis et al.	8,825,164 B2	9/2014	Tweden et al.
8,746,529 B2	6/2014	Shelton, IV et al.	8,827,133 B2	9/2014	Shelton, IV et al.
8,746,530 B2	6/2014	Giordano et al.	8,827,134 B2	9/2014	Viola et al.
8,746,533 B2	6/2014	Whitman et al.	8,827,903 B2	9/2014	Shelton, IV et al.
8,746,535 B2	6/2014	Shelton, IV et al.	8,833,219 B2	9/2014	Pierce
8,747,238 B2	6/2014	Shelton, IV et al.	8,833,630 B2	9/2014	Milliman
8,747,441 B2	6/2014	Konieczynski et al.	8,833,632 B2	9/2014	Swensgard
8,752,264 B2	6/2014	Ackley et al.	8,834,498 B2	9/2014	Byrum et al.
8,752,699 B2	6/2014	Morgan et al.	8,840,003 B2	9/2014	Morgan et al.
8,752,747 B2	6/2014	Shelton, IV et al.	8,840,603 B2	9/2014	Shelton, IV et al.
8,752,748 B2	6/2014	Whitman et al.	8,840,609 B2	9/2014	Stuebe
8,752,749 B2	6/2014	Moore et al.	8,844,789 B2	9/2014	Shelton, IV et al.
8,757,287 B2	6/2014	Mak et al.	8,851,215 B2	10/2014	Goto
8,757,465 B2	6/2014	Woodard, Jr. et al.	8,851,354 B2	10/2014	Swensgard et al.
8,758,235 B2	6/2014	Jaworek	8,852,185 B2	10/2014	Twomey
8,758,366 B2	6/2014	McLean et al.	8,852,199 B2	10/2014	Deslauriers et al.
8,758,391 B2	6/2014	Swayze et al.	8,857,693 B2	10/2014	Schuckmann et al.
8,758,438 B2	6/2014	Boyce et al.	8,857,694 B2	10/2014	Shelton, IV et al.
8,763,875 B2	7/2014	Morgan et al.	8,858,538 B2	10/2014	Belson et al.
8,763,877 B2	7/2014	Schall et al.	8,858,571 B2	10/2014	Shelton, IV et al.
8,763,879 B2	7/2014	Shelton, IV et al.	8,858,590 B2	10/2014	Shelton, IV et al.
8,764,732 B2	7/2014	Hartwell	8,864,007 B2	10/2014	Widenhouse et al.
8,770,458 B2	7/2014	Scirica	8,864,009 B2	10/2014	Shelton, IV et al.
8,770,459 B2	7/2014	Racenet et al.	8,864,010 B2	10/2014	Williams
8,770,460 B2	7/2014	Belzer	8,870,050 B2	10/2014	Hodgkinson
8,771,169 B2	7/2014	Whitman et al.	8,870,912 B2	10/2014	Brisson et al.
8,777,004 B2	7/2014	Shelton, IV et al.	8,875,971 B2	11/2014	Hall et al.
8,777,082 B2	7/2014	Scirica	8,875,972 B2	11/2014	Weisenburgh, II et al.
8,777,083 B2	7/2014	Racenet et al.	8,876,857 B2	11/2014	Burbank
8,777,898 B2	7/2014	Suon et al.	8,876,858 B2	11/2014	Braun
8,783,541 B2	7/2014	Shelton, IV et al.	8,887,979 B2	11/2014	Mastri et al.
8,783,542 B2	7/2014	Riestenberg et al.	8,888,688 B2	11/2014	Julian et al.
8,783,543 B2	7/2014	Shelton, IV et al.	8,888,695 B2	11/2014	Piskun et al.
8,784,304 B2	7/2014	Mikkaichi et al.	8,888,792 B2	11/2014	Harris et al.
8,784,404 B2	7/2014	Doyle et al.	8,888,809 B2	11/2014	Davison et al.
8,784,415 B2	7/2014	Malackowski et al.	8,893,946 B2	11/2014	Boudreaux et al.
8,789,737 B2	7/2014	Hodgkinson et al.	8,893,949 B2	11/2014	Shelton, IV et al.
8,789,739 B2	7/2014	Swensgard	8,894,647 B2	11/2014	Beardsley et al.
8,789,740 B2	7/2014	Baxter, III et al.	8,894,654 B2	11/2014	Anderson
8,789,741 B2	7/2014	Baxter, III et al.	8,899,460 B2	12/2014	Wojcicki
8,790,658 B2	7/2014	Cigarini et al.	8,899,461 B2	12/2014	Farascioni
8,790,684 B2	7/2014	Dave et al.	8,899,463 B2	12/2014	Schall et al.
8,794,496 B2	8/2014	Scirica	8,899,464 B2	12/2014	Hueil et al.
8,794,497 B2	8/2014	Zingman	8,899,465 B2	12/2014	Shelton, IV et al.
8,795,276 B2	8/2014	Dietz et al.	8,899,466 B2	12/2014	Baxter, III et al.
8,795,308 B2	8/2014	Valin	8,905,287 B2	12/2014	Racenet et al.
8,795,324 B2	8/2014	Kawai et al.	8,905,977 B2	12/2014	Shelton et al.
8,800,681 B2	8/2014	Rousson et al.	8,910,846 B2	12/2014	Viola
8,800,837 B2	8/2014	Zemlok	8,911,426 B2	12/2014	Coppeta et al.
8,800,838 B2	8/2014	Shelton, IV	8,911,448 B2	12/2014	Stein
8,800,839 B2	8/2014	Beetel	8,911,460 B2	12/2014	Neurohr et al.
8,800,840 B2	8/2014	Jankowski	8,911,471 B2	12/2014	Spivey et al.
8,800,841 B2	8/2014	Ellerhorst et al.	8,920,433 B2	12/2014	Barrier et al.
8,801,734 B2	8/2014	Shelton, IV et al.	8,920,435 B2	12/2014	Smith et al.
8,801,735 B2	8/2014	Shelton, IV et al.	8,920,438 B2	12/2014	Aranyi et al.
8,801,752 B2	8/2014	Fortier et al.	8,920,443 B2	12/2014	Hiles et al.
8,801,801 B2	8/2014	Datta et al.	8,920,444 B2	12/2014	Hiles et al.
8,806,973 B2	8/2014	Ross et al.	8,922,163 B2	12/2014	Macdonald
8,807,414 B2	8/2014	Ross et al.	8,925,782 B2	1/2015	Shelton, IV
8,808,161 B2	8/2014	Gregg et al.	8,925,783 B2	1/2015	Zemlok et al.
8,808,274 B2	8/2014	Hartwell	8,925,788 B2	1/2015	Hess et al.
8,808,294 B2	8/2014	Fox et al.	8,926,506 B2	1/2015	Widenhouse et al.
			8,926,598 B2	1/2015	Mollere et al.
			8,931,576 B2	1/2015	Iwata
			8,931,679 B2	1/2015	Kostrzewski
			8,931,680 B2	1/2015	Milliman

(56)

References Cited

U.S. PATENT DOCUMENTS

8,931,682 B2	1/2015	Timm et al.	9,039,690 B2	5/2015	Kersten et al.
8,936,614 B2	1/2015	Allen, IV	9,039,694 B2	5/2015	Ross et al.
8,939,343 B2	1/2015	Milliman et al.	9,039,720 B2	5/2015	Madan
8,939,344 B2	1/2015	Olson et al.	9,043,027 B2	5/2015	Durant et al.
8,945,163 B2	2/2015	Voegele et al.	9,044,227 B2	6/2015	Shelton, IV et al.
8,955,732 B2	2/2015	Zemlok et al.	9,044,228 B2	6/2015	Woodard, Jr. et al.
8,956,342 B1	2/2015	Russo et al.	9,044,229 B2	6/2015	Scheib et al.
8,956,390 B2	2/2015	Shah et al.	9,044,230 B2	6/2015	Morgan et al.
8,958,860 B2	2/2015	Banerjee et al.	9,050,083 B2	6/2015	Yates et al.
8,960,519 B2	2/2015	Whitman et al.	9,050,084 B2	6/2015	Schmid et al.
8,960,520 B2	2/2015	McCuen	9,050,100 B2	6/2015	Yates et al.
8,960,521 B2	2/2015	Kostrzewski	9,050,120 B2	6/2015	Swarup et al.
8,961,504 B2	2/2015	Hoarau et al.	9,050,123 B2	6/2015	Krause et al.
8,963,714 B2	2/2015	Medhal et al.	9,050,176 B2	6/2015	Datta et al.
8,967,443 B2	3/2015	McCuen	9,055,941 B2	6/2015	Schmid et al.
8,967,444 B2	3/2015	Beetel	9,055,942 B2	6/2015	Balbierz et al.
8,967,446 B2	3/2015	Beardsley et al.	9,055,943 B2	6/2015	Zemlok et al.
8,967,448 B2	3/2015	Carter et al.	9,055,944 B2	6/2015	Hodgkinson et al.
8,968,276 B2	3/2015	Zemlok et al.	9,055,961 B2	6/2015	Manzo et al.
8,968,312 B2	3/2015	Marczyk et al.	9,060,770 B2 *	6/2015	Shelton, IV A61B 17/07207
8,968,337 B2	3/2015	Whitfield et al.	9,060,776 B2	6/2015	Yates et al.
8,968,340 B2	3/2015	Chowaniec et al.	9,060,794 B2	6/2015	Kang et al.
8,968,355 B2	3/2015	Malkowski et al.	9,060,894 B2	6/2015	Wubbeling
8,968,358 B2	3/2015	Reschke	9,061,392 B2	6/2015	Forgues et al.
8,970,507 B2	3/2015	Holbein et al.	9,072,515 B2	7/2015	Hall et al.
8,973,803 B2	3/2015	Hall et al.	9,072,523 B2	7/2015	Houser et al.
8,973,804 B2	3/2015	Hess et al.	9,072,535 B2	7/2015	Shelton, IV et al.
8,974,440 B2	3/2015	Farritor et al.	9,072,536 B2	7/2015	Shelton, IV et al.
8,978,954 B2	3/2015	Shelton, IV et al.	9,078,653 B2	7/2015	Leimbach et al.
8,978,955 B2	3/2015	Aronhalt et al.	9,084,601 B2	7/2015	Moore et al.
8,978,956 B2	3/2015	Schall et al.	9,084,602 B2	7/2015	Gleiman
8,979,843 B2	3/2015	Timm et al.	9,086,875 B2	7/2015	Harrat et al.
8,979,890 B2	3/2015	Boudreaux	9,089,326 B2	7/2015	Krumanaker et al.
8,982,195 B2	3/2015	Claus et al.	9,089,330 B2	7/2015	Widenhouse et al.
8,991,676 B2	3/2015	Hess et al.	9,089,352 B2	7/2015	Jeong
8,991,677 B2	3/2015	Moore et al.	9,091,588 B2	7/2015	Lefler
8,991,678 B2	3/2015	Wellman et al.	9,095,339 B2	8/2015	Moore et al.
8,992,042 B2	3/2015	Eichenholz	9,095,346 B2	8/2015	Houser et al.
8,992,422 B2	3/2015	Spivey et al.	9,095,362 B2	8/2015	Dachs, II et al.
8,992,565 B2	3/2015	Brisson et al.	9,096,033 B2	8/2015	Holop et al.
8,996,165 B2	3/2015	Wang et al.	9,099,863 B2	8/2015	Smith et al.
8,998,058 B2	4/2015	Moore et al.	9,101,358 B2	8/2015	Kerr et al.
8,998,059 B2	4/2015	Smith et al.	9,101,385 B2	8/2015	Shelton, IV et al.
8,998,061 B2	4/2015	Williams et al.	9,101,475 B2	8/2015	Wei et al.
8,998,939 B2	4/2015	Price et al.	9,107,663 B2	8/2015	Swensgard
9,002,518 B2	4/2015	Manzo et al.	9,107,690 B2	8/2015	Bales, Jr. et al.
9,004,339 B1	4/2015	Park	9,110,587 B2	8/2015	Kim et al.
9,005,230 B2	4/2015	Yates et al.	9,113,862 B2	8/2015	Morgan et al.
9,005,238 B2	4/2015	DeSantis et al.	9,113,864 B2	8/2015	Morgan et al.
9,005,243 B2	4/2015	Stopek et al.	9,113,865 B2	8/2015	Shelton, IV et al.
9,010,606 B2	4/2015	Aranyi et al.	9,113,873 B2	8/2015	Marczyk et al.
9,010,608 B2	4/2015	Casasanta, Jr. et al.	9,113,874 B2	8/2015	Shelton, IV et al.
9,011,439 B2	4/2015	Shalaby et al.	9,113,876 B2	8/2015	Zemlok et al.
9,011,471 B2	4/2015	Timm et al.	9,113,880 B2	8/2015	Zemlok et al.
9,016,539 B2	4/2015	Kostrzewski et al.	9,113,881 B2	8/2015	Scirica
9,016,540 B2	4/2015	Whitman et al.	9,113,883 B2	8/2015	Aronhalt et al.
9,016,541 B2	4/2015	Viola et al.	9,113,884 B2	8/2015	Shelton, IV et al.
9,016,542 B2	4/2015	Shelton, IV et al.	9,113,887 B2	8/2015	Behnke, II et al.
9,016,545 B2	4/2015	Aranyi et al.	9,119,657 B2	9/2015	Shelton, IV et al.
9,017,331 B2	4/2015	Fox	9,119,898 B2	9/2015	Bayon et al.
9,017,355 B2	4/2015	Smith et al.	9,119,957 B2	9/2015	Gantz et al.
9,017,369 B2	4/2015	Renger et al.	9,123,286 B2	9/2015	Park
9,017,371 B2	4/2015	Whitman et al.	9,124,097 B2	9/2015	Cruz
9,021,684 B2	5/2015	Lenker et al.	9,125,654 B2	9/2015	Aronhalt et al.
9,023,014 B2	5/2015	Chowaniec et al.	9,125,662 B2	9/2015	Shelton, IV
9,023,071 B2	5/2015	Miller et al.	9,126,317 B2	9/2015	Lawton et al.
9,027,817 B2	5/2015	Milliman et al.	9,131,835 B2	9/2015	Widenhouse et al.
9,028,494 B2	5/2015	Shelton, IV et al.	9,131,940 B2	9/2015	Huitema et al.
9,028,495 B2	5/2015	Mueller et al.	9,131,950 B2	9/2015	Matthew
9,028,519 B2	5/2015	Yates et al.	9,131,957 B2	9/2015	Skarbnik et al.
9,030,169 B2	5/2015	Christensen et al.	9,138,225 B2	9/2015	Huang et al.
9,033,203 B2	5/2015	Woodard, Jr. et al.	9,138,226 B2	9/2015	Racenet et al.
9,033,204 B2	5/2015	Shelton, IV et al.	9,144,455 B2	9/2015	Kennedy et al.
9,034,505 B2	5/2015	Detry et al.	9,149,274 B2	10/2015	Spivey et al.
9,038,881 B1	5/2015	Schaller et al.	9,149,324 B2	10/2015	Huang et al.
			9,149,325 B2	10/2015	Worrell et al.
			9,153,994 B2	10/2015	Wood et al.
			9,161,753 B2	10/2015	Prior
			9,161,803 B2	10/2015	Yates et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

9,168,038 B2	10/2015	Shelton, IV et al.	9,282,966 B2	3/2016	Shelton, IV et al.
9,168,039 B1	10/2015	Knodel	9,282,974 B2	3/2016	Shelton, IV
9,168,054 B2	10/2015	Turner et al.	9,283,028 B2	3/2016	Johnson
9,168,144 B2	10/2015	Rivin et al.	9,283,045 B2	3/2016	Rhee et al.
9,179,911 B2	11/2015	Morgan et al.	9,283,054 B2	3/2016	Morgan et al.
9,179,912 B2	11/2015	Yates et al.	9,289,206 B2	3/2016	Hess et al.
9,182,244 B2	11/2015	Luke et al.	9,289,207 B2	3/2016	Shelton, IV
9,186,046 B2	11/2015	Ramamurthy et al.	9,289,210 B2	3/2016	Baxter, III et al.
9,186,137 B2	11/2015	Farascioni et al.	9,289,211 B2	3/2016	Williams et al.
9,186,140 B2	11/2015	Hiles et al.	9,289,212 B2	3/2016	Shelton, IV et al.
9,186,142 B2	11/2015	Fanelli et al.	9,289,225 B2	3/2016	Shelton, IV et al.
9,186,143 B2	11/2015	Timm et al.	9,289,256 B2	3/2016	Shelton, IV et al.
9,186,148 B2	11/2015	Felder et al.	9,293,757 B2	3/2016	Toussaint et al.
9,186,221 B2	11/2015	Burbank	9,295,464 B2	3/2016	Shelton, IV et al.
9,192,380 B2	11/2015	Racenet et al.	9,295,465 B2	3/2016	Farascioni
9,192,384 B2	11/2015	Bettuchi	9,295,466 B2	3/2016	Hodgkinson et al.
9,192,430 B2	11/2015	Rachlin et al.	9,295,468 B2	3/2016	Heinrich et al.
9,192,434 B2	11/2015	Twomey et al.	9,295,514 B2	3/2016	Shelton, IV et al.
9,193,045 B2	11/2015	Saur et al.	9,295,522 B2	3/2016	Kostrzewski
9,198,642 B2	12/2015	Storz	9,295,784 B2	3/2016	Eggert et al.
9,198,644 B2	12/2015	Balek et al.	9,301,691 B2	4/2016	Hufnagel et al.
9,198,661 B2	12/2015	Swensgard	9,301,752 B2	4/2016	Mandakolathur Vasudevan et al.
9,198,662 B2	12/2015	Barton et al.	9,301,753 B2	4/2016	Aldridge et al.
9,198,683 B2	12/2015	Friedman et al.	9,301,755 B2	4/2016	Shelton, IV et al.
9,204,830 B2	12/2015	Zand et al.	9,301,759 B2	4/2016	Spivey et al.
9,204,877 B2	12/2015	Whitman et al.	9,307,965 B2	4/2016	Ming et al.
9,204,878 B2	12/2015	Hall et al.	9,307,986 B2	4/2016	Hall et al.
9,204,879 B2	12/2015	Shelton, IV	9,307,987 B2	4/2016	Swensgard et al.
9,204,880 B2	12/2015	Baxter, III et al.	9,307,988 B2	4/2016	Shelton, IV
9,204,923 B2	12/2015	Manzo et al.	9,307,989 B2	4/2016	Shelton, IV et al.
9,204,924 B2	12/2015	Marczyk et al.	9,307,994 B2	4/2016	Gresham et al.
9,211,120 B2	12/2015	Scheib et al.	9,308,009 B2	4/2016	Madan et al.
9,211,121 B2	12/2015	Hall et al.	9,308,011 B2	4/2016	Chao et al.
9,211,122 B2	12/2015	Hagerty et al.	9,308,646 B2	4/2016	Lim et al.
9,216,013 B2	12/2015	Scirica et al.	9,314,246 B2	4/2016	Shelton, IV et al.
9,216,019 B2	12/2015	Schmid et al.	9,314,247 B2	4/2016	Shelton, IV et al.
9,216,020 B2	12/2015	Zhang et al.	9,314,261 B2	4/2016	Bales, Jr. et al.
9,216,030 B2	12/2015	Fan et al.	9,314,908 B2	4/2016	Tanimoto et al.
9,216,062 B2	12/2015	Duque et al.	9,320,518 B2	4/2016	Henderson et al.
9,220,500 B2	12/2015	Swayze et al.	9,320,520 B2	4/2016	Shelton, IV et al.
9,220,501 B2	12/2015	Baxter, III et al.	9,320,521 B2	4/2016	Shelton, IV et al.
9,220,502 B2	12/2015	Zemlok et al.	9,320,523 B2	4/2016	Shelton, IV et al.
9,220,508 B2	12/2015	Dannaher	9,326,767 B2	5/2016	Koch, Jr. et al.
9,220,559 B2	12/2015	Worrell et al.	9,326,768 B2	5/2016	Shelton, IV
9,220,570 B2	12/2015	Kim et al.	9,326,769 B2	5/2016	Shelton, IV et al.
9,226,750 B2	1/2016	Weir et al.	9,326,770 B2	5/2016	Shelton, IV et al.
9,226,751 B2	1/2016	Shelton, IV et al.	9,326,771 B2	5/2016	Baxter, III et al.
9,226,767 B2	1/2016	Stulen et al.	9,326,788 B2	5/2016	Batross et al.
9,232,941 B2	1/2016	Mandakolathur Vasudevan et al.	9,326,812 B2	5/2016	Waalder et al.
9,232,945 B2	1/2016	Zingman	9,332,890 B2	5/2016	Ozawa
9,232,979 B2	1/2016	Parihar et al.	9,332,974 B2	5/2016	Henderson et al.
9,233,610 B2	1/2016	Kim et al.	9,332,984 B2	5/2016	Weaner et al.
9,237,891 B2	1/2016	Shelton, IV	9,332,987 B2	5/2016	Leimbach et al.
9,237,892 B2	1/2016	Hodgkinson	9,333,040 B2	5/2016	Shellenberger et al.
9,237,895 B2	1/2016	McCarthy et al.	9,333,082 B2	5/2016	Wei et al.
9,237,921 B2	1/2016	Messery et al.	9,339,226 B2	5/2016	van der Walt et al.
9,240,740 B2	1/2016	Zeng et al.	9,345,477 B2	5/2016	Anim et al.
9,241,712 B2	1/2016	Zemlok et al.	9,345,480 B2	5/2016	Hessler et al.
9,241,714 B2	1/2016	Timm et al.	9,345,481 B2	5/2016	Hall et al.
9,241,716 B2	1/2016	Whitman	9,351,726 B2	5/2016	Leimbach et al.
9,241,731 B2	1/2016	Boudreaux et al.	9,351,727 B2	5/2016	Leimbach et al.
9,259,274 B2	2/2016	Prisco	9,351,728 B2	5/2016	Sniffin et al.
9,261,172 B2	2/2016	Solomon et al.	9,351,730 B2	5/2016	Schmid et al.
9,265,500 B2	2/2016	Sorrentino et al.	9,351,731 B2	5/2016	Carter et al.
9,265,516 B2	2/2016	Casey et al.	9,351,732 B2	5/2016	Hodgkinson
9,265,585 B2	2/2016	Wingardner et al.	9,358,003 B2	6/2016	Hall et al.
9,271,718 B2	3/2016	Milad et al.	9,358,005 B2	6/2016	Shelton, IV et al.
9,271,727 B2	3/2016	McGuckin, Jr. et al.	9,358,015 B2	6/2016	Sorrentino et al.
9,271,753 B2	3/2016	Butler et al.	9,358,031 B2	6/2016	Manzo
9,271,799 B2	3/2016	Shelton, IV et al.	9,364,217 B2	6/2016	Kostrzewski et al.
9,272,406 B2	3/2016	Aronhalt et al.	9,364,219 B2	6/2016	Olson et al.
9,277,919 B2	3/2016	Timmer et al.	9,364,220 B2	6/2016	Williams
9,277,922 B2	3/2016	Carter et al.	9,364,226 B2	6/2016	Zemlok et al.
9,282,962 B2	3/2016	Schmid et al.	9,364,229 B2	6/2016	D'Agostino et al.
9,282,963 B2	3/2016	Bryant	9,364,230 B2	6/2016	Shelton, IV et al.
			9,364,231 B2	6/2016	Wenchell
			9,364,233 B2	6/2016	Alexander, III et al.
			9,364,279 B2	6/2016	Houser et al.
			9,368,991 B2	6/2016	Qahouq

(56)

References Cited

U.S. PATENT DOCUMENTS

9,370,341 B2	6/2016	Ceniccola et al.	9,517,063 B2	12/2016	Swayze et al.
9,370,358 B2	6/2016	Shelton, IV et al.	9,517,068 B2	12/2016	Shelton, IV et al.
9,370,364 B2	6/2016	Smith et al.	9,521,996 B2	12/2016	Armstrong
9,375,206 B2	6/2016	Vidal et al.	9,522,029 B2	12/2016	Yates et al.
9,375,255 B2	6/2016	Houser et al.	9,526,481 B2	12/2016	Storz et al.
9,381,058 B2	7/2016	Houser et al.	9,526,499 B2	12/2016	Kostrzewski et al.
9,386,983 B2	7/2016	Swensgard et al.	9,526,564 B2	12/2016	Rusin
9,386,984 B2	7/2016	Aronhalt et al.	9,532,783 B2	1/2017	Swayze et al.
9,386,985 B2	7/2016	Koch, Jr. et al.	9,545,258 B2	1/2017	Smith et al.
9,386,988 B2	7/2016	Baxter, III et al.	9,549,732 B2	1/2017	Yates et al.
9,387,003 B2	7/2016	Kaercher et al.	9,549,735 B2	1/2017	Shelton, IV et al.
9,393,015 B2	7/2016	Laurent et al.	9,554,794 B2	1/2017	Baber et al.
9,393,017 B2	7/2016	Flanagan et al.	9,554,796 B2	1/2017	Kostrzewski
9,393,018 B2	7/2016	Wang et al.	9,554,812 B2	1/2017	Inkpen et al.
9,398,911 B2	7/2016	Auld	9,559,624 B2	1/2017	Philipp
9,402,604 B2	8/2016	Williams et al.	9,561,031 B2	2/2017	Heinrich et al.
9,402,626 B2	8/2016	Ortiz et al.	9,561,032 B2	2/2017	Shelton, IV et al.
9,402,627 B2	8/2016	Stevenson et al.	9,561,038 B2	2/2017	Shelton, IV et al.
9,408,604 B2	8/2016	Shelton, IV et al.	9,561,045 B2	2/2017	Hinman et al.
9,408,606 B2	8/2016	Shelton, IV	9,566,061 B2	2/2017	Aronhalt et al.
9,408,622 B2	8/2016	Stulen et al.	9,566,067 B2	2/2017	Milliman et al.
9,411,370 B2	8/2016	Benni et al.	9,572,574 B2	2/2017	Shelton, IV et al.
9,414,838 B2	8/2016	Shelton, IV et al.	9,572,577 B2	2/2017	Lloyd et al.
9,414,849 B2	8/2016	Nagashimada	9,572,592 B2	2/2017	Price et al.
9,414,880 B2	8/2016	Monson et al.	9,574,644 B2	2/2017	Parihar
9,420,967 B2	8/2016	Zand et al.	9,585,550 B2	3/2017	Abel et al.
9,421,003 B2	8/2016	Williams et al.	9,585,657 B2	3/2017	Shelton, IV et al.
9,421,014 B2	8/2016	Ingmanson et al.	9,585,658 B2	3/2017	Shelton, IV
9,421,030 B2	8/2016	Cole et al.	9,585,659 B2	3/2017	Viola et al.
9,421,060 B2	8/2016	Monson et al.	9,585,660 B2	3/2017	Laurent et al.
9,427,223 B2	8/2016	Park et al.	9,585,662 B2	3/2017	Shelton, IV et al.
9,427,231 B2	8/2016	Racenet et al.	9,585,663 B2	3/2017	Shelton, IV et al.
9,433,411 B2	9/2016	Racenet et al.	9,585,672 B2	3/2017	Bastia
9,433,419 B2	9/2016	Gonzalez et al.	9,592,050 B2	3/2017	Schmid et al.
9,433,420 B2	9/2016	Hodgkinson	9,592,052 B2	3/2017	Shelton, IV
9,439,649 B2	9/2016	Shelton, IV et al.	9,592,053 B2	3/2017	Shelton, IV et al.
9,439,650 B2	9/2016	McGuckin, Jr. et al.	9,592,054 B2	3/2017	Schmid et al.
9,439,651 B2	9/2016	Smith et al.	9,597,073 B2	3/2017	Sorrentino et al.
9,439,668 B2	9/2016	Timm et al.	9,597,075 B2	3/2017	Shelton, IV et al.
9,445,808 B2	9/2016	Woodard, Jr. et al.	9,597,080 B2	3/2017	Milliman et al.
9,445,813 B2	9/2016	Shelton, IV et al.	9,597,104 B2	3/2017	Nicholas et al.
9,451,958 B2	9/2016	Shelton, IV et al.	9,597,143 B2	3/2017	Madan et al.
9,461,340 B2	10/2016	Li et al.	9,603,595 B2	3/2017	Shelton, IV et al.
9,463,040 B2	10/2016	Jeong et al.	9,603,598 B2	3/2017	Shelton, IV et al.
9,463,260 B2	10/2016	Stopek	9,603,991 B2	3/2017	Shelton, IV et al.
9,468,438 B2	10/2016	Baber et al.	9,610,080 B2	4/2017	Whitfield et al.
9,468,447 B2	10/2016	Aman et al.	9,614,258 B2	4/2017	Takahashi et al.
9,470,297 B2	10/2016	Aranyi et al.	9,615,826 B2	4/2017	Shelton, IV et al.
9,471,969 B2	10/2016	Zeng et al.	9,629,623 B2	4/2017	Lytle, IV et al.
9,474,506 B2	10/2016	Magnin et al.	9,629,626 B2	4/2017	Soltz et al.
9,474,523 B2	10/2016	Meade et al.	9,629,629 B2	4/2017	Leimbach et al.
9,474,540 B2	10/2016	Stokes et al.	9,629,652 B2	4/2017	Mumaw et al.
9,475,180 B2	10/2016	Eshleman et al.	9,629,814 B2	4/2017	Widenhouse et al.
9,480,476 B2	11/2016	Aldridge et al.	9,636,850 B2	5/2017	Stopek et al.
9,480,492 B2	11/2016	Aranyi et al.	9,641,122 B2	5/2017	Romanowich et al.
9,483,095 B2	11/2016	Tran et al.	9,642,620 B2	5/2017	Baxter, III et al.
9,486,186 B2	11/2016	Fiebig et al.	9,649,096 B2	5/2017	Sholev
9,486,213 B2	11/2016	Altman et al.	9,649,110 B2	5/2017	Parihar et al.
9,486,214 B2	11/2016	Shelton, IV	9,649,111 B2	5/2017	Shelton, IV et al.
9,486,302 B2	11/2016	Boey et al.	9,655,613 B2	5/2017	Schaller
9,488,197 B2	11/2016	Wi	9,655,614 B2	5/2017	Swensgard et al.
9,492,146 B2	11/2016	Kostrzewski et al.	9,655,615 B2	5/2017	Knodel et al.
9,492,167 B2	11/2016	Shelton, IV et al.	9,655,624 B2	5/2017	Shelton, IV et al.
9,492,170 B2	11/2016	Bear et al.	9,662,108 B2	5/2017	Williams
9,492,189 B2	11/2016	Williams et al.	9,662,110 B2	5/2017	Huang et al.
9,492,192 B2	11/2016	To et al.	9,662,116 B2	5/2017	Smith et al.
9,498,213 B2	11/2016	Marczyk et al.	9,662,131 B2	5/2017	Omori et al.
9,498,219 B2	11/2016	Moore et al.	9,668,729 B2	6/2017	Williams et al.
9,504,521 B2	11/2016	Deutmeyer et al.	9,668,732 B2	6/2017	Patel et al.
D775,336 S	12/2016	Shelton, IV et al.	9,675,344 B2	6/2017	Combrowski et al.
9,510,828 B2	12/2016	Yates et al.	9,675,351 B2	6/2017	Hodgkinson et al.
9,510,830 B2	12/2016	Shelton, IV et al.	9,675,355 B2	6/2017	Shelton, IV et al.
9,510,846 B2	12/2016	Sholev et al.	9,675,372 B2	6/2017	Laurent et al.
9,510,895 B2	12/2016	Houser et al.	9,675,375 B2	6/2017	Houser et al.
9,510,925 B2	12/2016	Hotter et al.	9,675,405 B2	6/2017	Trees et al.
			9,681,870 B2	6/2017	Baxter, III et al.
			9,681,873 B2	6/2017	Smith et al.
			9,681,884 B2	6/2017	Clem et al.
			9,687,230 B2	6/2017	Leimbach et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

9,687,231 B2	6/2017	Baxter, III et al.	9,795,383 B2	10/2017	Aldridge et al.
9,687,232 B2	6/2017	Shelton, IV et al.	9,795,384 B2	10/2017	Weaner et al.
9,687,233 B2	6/2017	Fernandez et al.	9,797,486 B2	10/2017	Zergiebel et al.
9,687,236 B2	6/2017	Leimbach et al.	9,801,626 B2	10/2017	Parihar et al.
9,687,237 B2	6/2017	Schmid et al.	9,801,627 B2	10/2017	Harris et al.
9,687,253 B2	6/2017	Detry et al.	9,801,628 B2	10/2017	Harris et al.
9,689,466 B2	6/2017	Kanai et al.	9,801,634 B2	10/2017	Shelton, IV et al.
9,690,362 B2	6/2017	Leimbach et al.	9,802,033 B2	10/2017	Hibner et al.
9,693,772 B2	7/2017	Ingmanson et al.	9,804,618 B2	10/2017	Leimbach et al.
9,693,774 B2	7/2017	Gettinger et al.	9,808,244 B2	11/2017	Leimbach et al.
9,693,777 B2	7/2017	Schellin et al.	9,808,246 B2	11/2017	Shelton, IV et al.
9,700,309 B2	7/2017	Jaworek et al.	9,808,247 B2	11/2017	Shelton, IV et al.
9,700,310 B2	7/2017	Morgan et al.	9,808,249 B2	11/2017	Shelton, IV
9,700,312 B2	7/2017	Kostrzewski et al.	9,814,460 B2	11/2017	Kimsey et al.
9,700,317 B2	7/2017	Aronhalt et al.	9,814,462 B2	11/2017	Woodard, Jr. et al.
9,700,318 B2	7/2017	Scirica et al.	9,820,738 B2	11/2017	Lytle, IV et al.
9,700,319 B2	7/2017	Motoooka et al.	9,820,741 B2	11/2017	Kostrzewski
9,700,321 B2	7/2017	Shelton, IV et al.	9,820,768 B2	11/2017	Gee et al.
9,706,981 B2	7/2017	Nicholas et al.	9,825,455 B2	11/2017	Sandhu et al.
9,706,991 B2	7/2017	Hess et al.	9,826,976 B2	11/2017	Parihar et al.
9,706,993 B2	7/2017	Hessler et al.	9,826,977 B2	11/2017	Leimbach et al.
9,707,026 B2	7/2017	Malackowski et al.	9,826,978 B2	11/2017	Shelton, IV et al.
9,707,043 B2	7/2017	Bozung	9,829,698 B2	11/2017	Haraguchi et al.
9,707,684 B2	7/2017	Ruiz Morales et al.	9,833,236 B2	12/2017	Shelton, IV et al.
9,713,468 B2	7/2017	Harris et al.	9,833,238 B2	12/2017	Baxter, III et al.
9,713,470 B2	7/2017	Scirica et al.	9,833,239 B2	12/2017	Yates et al.
9,724,091 B2	8/2017	Shelton, IV et al.	9,833,241 B2	12/2017	Huitema et al.
9,724,092 B2	8/2017	Baxter, III et al.	9,833,242 B2	12/2017	Baxter, III et al.
9,724,094 B2	8/2017	Baber et al.	9,839,420 B2	12/2017	Shelton, IV et al.
9,724,096 B2	8/2017	Thompson et al.	9,839,421 B2	12/2017	Zerkle et al.
9,724,098 B2	8/2017	Baxter, III et al.	9,839,422 B2	12/2017	Schellin et al.
9,724,163 B2	8/2017	Orban	9,839,423 B2	12/2017	Vendely et al.
9,730,692 B2	8/2017	Shelton, IV et al.	9,839,427 B2	12/2017	Swayze et al.
9,730,695 B2	8/2017	Leimbach et al.	9,839,428 B2	12/2017	Baxter, III et al.
9,730,697 B2	8/2017	Morgan et al.	9,839,429 B2	12/2017	Weisenburgh, II et al.
9,730,717 B2	8/2017	Katsuki et al.	9,839,480 B2	12/2017	Pribanic et al.
9,731,410 B2	8/2017	Hirabayashi et al.	9,844,368 B2	12/2017	Boudreaux et al.
9,733,663 B2	8/2017	Leimbach et al.	9,844,369 B2	12/2017	Huitema et al.
9,737,297 B2	8/2017	Racenet et al.	9,844,372 B2	12/2017	Shelton, IV et al.
9,737,301 B2	8/2017	Baber et al.	9,844,373 B2	12/2017	Swayze et al.
9,737,302 B2	8/2017	Shelton, IV et al.	9,844,374 B2	12/2017	Lytle, IV et al.
9,737,303 B2	8/2017	Shelton, IV et al.	9,844,375 B2	12/2017	Overmyer et al.
9,737,365 B2	8/2017	Hegeman et al.	9,844,376 B2	12/2017	Baxter, III et al.
9,743,927 B2	8/2017	Whitman	9,844,379 B2	12/2017	Shelton, IV et al.
9,743,928 B2	8/2017	Shelton, IV et al.	9,848,873 B2	12/2017	Shelton, IV
9,743,929 B2	8/2017	Leimbach et al.	9,848,875 B2	12/2017	Aronhalt et al.
9,750,498 B2	9/2017	Timm et al.	9,855,662 B2	1/2018	Ruiz Morales et al.
9,750,499 B2	9/2017	Leimbach et al.	9,861,261 B2	1/2018	Shahinian
9,750,501 B2	9/2017	Shelton, IV et al.	9,861,359 B2	1/2018	Shelton, IV et al.
9,750,639 B2	9/2017	Barnes et al.	9,861,361 B2	1/2018	Aronhalt et al.
9,757,123 B2	9/2017	Giordano et al.	9,861,382 B2	1/2018	Smith et al.
9,757,124 B2	9/2017	Schellin et al.	9,867,612 B2	1/2018	Parihar et al.
9,757,126 B2	9/2017	Cappola	9,867,618 B2	1/2018	Hall et al.
9,757,128 B2	9/2017	Baber et al.	9,868,198 B2	1/2018	Nicholas et al.
9,757,129 B2	9/2017	Williams	9,872,682 B2	1/2018	Hess et al.
9,757,130 B2	9/2017	Shelton, IV	9,872,683 B2	1/2018	Hopkins et al.
9,763,662 B2	9/2017	Shelton, IV et al.	9,872,684 B2	1/2018	Hall et al.
9,770,245 B2	9/2017	Swayze et al.	9,877,721 B2	1/2018	Schellin et al.
D800,904 S	10/2017	Leimbach et al.	9,877,723 B2	1/2018	Hall et al.
9,775,608 B2	10/2017	Aronhalt et al.	9,883,843 B2	2/2018	Garlow
9,775,609 B2	10/2017	Shelton, IV et al.	9,883,860 B2	2/2018	Leimbach et al.
9,775,610 B2	10/2017	Nicholas et al.	9,883,861 B2	2/2018	Shelton, IV et al.
9,775,611 B2	10/2017	Kostrzewski	9,884,456 B2	2/2018	Schellin et al.
9,775,613 B2	10/2017	Shelton, IV et al.	9,888,919 B2	2/2018	Leimbach et al.
9,775,614 B2	10/2017	Shelton, IV et al.	9,888,924 B2	2/2018	Ebersole et al.
9,782,169 B2	10/2017	Kimsey et al.	9,889,230 B2	2/2018	Bennett et al.
9,782,170 B2	10/2017	Zemlok et al.	9,895,147 B2	2/2018	Shelton, IV
9,782,214 B2	10/2017	Houser et al.	9,895,148 B2	2/2018	Shelton, IV et al.
9,788,834 B2	10/2017	Schmid et al.	9,895,813 B2	2/2018	Blumenkranz et al.
9,788,836 B2	10/2017	Overmyer et al.	9,901,341 B2	2/2018	Kostrzewski
9,788,847 B2	10/2017	Jinno	9,901,342 B2	2/2018	Shelton, IV et al.
9,788,851 B2	10/2017	Dannaher et al.	9,901,344 B2	2/2018	Moore et al.
9,795,379 B2	10/2017	Leimbach et al.	9,901,345 B2	2/2018	Moore et al.
9,795,381 B2	10/2017	Shelton, IV	9,901,346 B2	2/2018	Moore et al.
9,795,382 B2	10/2017	Shelton, IV	9,907,456 B2	3/2018	Miyoshi
			9,907,553 B2	3/2018	Cole et al.
			9,907,620 B2	3/2018	Shelton, IV et al.
			9,913,642 B2	3/2018	Leimbach et al.
			9,913,644 B2	3/2018	McCuen

(56)

References Cited

U.S. PATENT DOCUMENTS

9,913,646	B2	3/2018	Shelton, IV	10,052,102	B2	8/2018	Baxter, III et al.
9,913,647	B2	3/2018	Weisenburgh, II et al.	10,052,104	B2	8/2018	Shelton, IV et al.
9,913,648	B2	3/2018	Shelton, IV et al.	10,052,164	B2	8/2018	Overmyer
9,913,694	B2	3/2018	Brisson	10,058,317	B2	8/2018	Fan et al.
9,918,704	B2	3/2018	Shelton, IV et al.	10,058,327	B2	8/2018	Weisenburgh, II et al.
9,918,715	B2	3/2018	Menn	10,058,963	B2	8/2018	Shelton, IV et al.
9,918,716	B2	3/2018	Baxter, III et al.	10,064,620	B2	9/2018	Gettlinger et al.
9,924,942	B2	3/2018	Swayze et al.	10,064,621	B2	9/2018	Kerr et al.
9,924,944	B2	3/2018	Shelton, IV et al.	10,064,624	B2	9/2018	Shelton, IV et al.
9,924,945	B2	3/2018	Zheng et al.	10,064,639	B2	9/2018	Ishida et al.
9,924,946	B2	3/2018	Vendely et al.	10,064,649	B2	9/2018	Golebieski et al.
9,924,947	B2	3/2018	Shelton, IV et al.	10,064,688	B2	9/2018	Shelton, IV et al.
9,924,961	B2	3/2018	Shelton, IV et al.	10,070,861	B2	9/2018	Spivey et al.
9,931,116	B2	4/2018	Racenet et al.	10,070,863	B2	9/2018	Swayze et al.
9,931,118	B2	4/2018	Shelton, IV et al.	10,071,452	B2	9/2018	Shelton, IV et al.
9,936,949	B2	4/2018	Measamer et al.	10,076,325	B2	9/2018	Huang et al.
9,936,950	B2	4/2018	Shelton, IV et al.	10,076,326	B2	9/2018	Yates et al.
9,936,951	B2	4/2018	Hufnagel et al.	10,085,624	B2	10/2018	Isoda et al.
9,936,954	B2	4/2018	Shelton, IV et al.	10,085,748	B2	10/2018	Morgan et al.
9,943,309	B2	4/2018	Shelton, IV et al.	10,085,751	B2	10/2018	Overmyer et al.
9,943,310	B2	4/2018	Harris et al.	10,085,806	B2	10/2018	Hagn et al.
9,943,312	B2	4/2018	Posada et al.	10,092,292	B2	10/2018	Boudreaux et al.
9,955,965	B2	5/2018	Chen et al.	10,098,636	B2	10/2018	Shelton, IV et al.
9,955,966	B2	5/2018	Zergiebel	10,098,642	B2	10/2018	Baxter, III et al.
9,962,158	B2	5/2018	Hall et al.	10,099,303	B2	10/2018	Yoshida et al.
9,962,159	B2	5/2018	Heinrich et al.	10,105,128	B2	10/2018	Cooper et al.
9,962,161	B2	5/2018	Scheib et al.	10,105,136	B2	10/2018	Yates et al.
9,968,354	B2	5/2018	Shelton, IV et al.	10,105,139	B2	10/2018	Yates et al.
9,968,355	B2	5/2018	Shelton, IV et al.	10,105,140	B2	10/2018	Malinouskas et al.
9,968,356	B2	5/2018	Shelton, IV et al.	10,111,679	B2	10/2018	Baber et al.
9,968,397	B2	5/2018	Taylor et al.	2001/0000531	A1	4/2001	Casscells et al.
9,974,529	B2	5/2018	Shelton, IV et al.	2001/0025183	A1	9/2001	Shahidi
9,974,538	B2	5/2018	Baxter, III et al.	2002/0014510	A1	2/2002	Richter et al.
9,974,539	B2	5/2018	Yates et al.	2002/0022810	A1	2/2002	Urich
9,980,713	B2	5/2018	Aronhalt et al.	2002/0022836	A1	2/2002	Goble et al.
9,980,729	B2	5/2018	Moore et al.	2002/0022861	A1	2/2002	Jacobs et al.
9,987,000	B2	6/2018	Shelton, IV et al.	2002/0029032	A1	3/2002	Arkin
9,987,003	B2	6/2018	Timm et al.	2002/0029036	A1	3/2002	Goble et al.
9,987,006	B2	6/2018	Morgan et al.	2002/0042620	A1	4/2002	Julian et al.
9,987,099	B2	6/2018	Chen et al.	2002/0091374	A1	7/2002	Cooper
9,993,248	B2	6/2018	Shelton, IV et al.	2002/0095175	A1	7/2002	Brock et al.
9,993,258	B2	6/2018	Shelton, IV et al.	2002/0103494	A1	8/2002	Pacey
9,999,408	B2	6/2018	Boudreaux et al.	2002/0117534	A1	8/2002	Green et al.
9,999,426	B2	6/2018	Moore et al.	2002/0127265	A1	9/2002	Bowman et al.
9,999,431	B2	6/2018	Shelton, IV et al.	2002/0128633	A1	9/2002	Brock et al.
10,004,497	B2	6/2018	Overmyer et al.	2002/0134811	A1	9/2002	Napier et al.
10,004,498	B2	6/2018	Morgan et al.	2002/0135474	A1	9/2002	Sylliassen
10,004,500	B2	6/2018	Shelton, IV et al.	2002/0143340	A1	10/2002	Kaneko
10,004,501	B2	6/2018	Shelton, IV et al.	2002/0158593	A1	10/2002	Henderson et al.
10,004,505	B2	6/2018	Moore et al.	2002/0185514	A1	12/2002	Adams et al.
10,004,506	B2	6/2018	Shelton, IV et al.	2002/0188170	A1	12/2002	Santamore et al.
10,010,322	B2	7/2018	Shelton, IV et al.	2002/0188287	A1	12/2002	Zvuloni et al.
10,010,324	B2	7/2018	Huitema et al.	2003/0009193	A1	1/2003	Corsaro
10,013,049	B2	7/2018	Leimbach et al.	2003/0011245	A1	1/2003	Fiebig
10,016,199	B2	7/2018	Baber et al.	2003/0066858	A1	4/2003	Holgersson
10,022,125	B2	7/2018	Stopek et al.	2003/0078647	A1	4/2003	Vallana et al.
10,024,407	B2	7/2018	Aranyi et al.	2003/0083648	A1	5/2003	Wang et al.
10,028,742	B2	7/2018	Shelton, IV et al.	2003/0084983	A1	5/2003	Rangachari et al.
10,028,743	B2	7/2018	Shelton, IV et al.	2003/0093103	A1	5/2003	Malackowski et al.
10,028,744	B2	7/2018	Shelton, IV et al.	2003/0094356	A1	5/2003	Waldron
10,028,761	B2	7/2018	Leimbach et al.	2003/0096158	A1	5/2003	Takano et al.
10,029,125	B2	7/2018	Shapiro et al.	2003/0114851	A1	6/2003	Truckai et al.
10,034,668	B2	7/2018	Ebner	2003/0139741	A1	7/2003	Goble et al.
10,039,440	B2	8/2018	Fenech et al.	2003/0153908	A1	8/2003	Goble et al.
10,039,529	B2	8/2018	Kerr et al.	2003/0153968	A1	8/2003	Geis et al.
10,039,545	B2	8/2018	Sadowski et al.	2003/0163085	A1	8/2003	Tanner et al.
10,041,822	B2	8/2018	Zemlok	2003/0181900	A1	9/2003	Long
10,045,769	B2	8/2018	Aronhalt et al.	2003/0190584	A1	10/2003	Heasley
10,045,776	B2	8/2018	Shelton, IV et al.	2003/0195387	A1	10/2003	Kortenbach et al.
10,045,778	B2	8/2018	Yates et al.	2003/0205029	A1	11/2003	Chapolini et al.
10,045,779	B2	8/2018	Savage et al.	2003/0212005	A1	11/2003	Petito et al.
10,045,781	B2	8/2018	Cropper et al.	2003/0216732	A1	11/2003	Truckai et al.
10,052,044	B2	8/2018	Shelton, IV et al.	2003/0236505	A1	12/2003	Bonadio et al.
10,052,099	B2	8/2018	Morgan et al.	2004/0006335	A1	1/2004	Garrison
10,052,100	B2	8/2018	Morgan et al.	2004/0006340	A1	1/2004	Latterell et al.
				2004/0007608	A1	1/2004	Ehrenfels et al.
				2004/0024457	A1	2/2004	Boyce et al.
				2004/0028502	A1	2/2004	Cummins
				2004/0030333	A1	2/2004	Goble

(56)

References Cited

U.S. PATENT DOCUMENTS

2004/0034357	A1	2/2004	Beane et al.	2005/0139636	A1	6/2005	Schwemberger et al.
2004/0044364	A1	3/2004	DeVries et al.	2005/0143759	A1	6/2005	Kelly
2004/0049121	A1	3/2004	Yaron	2005/0143769	A1	6/2005	White et al.
2004/0049172	A1	3/2004	Root et al.	2005/0145671	A1	7/2005	Viola
2004/0059362	A1	3/2004	Knodel et al.	2005/0150928	A1	7/2005	Kameyama et al.
2004/0068161	A1	4/2004	Couvillon	2005/0154258	A1	7/2005	Tartaglia et al.
2004/0068224	A1	4/2004	Couvillon et al.	2005/0154406	A1	7/2005	Bombard et al.
2004/0068307	A1	4/2004	Goble	2005/0159778	A1	7/2005	Heinrich et al.
2004/0070369	A1	4/2004	Sakakibara	2005/0165419	A1	7/2005	Sauer et al.
2004/0073222	A1	4/2004	Koseki	2005/0169974	A1	8/2005	Tenerz et al.
2004/0078037	A1	4/2004	Batchelor et al.	2005/0171522	A1	8/2005	Christopherson
2004/0085180	A1	5/2004	Juang	2005/0177181	A1	8/2005	Kagan et al.
2004/0093024	A1	5/2004	Lousararian et al.	2005/0177249	A1	8/2005	Kladakis et al.
2004/0098040	A1	5/2004	Taniguchi et al.	2005/0182298	A1	8/2005	Ikeda et al.
2004/0101822	A1	5/2004	Wiesner et al.	2005/0184121	A1	8/2005	Heinrich
2004/0102783	A1	5/2004	Sutterlin et al.	2005/0186240	A1	8/2005	Ringeisen et al.
2004/0108357	A1	6/2004	Milliman et al.	2005/0187545	A1	8/2005	Hoooven et al.
2004/0110439	A1	6/2004	Chaikof et al.	2005/0203550	A1	9/2005	Laufer et al.
2004/0115022	A1	6/2004	Albertson et al.	2005/0209614	A1	9/2005	Fenter et al.
2004/0116952	A1	6/2004	Sakurai et al.	2005/0216055	A1	9/2005	Scirica et al.
2004/0122423	A1	6/2004	Dycus et al.	2005/0222587	A1	10/2005	Jinno et al.
2004/0133095	A1	7/2004	Dunki-Jacobs et al.	2005/0222611	A1	10/2005	Weitkamp
2004/0143297	A1	7/2004	Ramsey	2005/0222616	A1	10/2005	Rethy et al.
2004/0147909	A1	7/2004	Johnston et al.	2005/0222665	A1	10/2005	Aranyi
2004/0153100	A1	8/2004	Ahlberg et al.	2005/0228224	A1	10/2005	Okada et al.
2004/0158261	A1	8/2004	Vu	2005/0228446	A1	10/2005	Mooradian et al.
2004/0164123	A1	8/2004	Racenet et al.	2005/0230453	A1	10/2005	Viola
2004/0166169	A1	8/2004	Malaviya et al.	2005/0240178	A1	10/2005	Morley et al.
2004/0167572	A1	8/2004	Roth et al.	2005/0245965	A1	11/2005	Orban, III et al.
2004/0181219	A1	9/2004	Goble et al.	2005/0251063	A1	11/2005	Basude
2004/0193189	A1	9/2004	Kortenbach et al.	2005/0256452	A1	11/2005	DeMarchi et al.
2004/0197367	A1	10/2004	Rezania et al.	2005/0261676	A1	11/2005	Hall et al.
2004/0199181	A1	10/2004	Knodel et al.	2005/0263563	A1	12/2005	Racenet et al.
2004/0204735	A1	10/2004	Shiroff et al.	2005/0267455	A1	12/2005	Eggers et al.
2004/0222268	A1	11/2004	Bilotti et al.	2005/0274034	A1	12/2005	Hayashida et al.
2004/0225186	A1	11/2004	Horne et al.	2005/0283188	A1	12/2005	Loshakove et al.
2004/0232201	A1	11/2004	Wenchell et al.	2006/0008787	A1	1/2006	Hayman et al.
2004/0236352	A1	11/2004	Wang et al.	2006/0015009	A1	1/2006	Jaffe et al.
2004/0243147	A1	12/2004	Lipow	2006/0020258	A1	1/2006	Strauss et al.
2004/0243151	A1	12/2004	Demmy et al.	2006/0020336	A1	1/2006	Liddicoat
2004/0243163	A1	12/2004	Casiano et al.	2006/0025812	A1	2/2006	Shelton
2004/0247415	A1	12/2004	Mangone	2006/0041188	A1	2/2006	Dirusso et al.
2004/0249366	A1	12/2004	Kunz	2006/0047275	A1	3/2006	Goble
2004/0254455	A1	12/2004	Iddan	2006/0049229	A1	3/2006	Milliman et al.
2004/0254566	A1	12/2004	Plicchi et al.	2006/0052824	A1	3/2006	Ransick et al.
2004/0254590	A1	12/2004	Hoffman et al.	2006/0052825	A1	3/2006	Ransick et al.
2004/0260315	A1	12/2004	Dell et al.	2006/0064086	A1	3/2006	Odom
2004/0267310	A1	12/2004	Racenet et al.	2006/0079735	A1	4/2006	Martone et al.
2005/0010158	A1	1/2005	Brugger et al.	2006/0079879	A1	4/2006	Faller et al.
2005/0010213	A1	1/2005	Stad et al.	2006/0086032	A1	4/2006	Valencic et al.
2005/0021078	A1	1/2005	Vleugels et al.	2006/0087746	A1	4/2006	Lipow
2005/0032511	A1	2/2005	Malone et al.	2006/0089535	A1	4/2006	Raz et al.
2005/0033352	A1	2/2005	Zepf et al.	2006/0100643	A1	5/2006	Laufer et al.
2005/0051163	A1	3/2005	Deem et al.	2006/0100649	A1	5/2006	Hart
2005/0054946	A1	3/2005	Krzyzanowski	2006/0111210	A1	5/2006	Hinman
2005/0057225	A1	3/2005	Marquet	2006/0111711	A1	5/2006	Goble
2005/0058890	A1	3/2005	Brazell et al.	2006/0111723	A1	5/2006	Chapolini et al.
2005/0059997	A1	3/2005	Bauman et al.	2006/0116634	A1	6/2006	Shachar
2005/0070929	A1	3/2005	Dallessandro et al.	2006/0142772	A1	6/2006	Ralph et al.
2005/0075561	A1	4/2005	Golden	2006/0161050	A1	7/2006	Butler et al.
2005/0080342	A1	4/2005	Gilreath et al.	2006/0161185	A1	7/2006	Saadat et al.
2005/0085693	A1	4/2005	Belson et al.	2006/0167471	A1	7/2006	Phillips
2005/0090817	A1	4/2005	Phan	2006/0173470	A1	8/2006	Oray et al.
2005/0096683	A1	5/2005	Ellins et al.	2006/0176031	A1	8/2006	Forman et al.
2005/0116673	A1	6/2005	Carl et al.	2006/0178556	A1	8/2006	Hasser et al.
2005/0124855	A1	6/2005	Jaffe et al.	2006/0180633	A1	8/2006	Emmons
2005/0125897	A1	6/2005	Wyslucha et al.	2006/0180634	A1	8/2006	Shelton et al.
2005/0130682	A1	6/2005	Takara et al.	2006/0185682	A1	8/2006	Marczyk
2005/0131173	A1	6/2005	McDaniel et al.	2006/0199999	A1	9/2006	Ikeda et al.
2005/0131211	A1	6/2005	Bayley et al.	2006/0201989	A1	9/2006	Ojeda
2005/0131390	A1	6/2005	Heinrich et al.	2006/0206100	A1	9/2006	Eskridge et al.
2005/0131436	A1	6/2005	Johnston et al.	2006/0217729	A1	9/2006	Eskridge et al.
2005/0131457	A1	6/2005	Douglas et al.	2006/0235368	A1	10/2006	Oz
2005/0137454	A1	6/2005	Saadat et al.	2006/0244460	A1	11/2006	Weaver
2005/0137455	A1	6/2005	Ewers et al.	2006/0252990	A1	11/2006	Kubach
				2006/0252993	A1	11/2006	Freed et al.
				2006/0258904	A1	11/2006	Stefanchik et al.
				2006/0259073	A1	11/2006	Miyamoto et al.
				2006/0261763	A1	11/2006	Iott et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2006/0264831	A1	11/2006	Skwarek et al.	2008/0078802	A1	4/2008	Hess et al.
2006/0264929	A1	11/2006	Goble et al.	2008/0082114	A1	4/2008	McKenna et al.
2006/0271042	A1	11/2006	Latterell et al.	2008/0082125	A1	4/2008	Murray et al.
2006/0271102	A1	11/2006	Bosshard et al.	2008/0082126	A1	4/2008	Murray et al.
2006/0282064	A1	12/2006	Shimizu et al.	2008/0083807	A1	4/2008	Beardsley et al.
2006/0284730	A1	12/2006	Schmid et al.	2008/0085296	A1	4/2008	Powell et al.
2006/0287576	A1	12/2006	Tsuji et al.	2008/0086078	A1	4/2008	Powell et al.
2006/0289602	A1	12/2006	Wales et al.	2008/0091072	A1	4/2008	Omori et al.
2006/0291981	A1	12/2006	Viola et al.	2008/0108443	A1	5/2008	Jinno et al.
2007/0010702	A1	1/2007	Wang et al.	2008/0114250	A1	5/2008	Urbano et al.
2007/0010838	A1	1/2007	Shelton et al.	2008/0125749	A1	5/2008	Olson
2007/0016235	A1	1/2007	Tanaka et al.	2008/0128469	A1	6/2008	Dalessandro et al.
2007/0026039	A1	2/2007	Drumheller et al.	2008/0129253	A1	6/2008	Shiue et al.
2007/0026040	A1	2/2007	Crawley et al.	2008/0135600	A1	6/2008	Hiranuma et al.
2007/0027468	A1	2/2007	Wales et al.	2008/0140115	A1	6/2008	Stopek
2007/0027551	A1	2/2007	Farnsworth et al.	2008/0140159	A1	6/2008	Bornhofs et al.
2007/0043387	A1	2/2007	Vargas et al.	2008/0154299	A1	6/2008	Livneh
2007/0049951	A1	3/2007	Menn	2008/0154335	A1	6/2008	Thrope et al.
2007/0049966	A1	3/2007	Bonadio et al.	2008/0169328	A1	7/2008	Shelton
2007/0051375	A1	3/2007	Milliman	2008/0169332	A1	7/2008	Shelton et al.
2007/0055228	A1	3/2007	Berg et al.	2008/0169333	A1	7/2008	Shelton et al.
2007/0073341	A1	3/2007	Smith et al.	2008/0172087	A1	7/2008	Fuchs et al.
2007/0073389	A1	3/2007	Bolduc et al.	2008/0183193	A1	7/2008	Omori et al.
2007/0078328	A1	4/2007	Ozaki et al.	2008/0190989	A1	8/2008	Crews et al.
2007/0078484	A1	4/2007	Talarico et al.	2008/0196419	A1	8/2008	Dube
2007/0084897	A1	4/2007	Shelton et al.	2008/0197167	A1	8/2008	Viola et al.
2007/0090788	A1	4/2007	Hansford et al.	2008/0200755	A1	8/2008	Bakos
2007/0093869	A1	4/2007	Bloom et al.	2008/0200762	A1	8/2008	Stokes et al.
2007/0102472	A1	5/2007	Shelton	2008/0200835	A1	8/2008	Monson et al.
2007/0106113	A1	5/2007	Ravo	2008/0200911	A1	8/2008	Long
2007/0106317	A1	5/2007	Shelton et al.	2008/0200933	A1	8/2008	Bakos et al.
2007/0134251	A1	6/2007	Ashkenazi et al.	2008/0200934	A1	8/2008	Fox
2007/0135686	A1	6/2007	Pruitt et al.	2008/0234709	A1	9/2008	Houser
2007/0135803	A1	6/2007	Belson	2008/0242939	A1	10/2008	Johnston
2007/0155010	A1	7/2007	Farnsworth et al.	2008/0249536	A1	10/2008	Stahler et al.
2007/0170225	A1	7/2007	Shelton et al.	2008/0249608	A1	10/2008	Dave
2007/0173687	A1	7/2007	Shima et al.	2008/0255413	A1	10/2008	Zemlok et al.
2007/0173813	A1	7/2007	Odom	2008/0262654	A1	10/2008	Omori et al.
2007/0175950	A1	8/2007	Shelton et al.	2008/0269596	A1	10/2008	Revie et al.
2007/0175951	A1	8/2007	Shelton et al.	2008/0281171	A1	11/2008	Fennell et al.
2007/0175955	A1	8/2007	Shelton et al.	2008/0287944	A1	11/2008	Pearson et al.
2007/0179477	A1	8/2007	Danger	2008/0293910	A1	11/2008	Kapiamba et al.
2007/0185545	A1	8/2007	Duke	2008/0294179	A1	11/2008	Balbierz et al.
2007/0190110	A1	8/2007	Pameijer et al.	2008/0296346	A1	12/2008	Shelton, IV et al.
2007/0191868	A1	8/2007	Theroux et al.	2008/0297287	A1	12/2008	Shachar et al.
2007/0194079	A1	8/2007	Hueil et al.	2008/0308602	A1	12/2008	Timm et al.
2007/0194082	A1	8/2007	Morgan et al.	2008/0308603	A1	12/2008	Shelton et al.
2007/0197954	A1	8/2007	Keenan	2008/0312687	A1	12/2008	Blier
2007/0198039	A1	8/2007	Jones et al.	2008/0315829	A1	12/2008	Jones et al.
2007/0203510	A1	8/2007	Bettuchi	2009/0001121	A1	1/2009	Hess et al.
2007/0208375	A1	9/2007	Nishizawa et al.	2009/0001130	A1	1/2009	Hess et al.
2007/0213750	A1	9/2007	Weadock	2009/0004455	A1	1/2009	Gravagna et al.
2007/0225562	A1	9/2007	Spivey et al.	2009/0005809	A1	1/2009	Hess et al.
2007/0233163	A1	10/2007	Bombard et al.	2009/0012534	A1	1/2009	Madhani et al.
2007/0243227	A1	10/2007	Gertner	2009/0015195	A1	1/2009	Loth-Krausser
2007/0244471	A1	10/2007	Malackowski	2009/0020958	A1	1/2009	Soul
2007/0246505	A1	10/2007	Pace-Florida et al.	2009/0048583	A1	2/2009	Williams et al.
2007/0275035	A1	11/2007	Herman et al.	2009/0048589	A1	2/2009	Takashino et al.
2007/0276409	A1	11/2007	Ortiz et al.	2009/0076506	A1	3/2009	Baker
2007/0279011	A1	12/2007	Jones et al.	2009/0078736	A1	3/2009	Van Lue
2007/0286892	A1	12/2007	Herzberg et al.	2009/0081313	A1	3/2009	Aghion et al.
2007/0296286	A1	12/2007	Avenell	2009/0088659	A1	4/2009	Graham et al.
2008/0003196	A1	1/2008	Jonn et al.	2009/0090763	A1	4/2009	Zemlok et al.
2008/0015598	A1	1/2008	Prommersberger	2009/0092651	A1	4/2009	Shah et al.
2008/0021486	A1	1/2008	Oyola et al.	2009/009579	A1	4/2009	Nentwick et al.
2008/0029570	A1	2/2008	Shelton et al.	2009/0099876	A1	4/2009	Whitman
2008/0029573	A1	2/2008	Shelton et al.	2009/0119011	A1	5/2009	Kondo et al.
2008/0029574	A1	2/2008	Shelton et al.	2009/0143855	A1	6/2009	Weber et al.
2008/0029575	A1	2/2008	Shelton et al.	2009/0149871	A9	6/2009	Kagan et al.
2008/0030170	A1	2/2008	Dacquay et al.	2009/0171147	A1	7/2009	Lee et al.
2008/0042861	A1	2/2008	Dacquay et al.	2009/0177226	A1	7/2009	Reinprecht et al.
2008/0051833	A1	2/2008	Gramuglia et al.	2009/0181290	A1	7/2009	Baldwin et al.
2008/0064921	A1	3/2008	Larkin et al.	2009/0188964	A1	7/2009	Orlov
2008/0065153	A1	3/2008	Allard et al.	2009/0198272	A1	8/2009	Kerver et al.
2008/0071328	A1	3/2008	Haubrich et al.	2009/0204108	A1	8/2009	Steffen
				2009/0204109	A1	8/2009	Grove et al.
				2009/0206125	A1	8/2009	Huitema et al.
				2009/0206126	A1	8/2009	Huitema et al.
				2009/0206131	A1	8/2009	Weisenburgh, II et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2009/0206133	A1	8/2009	Morgan et al.	2011/0112530	A1	5/2011	Keller
2009/0206137	A1	8/2009	Hall et al.	2011/0114697	A1	5/2011	Baxter, III et al.
2009/0206139	A1	8/2009	Hall et al.	2011/0121049	A1	5/2011	Malinouskas et al.
2009/0206141	A1	8/2009	Huitema et al.	2011/0125176	A1	5/2011	Yates et al.
2009/0206142	A1	8/2009	Huitema et al.	2011/0127945	A1	6/2011	Yoneda
2009/0221993	A1	9/2009	Sohi et al.	2011/0129706	A1	6/2011	Takahashi et al.
2009/0234273	A1	9/2009	Intoccia et al.	2011/0144764	A1	6/2011	Bagga et al.
2009/0242610	A1	10/2009	Shelton, IV et al.	2011/0147433	A1	6/2011	Shelton, IV et al.
2009/0247368	A1	10/2009	Chiang	2011/0163146	A1	7/2011	Ortiz et al.
2009/0247901	A1	10/2009	Zimmer	2011/0172495	A1	7/2011	Armstrong
2009/0248041	A1	10/2009	Williams et al.	2011/0174861	A1	7/2011	Shelton, IV et al.
2009/0253959	A1	10/2009	Yoshie et al.	2011/0192882	A1	8/2011	Hess et al.
2009/0255974	A1	10/2009	Viola	2011/0199225	A1	8/2011	Touchberry et al.
2009/0262078	A1	10/2009	Pizzi	2011/0218400	A1	9/2011	Ma et al.
2009/0270895	A1	10/2009	Churchill et al.	2011/0218550	A1	9/2011	Ma
2009/0290016	A1	11/2009	Suda	2011/0230713	A1	9/2011	Kleemann et al.
2009/0292283	A1	11/2009	Odom	2011/0238044	A1	9/2011	Main et al.
2009/0306639	A1	12/2009	Nevo et al.	2011/0241597	A1	10/2011	Zhu et al.
2009/0308907	A1	12/2009	Nalagatla et al.	2011/0275901	A1	11/2011	Shelton, IV
2010/0012703	A1	1/2010	Calabrese et al.	2011/0276083	A1	11/2011	Shelton, IV et al.
2010/0016888	A1	1/2010	Calabrese et al.	2011/0278343	A1	11/2011	Knodel et al.
2010/0023024	A1	1/2010	Zeiner et al.	2011/0279268	A1	11/2011	Konishi et al.
2010/0030233	A1	2/2010	Whitman et al.	2011/0290856	A1	12/2011	Shelton, IV et al.
2010/0036370	A1	2/2010	Mirel et al.	2011/0293690	A1	12/2011	Griffin et al.
2010/0065604	A1	3/2010	Weng	2011/0295295	A1	12/2011	Shelton, IV et al.
2010/0069942	A1	3/2010	Shelton, IV	2011/0313894	A1	12/2011	Dye et al.
2010/0076483	A1	3/2010	Imuta	2011/0315413	A1	12/2011	Fisher et al.
2010/0076489	A1	3/2010	Stopek et al.	2012/0004636	A1	1/2012	Lo
2010/0081883	A1	4/2010	Murray et al.	2012/0016239	A1	1/2012	Barthe et al.
2010/0094340	A1	4/2010	Stopek et al.	2012/0016413	A1	1/2012	Timm et al.
2010/0100124	A1	4/2010	Calabrese et al.	2012/0016467	A1	1/2012	Chen et al.
2010/0116519	A1	5/2010	Gareis	2012/0029272	A1	2/2012	Shelton, IV et al.
2010/0122339	A1	5/2010	Boccacci	2012/0033360	A1	2/2012	Hsu
2010/0133317	A1	6/2010	Shelton, IV et al.	2012/0059286	A1	3/2012	Hastings et al.
2010/0145146	A1	6/2010	Melder	2012/0064483	A1	3/2012	Lint et al.
2010/0147921	A1	6/2010	Olson	2012/0074200	A1	3/2012	Schmid et al.
2010/0147922	A1	6/2010	Olson	2012/0078071	A1	3/2012	Bohm et al.
2010/0179022	A1	7/2010	Shirokoshi	2012/0078139	A1	3/2012	Aldridge et al.
2010/0180711	A1	7/2010	Kilibarda et al.	2012/0078244	A1	3/2012	Worrell et al.
2010/0191262	A1	7/2010	Harris et al.	2012/0080336	A1	4/2012	Shelton, IV et al.
2010/0191292	A1	7/2010	DeMeo et al.	2012/0080340	A1	4/2012	Shelton, IV et al.
2010/0193566	A1	8/2010	Scheib et al.	2012/0080344	A1	4/2012	Shelton, IV
2010/0204717	A1	8/2010	Knodel	2012/0080478	A1	4/2012	Morgan et al.
2010/0222901	A1	9/2010	Swayze et al.	2012/0080498	A1	4/2012	Shelton, IV et al.
2010/0249497	A1	9/2010	Peine et al.	2012/0086276	A1	4/2012	Sawyers
2010/0256675	A1	10/2010	Romans	2012/0095458	A1	4/2012	Cybulski et al.
2010/0258327	A1	10/2010	Esenwein et al.	2012/0109186	A1	5/2012	Parrott et al.
2010/0267662	A1	10/2010	Fielder et al.	2012/0116261	A1	5/2012	Mumaw et al.
2010/0274160	A1	10/2010	Yachi et al.	2012/0116265	A1	5/2012	Houser et al.
2010/0292540	A1	11/2010	Hess et al.	2012/0116266	A1	5/2012	Houser et al.
2010/0298636	A1	11/2010	Castro et al.	2012/0118595	A1	5/2012	Pellenc
2010/0312261	A1	12/2010	Suzuki et al.	2012/0123203	A1	5/2012	Riva
2010/0318085	A1	12/2010	Austin et al.	2012/0125792	A1	5/2012	Cassivi
2010/0331856	A1	12/2010	Carlson et al.	2012/0132286	A1	5/2012	Lim et al.
2011/0006101	A1	1/2011	Hall et al.	2012/0171539	A1	7/2012	Rejman et al.
2011/0011916	A1	1/2011	Levine	2012/0175398	A1	7/2012	Sandborn et al.
2011/0016960	A1	1/2011	Debrailly	2012/0197272	A1	8/2012	Oray et al.
2011/0021871	A1	1/2011	Berkelaar	2012/0211542	A1	8/2012	Racenet
2011/0022032	A1	1/2011	Zemlok et al.	2012/0223121	A1	9/2012	Viola et al.
2011/0024477	A1	2/2011	Hall	2012/0234895	A1	9/2012	O'Connor et al.
2011/0024478	A1	2/2011	Shelton, IV	2012/0234897	A1	9/2012	Shelton, IV et al.
2011/0025311	A1	2/2011	Chauvin et al.	2012/0239068	A1	9/2012	Morris et al.
2011/0034910	A1	2/2011	Ross et al.	2012/0241493	A1	9/2012	Baxter, III et al.
2011/0036891	A1	2/2011	Zemlok et al.	2012/0248169	A1	10/2012	Widenhouse et al.
2011/0046667	A1	2/2011	Culligan et al.	2012/0251861	A1	10/2012	Liang et al.
2011/0060363	A1	3/2011	Hess et al.	2012/0253328	A1	10/2012	Cunningham et al.
2011/0066156	A1	3/2011	McGahan et al.	2012/0283707	A1	11/2012	Giordano et al.
2011/0082538	A1	4/2011	Dahlgren et al.	2012/0289979	A1	11/2012	Eskaros et al.
2011/0087276	A1	4/2011	Bedi et al.	2012/0292367	A1	11/2012	Morgan et al.
2011/0087278	A1	4/2011	Viola et al.	2012/0298722	A1	11/2012	Hess et al.
2011/0088921	A1	4/2011	Forgues et al.	2012/0303002	A1	11/2012	Chowaniec et al.
2011/0095064	A1	4/2011	Taylor et al.	2013/0006227	A1	1/2013	Takashino
2011/0101069	A1	5/2011	Bombard et al.	2013/0012983	A1	1/2013	Kleyman
2011/0101794	A1	5/2011	Schroeder et al.	2013/0018400	A1	1/2013	Milton et al.
2011/0112517	A1	5/2011	Peine et al.	2013/0020375	A1	1/2013	Shelton, IV et al.
				2013/0020376	A1	1/2013	Shelton, IV et al.
				2013/0023861	A1	1/2013	Shelton, IV et al.
				2013/0023910	A1	1/2013	Solomon et al.
				2013/0026208	A1	1/2013	Shelton, IV et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2013/0026210 A1	1/2013	Shelton, IV et al.	2014/0224857 A1	8/2014	Schmid
2013/0030462 A1	1/2013	Keating et al.	2014/0228867 A1	8/2014	Thomas et al.
2013/0068816 A1	3/2013	Mandakolathur Vasudevan et al.	2014/0230595 A1	8/2014	Butt et al.
2013/0087597 A1	4/2013	Shelton, IV et al.	2014/0243865 A1	8/2014	Swayze et al.
2013/0090534 A1	4/2013	Burns et al.	2014/0246475 A1	9/2014	Hall et al.
2013/0096568 A1	4/2013	Justis	2014/0248167 A1	9/2014	Sugimoto et al.
2013/0098970 A1	4/2013	Racenet et al.	2014/0249557 A1	9/2014	Koch, Jr. et al.
2013/0105552 A1	5/2013	Weir et al.	2014/0249573 A1	9/2014	Arav
2013/0116669 A1	5/2013	Shelton, IV et al.	2014/0263541 A1	9/2014	Leimbach et al.
2013/0123816 A1	5/2013	Hodgkinson et al.	2014/0263552 A1	9/2014	Hall et al.
2013/0126202 A1	5/2013	Oomori et al.	2014/0263554 A1	9/2014	Leimbach et al.
2013/0131476 A1	5/2013	Siu et al.	2014/0263558 A1	9/2014	Hausen et al.
2013/0131651 A1	5/2013	Strobl et al.	2014/0276730 A1	9/2014	Boudreaux et al.
2013/0136969 A1	5/2013	Yasui et al.	2014/0284371 A1	9/2014	Morgan et al.
2013/0153636 A1	6/2013	Shelton, IV et al.	2014/0288460 A1	9/2014	Ouyang et al.
2013/0153641 A1	6/2013	Shelton, IV et al.	2014/0291378 A1	10/2014	Shelton, IV et al.
2013/0158390 A1	6/2013	Tan et al.	2014/0291379 A1	10/2014	Schellin et al.
2013/0162198 A1	6/2013	Yokota et al.	2014/0291383 A1	10/2014	Spivey et al.
2013/0172929 A1	7/2013	Hess et al.	2014/0299648 A1	10/2014	Shelton, IV et al.
2013/0175317 A1	7/2013	Yates et al.	2014/0303645 A1	10/2014	Morgan et al.
2013/0181033 A1	7/2013	Shelton, IV et al.	2014/0303660 A1	10/2014	Boyden et al.
2013/0181034 A1	7/2013	Shelton, IV et al.	2014/0305990 A1	10/2014	Shelton, IV et al.
2013/0214025 A1	8/2013	Zemlok et al.	2014/0305991 A1	10/2014	Parihar et al.
2013/0214030 A1	8/2013	Aronhalt et al.	2014/0309666 A1	10/2014	Shelton, IV et al.
2013/0233906 A1	9/2013	Hess et al.	2014/0330161 A1	11/2014	Swayze et al.
2013/0238021 A1	9/2013	Gross et al.	2014/0367445 A1	12/2014	Ingmanson et al.
2013/0248578 A1	9/2013	Arteaga Gonzalez	2014/0367446 A1	12/2014	Ingmanson et al.
2013/0253480 A1	9/2013	Kimball et al.	2014/0374130 A1	12/2014	Nakamura et al.
2013/0256373 A1	10/2013	Schmid et al.	2014/0378950 A1	12/2014	Chiu
2013/0256379 A1	10/2013	Schmid et al.	2015/0002089 A1	1/2015	Rejman et al.
2013/0256380 A1	10/2013	Schmid et al.	2015/0008248 A1	1/2015	Giordano et al.
2013/0270322 A1	10/2013	Scheib et al.	2015/0053737 A1	2/2015	Leimbach et al.
2013/0277410 A1	10/2013	Fernandez et al.	2015/0053742 A1	2/2015	Shelton, IV et al.
2013/0317753 A1	11/2013	Kamen et al.	2015/0053743 A1	2/2015	Yates et al.
2013/0324981 A1	12/2013	Smith et al.	2015/0053746 A1	2/2015	Shelton, IV et al.
2013/0324982 A1	12/2013	Smith et al.	2015/0053748 A1	2/2015	Yates et al.
2013/0327552 A1	12/2013	Lovell et al.	2015/0060518 A1	3/2015	Shelton, IV et al.
2013/0333910 A1	12/2013	Tanimoto et al.	2015/0060519 A1	3/2015	Shelton, IV et al.
2013/0334280 A1	12/2013	Krehel et al.	2015/0060520 A1	3/2015	Shelton, IV et al.
2013/0334283 A1	12/2013	Swayze et al.	2015/0060521 A1	3/2015	Weisenburgh, II et al.
2013/0334284 A1	12/2013	Swayze et al.	2015/0066000 A1	3/2015	An et al.
2013/0334285 A1	12/2013	Swayze et al.	2015/0076207 A1	3/2015	Boudreaux et al.
2013/0341374 A1	12/2013	Shelton, IV et al.	2015/0076208 A1	3/2015	Shelton, IV
2014/0001231 A1	1/2014	Shelton, IV et al.	2015/0076209 A1	3/2015	Shelton, IV et al.
2014/0001234 A1	1/2014	Shelton, IV et al.	2015/0076210 A1	3/2015	Shelton, IV et al.
2014/0005640 A1	1/2014	Shelton, IV et al.	2015/0076212 A1	3/2015	Shelton, IV
2014/0005678 A1	1/2014	Shelton, IV et al.	2015/0080868 A1	3/2015	Kerr
2014/0005702 A1	1/2014	Timm et al.	2015/0083781 A1	3/2015	Giordano et al.
2014/0005718 A1	1/2014	Shelton, IV et al.	2015/0083782 A1	3/2015	Scheib et al.
2014/0012289 A1	1/2014	Snow et al.	2015/0090760 A1	4/2015	Giordano et al.
2014/0012299 A1	1/2014	Stoddard et al.	2015/0090761 A1	4/2015	Giordano et al.
2014/0014705 A1	1/2014	Baxter, III	2015/0090762 A1	4/2015	Giordano et al.
2014/0018832 A1	1/2014	Shelton, IV	2015/0090763 A1	4/2015	Murray et al.
2014/0039549 A1	2/2014	Belsky et al.	2015/0108199 A1	4/2015	Shelton, IV et al.
2014/0048580 A1	2/2014	Merchant et al.	2015/0122870 A1	5/2015	Zemlok et al.
2014/0081176 A1	3/2014	Hassan	2015/0148830 A1	5/2015	Stulen et al.
2014/0100558 A1	4/2014	Schmitz et al.	2015/0150554 A1	6/2015	Soltz
2014/0107640 A1	4/2014	Yates et al.	2015/0150620 A1	6/2015	Miyamoto et al.
2014/0110456 A1	4/2014	Taylor	2015/0173744 A1	6/2015	Shelton, IV et al.
2014/0114327 A1	4/2014	Boudreaux et al.	2015/0173749 A1	6/2015	Shelton, IV et al.
2014/0115229 A1	4/2014	Kothamasu et al.	2015/0173756 A1	6/2015	Baxter, III et al.
2014/0131418 A1	5/2014	Kostrzewski	2015/0173789 A1	6/2015	Baxter, III et al.
2014/0151433 A1	6/2014	Shelton, IV et al.	2015/0182220 A1	7/2015	Yates et al.
2014/0158747 A1	6/2014	Measamer et al.	2015/0196295 A1	7/2015	Shelton, IV et al.
2014/0166724 A1	6/2014	Schellin et al.	2015/0196296 A1	7/2015	Swayze et al.
2014/0166725 A1	6/2014	Schellin et al.	2015/0196299 A1	7/2015	Swayze et al.
2014/0166726 A1	6/2014	Schellin et al.	2015/0196347 A1	7/2015	Yates et al.
2014/0171966 A1	6/2014	Giordano et al.	2015/0196348 A1	7/2015	Yates et al.
2014/0175147 A1	6/2014	Manoux et al.	2015/0201932 A1	7/2015	Swayze et al.
2014/0175150 A1	6/2014	Shelton, IV et al.	2015/0201936 A1	7/2015	Swayze et al.
2014/0175152 A1	6/2014	Hess et al.	2015/0201937 A1	7/2015	Swayze et al.
2014/0188159 A1	7/2014	Steege	2015/0201938 A1	7/2015	Swayze et al.
2014/0200561 A1	7/2014	Ingmanson et al.	2015/0201939 A1	7/2015	Swayze et al.
2014/0207124 A1	7/2014	Aldridge et al.	2015/0201940 A1	7/2015	Swayze et al.
2014/0207125 A1	7/2014	Applegate et al.	2015/0201941 A1	7/2015	Swayze et al.
			2015/0209031 A1	7/2015	Shelton, IV et al.
			2015/0222212 A1	8/2015	Iwata
			2015/0231409 A1	8/2015	Racenet et al.
			2015/0245835 A1	9/2015	Racenet et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2015/0265276	A1	9/2015	Huitema et al.
2015/0265357	A1	9/2015	Shelton, IV et al.
2015/0272557	A1	10/2015	Overmyer et al.
2015/0272571	A1	10/2015	Leimbach et al.
2015/0272580	A1	10/2015	Leimbach et al.
2015/0272582	A1	10/2015	Leimbach et al.
2015/0272604	A1	10/2015	Chowaniec et al.
2015/0280384	A1	10/2015	Leimbach et al.
2015/0282810	A1	10/2015	Shelton, IV et al.
2015/0289873	A1	10/2015	Shelton, IV et al.
2015/0289874	A1	10/2015	Leimbach et al.
2015/0297200	A1	10/2015	Fitzsimmons et al.
2015/0297210	A1	10/2015	Widenhouse et al.
2015/0297219	A1	10/2015	Shelton, IV et al.
2015/0297222	A1	10/2015	Huitema et al.
2015/0297223	A1	10/2015	Huitema et al.
2015/0297225	A1	10/2015	Huitema et al.
2015/0297228	A1	10/2015	Huitema et al.
2015/0297229	A1	10/2015	Schellin et al.
2015/0297232	A1	10/2015	Huitema et al.
2015/0297233	A1	10/2015	Huitema et al.
2015/0297234	A1	10/2015	Schellin et al.
2015/0297235	A1	10/2015	Harris et al.
2015/0297236	A1	10/2015	Harris et al.
2015/0303417	A1	10/2015	Koeder et al.
2015/0305729	A1	10/2015	Fitzsimmons et al.
2015/0313594	A1	11/2015	Shelton, IV et al.
2015/0324317	A1	11/2015	Collins et al.
2015/0327864	A1	11/2015	Hodgkinson et al.
2015/0335328	A1	11/2015	Shelton, IV et al.
2015/0336249	A1	11/2015	Iwata et al.
2015/0342607	A1	12/2015	Shelton, IV et al.
2015/0351758	A1	12/2015	Shelton, IV et al.
2015/0351762	A1	12/2015	Vendely et al.
2015/0351765	A1	12/2015	Valentine et al.
2015/0352699	A1	12/2015	Sakai et al.
2015/0366220	A1	12/2015	Zhang et al.
2015/0372265	A1	12/2015	Morisaku et al.
2015/0374360	A1	12/2015	Scheib et al.
2015/0374361	A1	12/2015	Gettinger et al.
2015/0374363	A1	12/2015	Laurent, IV et al.
2015/0374368	A1	12/2015	Swayze et al.
2015/0374369	A1	12/2015	Yates et al.
2015/0374371	A1	12/2015	Richard et al.
2015/0374374	A1	12/2015	Shelton, IV et al.
2015/0374375	A1	12/2015	Shelton, IV et al.
2015/0374376	A1	12/2015	Shelton, IV
2015/0374377	A1	12/2015	Shelton, IV
2015/0374378	A1	12/2015	Giordano et al.
2015/0374379	A1	12/2015	Shelton, IV
2015/0380187	A1	12/2015	Zergiebel et al.
2016/0000430	A1	1/2016	Ming et al.
2016/0000431	A1	1/2016	Giordano et al.
2016/0000437	A1	1/2016	Giordano et al.
2016/0000438	A1	1/2016	Swayze et al.
2016/0000442	A1	1/2016	Shelton, IV
2016/0000452	A1	1/2016	Yates et al.
2016/0000453	A1	1/2016	Yates et al.
2016/0000513	A1	1/2016	Shelton, IV et al.
2016/0007992	A1	1/2016	Yates et al.
2016/0008023	A1	1/2016	Yates et al.
2016/0015391	A1	1/2016	Shelton, IV et al.
2016/0023342	A1	1/2016	Koenig et al.
2016/0030042	A1	2/2016	Heinrich et al.
2016/0030103	A1	2/2016	Manwaring et al.
2016/0051257	A1	2/2016	Shelton, IV et al.
2016/0058443	A1	3/2016	Yates et al.
2016/0066911	A1	3/2016	Baber et al.
2016/0066913	A1	3/2016	Swayze et al.
2016/0069449	A1	3/2016	Kanai et al.
2016/0073909	A1	3/2016	Zand et al.
2016/0074040	A1	3/2016	Widenhouse et al.
2016/0082161	A1	3/2016	Zilberman et al.
2016/0089137	A1	3/2016	Hess et al.
2016/0089142	A1	3/2016	Harris et al.
2016/0089146	A1	3/2016	Harris et al.
2016/0089147	A1	3/2016	Harris et al.
2016/0089149	A1	3/2016	Harris et al.
2016/0089198	A1	3/2016	Arya et al.
2016/0095585	A1	4/2016	Zergiebel et al.
2016/0106431	A1	4/2016	Shelton, IV et al.
2016/0113653	A1	4/2016	Zingman
2016/0120544	A1	5/2016	Shelton, IV et al.
2016/0120545	A1	5/2016	Shelton, IV et al.
2016/0166256	A1	6/2016	Baxter, III et al.
2016/0166308	A1	6/2016	Manwaring et al.
2016/0174969	A1	6/2016	Kerr et al.
2016/0174971	A1	6/2016	Baxter, III et al.
2016/0174972	A1	6/2016	Shelton, IV et al.
2016/0174974	A1	6/2016	Schmid et al.
2016/0174984	A1	6/2016	Smith et al.
2016/0174985	A1	6/2016	Baxter, III et al.
2016/0183939	A1	6/2016	Shelton, IV et al.
2016/0183943	A1	6/2016	Shelton, IV
2016/0183944	A1	6/2016	Swensgard et al.
2016/0183945	A1	6/2016	Shelton, IV et al.
2016/0192916	A1	7/2016	Shelton, IV et al.
2016/0192917	A1	7/2016	Shelton, IV et al.
2016/0192918	A1	7/2016	Shelton, IV et al.
2016/0192929	A1	7/2016	Schmid et al.
2016/0192933	A1	7/2016	Shelton, IV
2016/0192936	A1	7/2016	Leimbach et al.
2016/0192977	A1	7/2016	Manwaring et al.
2016/0192996	A1	7/2016	Spivey et al.
2016/0199059	A1	7/2016	Shelton, IV et al.
2016/0199061	A1	7/2016	Shelton, IV et al.
2016/0199063	A1	7/2016	Mandakolathur Vasudevan et al.
2016/0199064	A1	7/2016	Shelton, IV et al.
2016/0199089	A1	7/2016	Hess et al.
2016/0199956	A1	7/2016	Shelton, IV et al.
2016/0206310	A1	7/2016	Shelton, IV
2016/0206314	A1	7/2016	Scheib et al.
2016/0220248	A1	8/2016	Timm et al.
2016/0220249	A1	8/2016	Shelton, IV et al.
2016/0220266	A1	8/2016	Shelton, IV et al.
2016/0220268	A1	8/2016	Shelton, IV et al.
2016/0235403	A1	8/2016	Shelton, IV et al.
2016/0235404	A1	8/2016	Shelton, IV
2016/0235405	A1	8/2016	Shelton, IV et al.
2016/0235406	A1	8/2016	Shelton, IV et al.
2016/0235408	A1	8/2016	Shelton, IV et al.
2016/0235409	A1	8/2016	Shelton, IV et al.
2016/0235494	A1	8/2016	Shelton, IV et al.
2016/0242775	A1	8/2016	Shelton, IV et al.
2016/0242776	A1	8/2016	Shelton, IV et al.
2016/0242777	A1	8/2016	Shelton, IV et al.
2016/0242781	A1	8/2016	Shelton, IV et al.
2016/0242782	A1	8/2016	Shelton, IV et al.
2016/0242783	A1	8/2016	Shelton, IV et al.
2016/0249909	A1	9/2016	Shelton, IV et al.
2016/0249910	A1	9/2016	Shelton, IV et al.
2016/0249911	A1	9/2016	Timm et al.
2016/0249915	A1	9/2016	Beckman et al.
2016/0249916	A1	9/2016	Shelton, IV et al.
2016/0249917	A1	9/2016	Beckman et al.
2016/0249918	A1	9/2016	Shelton, IV et al.
2016/0249922	A1	9/2016	Morgan et al.
2016/0249927	A1	9/2016	Beckman et al.
2016/0256071	A1	9/2016	Shelton, IV et al.
2016/0256154	A1	9/2016	Shelton, IV et al.
2016/0256156	A1	9/2016	Shelton, IV et al.
2016/0256159	A1	9/2016	Pinjala et al.
2016/0256160	A1	9/2016	Shelton, IV et al.
2016/0256161	A1	9/2016	Overmyer et al.
2016/0256185	A1	9/2016	Shelton, IV et al.
2016/0256229	A1	9/2016	Morgan et al.
2016/0262745	A1	9/2016	Morgan et al.
2016/0262746	A1	9/2016	Shelton, IV et al.
2016/0270780	A1	9/2016	Hall et al.
2016/0278765	A1	9/2016	Shelton, IV et al.
2016/0278775	A1	9/2016	Shelton, IV et al.
2016/0287249	A1	10/2016	Alexander, III et al.
2016/0287250	A1	10/2016	Shelton, IV et al.
2016/0287251	A1	10/2016	Shelton, IV et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2016/0287253	A1	10/2016	Shelton, IV et al.	2017/0128149	A1	5/2017	Heinrich et al.
2016/0310143	A1	10/2016	Bettuchi	2017/0135695	A1	5/2017	Shelton, IV et al.
2016/0331375	A1	11/2016	Shelton, IV et al.	2017/0135697	A1	5/2017	Mozdzierz et al.
2016/0345976	A1	12/2016	Gonzalez et al.	2017/0150983	A1	6/2017	Ingmanson et al.
2016/0346034	A1	12/2016	Arya et al.	2017/0172672	A1	6/2017	Bailey et al.
2016/0354085	A1	12/2016	Shelton, IV et al.	2017/0182211	A1	6/2017	Raxworthy et al.
2016/0367122	A1	12/2016	Ichimura et al.	2017/0189018	A1	7/2017	Harris et al.
2016/0367245	A1	12/2016	Wise et al.	2017/0189019	A1	7/2017	Harris et al.
2016/0367246	A1	12/2016	Baxter, III et al.	2017/0189020	A1	7/2017	Harris et al.
2016/0367247	A1	12/2016	Weaner et al.	2017/0196558	A1	7/2017	Morgan et al.
2016/0367254	A1	12/2016	Baxter, III et al.	2017/0196560	A1	7/2017	Leimbach et al.
2016/0367255	A1	12/2016	Wise et al.	2017/0196561	A1	7/2017	Shelton, IV et al.
2016/0367256	A1	12/2016	Hensel et al.	2017/0196562	A1	7/2017	Shelton, IV et al.
2016/0374675	A1	12/2016	Shelton, IV et al.	2017/0196637	A1	7/2017	Shelton, IV et al.
2017/0000485	A1	1/2017	Shelton, IV et al.	2017/0196649	A1	7/2017	Yates et al.
2017/0007236	A1	1/2017	Shelton, IV et al.	2017/0202596	A1	7/2017	Shelton, IV et al.
2017/0007237	A1	1/2017	Yates et al.	2017/0209145	A1	7/2017	Swayze et al.
2017/0007238	A1	1/2017	Yates et al.	2017/0209146	A1	7/2017	Yates et al.
2017/0007239	A1	1/2017	Shelton, IV	2017/0209226	A1	7/2017	Overmyer et al.
2017/0007241	A1	1/2017	Shelton, IV et al.	2017/0215881	A1	8/2017	Shelton, IV et al.
2017/0007242	A1	1/2017	Shelton, IV et al.	2017/0224330	A1	8/2017	Worthington et al.
2017/0007243	A1	1/2017	Shelton, IV et al.	2017/0224331	A1	8/2017	Worthington et al.
2017/0007244	A1	1/2017	Shelton, IV et al.	2017/0224332	A1	8/2017	Hunter et al.
2017/0007245	A1	1/2017	Shelton, IV et al.	2017/0224333	A1	8/2017	Hunter et al.
2017/0007246	A1	1/2017	Shelton, IV et al.	2017/0224334	A1	8/2017	Worthington et al.
2017/0007247	A1	1/2017	Shelton, IV et al.	2017/0224335	A1	8/2017	Weaner et al.
2017/0007248	A1	1/2017	Shelton, IV et al.	2017/0224336	A1	8/2017	Hunter et al.
2017/0007249	A1	1/2017	Shelton, IV et al.	2017/0224339	A1	8/2017	Huang et al.
2017/0007250	A1	1/2017	Shelton, IV et al.	2017/0224342	A1	8/2017	Worthington et al.
2017/0007251	A1	1/2017	Yates et al.	2017/0224343	A1	8/2017	Baxter, III et al.
2017/0007254	A1	1/2017	Jaworek et al.	2017/0231623	A1	8/2017	Shelton, IV et al.
2017/0007255	A1	1/2017	Jaworek et al.	2017/0231626	A1	8/2017	Shelton, IV et al.
2017/0007340	A1	1/2017	Swensgard et al.	2017/0231627	A1	8/2017	Shelton, IV et al.
2017/0007341	A1	1/2017	Swensgard et al.	2017/0231628	A1	8/2017	Shelton, IV et al.
2017/0007347	A1	1/2017	Jaworek et al.	2017/0238928	A1	8/2017	Morgan et al.
2017/0014125	A1	1/2017	Shelton, IV et al.	2017/0238929	A1	8/2017	Yates et al.
2017/0049444	A1	2/2017	Schellin et al.	2017/0245952	A1	8/2017	Shelton, IV et al.
2017/0049447	A1	2/2017	Barton et al.	2017/0245953	A1	8/2017	Shelton, IV et al.
2017/0049448	A1	2/2017	Widenhouse et al.	2017/0249431	A1	8/2017	Shelton, IV et al.
2017/0055986	A1	3/2017	Harris et al.	2017/0258469	A1	9/2017	Shelton, IV et al.
2017/0055989	A1	3/2017	Shelton, IV et al.	2017/0265856	A1	9/2017	Shelton, IV et al.
2017/0055997	A1	3/2017	Swayze et al.	2017/0281167	A1	10/2017	Shelton, IV et al.
2017/0055998	A1	3/2017	Baxter, III et al.	2017/0281180	A1	10/2017	Morgan et al.
2017/0055999	A1	3/2017	Baxter, III et al.	2017/0290585	A1	10/2017	Shelton, IV et al.
2017/0056000	A1	3/2017	Nalagatla et al.	2017/0296169	A1	10/2017	Yates et al.
2017/0056001	A1	3/2017	Shelton, IV et al.	2017/0296170	A1	10/2017	Shelton, IV et al.
2017/0056002	A1	3/2017	Nalagatla et al.	2017/0296171	A1	10/2017	Shelton, IV et al.
2017/0056004	A1	3/2017	Shelton, IV et al.	2017/0296172	A1	10/2017	Harris et al.
2017/0056005	A1	3/2017	Shelton, IV et al.	2017/0296173	A1	10/2017	Shelton, IV et al.
2017/0056006	A1	3/2017	Shelton, IV et al.	2017/0296177	A1	10/2017	Harris et al.
2017/0056007	A1	3/2017	Eckert et al.	2017/0296178	A1	10/2017	Miller et al.
2017/0079640	A1	3/2017	Overmyer et al.	2017/0296179	A1	10/2017	Shelton, IV et al.
2017/0079642	A1	3/2017	Overmyer et al.	2017/0296180	A1	10/2017	Harris et al.
2017/0079643	A1	3/2017	Yates et al.	2017/0296183	A1	10/2017	Shelton, IV et al.
2017/0079644	A1	3/2017	Overmyer et al.	2017/0296184	A1	10/2017	Harris et al.
2017/0086823	A1	3/2017	Leimbach et al.	2017/0296185	A1	10/2017	Swensgard et al.
2017/0086827	A1	3/2017	Vendely et al.	2017/0296189	A1	10/2017	Vendely et al.
2017/0086829	A1	3/2017	Vendely et al.	2017/0296190	A1	10/2017	Aronhalt et al.
2017/0086830	A1	3/2017	Yates et al.	2017/0296191	A1	10/2017	Shelton, IV et al.
2017/0086831	A1	3/2017	Shelton, IV et al.	2017/0296213	A1	10/2017	Swensgard et al.
2017/0086832	A1	3/2017	Harris et al.	2017/0311944	A1	11/2017	Morgan et al.
2017/0086835	A1	3/2017	Harris et al.	2017/0311949	A1	11/2017	Shelton, IV
2017/0086836	A1	3/2017	Harris et al.	2017/0311950	A1	11/2017	Shelton, IV et al.
2017/0086837	A1	3/2017	Vendely et al.	2017/0312040	A1	11/2017	Giordano et al.
2017/0086838	A1	3/2017	Harris et al.	2017/0312041	A1	11/2017	Giordano et al.
2017/0086839	A1	3/2017	Vendely et al.	2017/0312042	A1	11/2017	Giordano et al.
2017/0086840	A1	3/2017	Harris et al.	2017/0319201	A1	11/2017	Morgan et al.
2017/0086841	A1	3/2017	Vendely et al.	2017/0319207	A1	11/2017	Shelton, IV et al.
2017/0086842	A1	3/2017	Shelton, IV et al.	2017/0319209	A1	11/2017	Morgan et al.
2017/0086843	A1	3/2017	Vendely et al.	2017/0319777	A1	11/2017	Shelton, IV et al.
2017/0086844	A1	3/2017	Vendely et al.	2017/0333034	A1	11/2017	Morgan et al.
2017/0086845	A1	3/2017	Vendely et al.	2017/0333035	A1	11/2017	Morgan et al.
2017/0086936	A1	3/2017	Shelton, IV et al.	2017/0333070	A1	11/2017	Laurent et al.
2017/0119390	A1	5/2017	Schellin et al.	2017/0348043	A1	12/2017	Wang et al.
2017/0119397	A1	5/2017	Harris et al.	2017/0354415	A1	12/2017	Casasanta, Jr. et al.
				2017/0360442	A1	12/2017	Shelton, IV et al.
				2017/0367700	A1	12/2017	Leimbach et al.
				2017/0367991	A1	12/2017	Widenhouse et al.
				2018/0000483	A1	1/2018	Leimbach et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2018/0000545 A1 1/2018 Giordano et al.
 2018/0008269 A1 1/2018 Moore et al.
 2018/0008270 A1 1/2018 Moore et al.
 2018/0008271 A1 1/2018 Moore et al.
 2018/0008356 A1 1/2018 Giordano et al.
 2018/0008357 A1 1/2018 Giordano et al.
 2018/0028184 A1 2/2018 Shelton, IV et al.
 2018/0028185 A1 2/2018 Shelton, IV et al.
 2018/0042611 A1 2/2018 Swayze et al.
 2018/0049824 A1 2/2018 Harris et al.
 2018/0049883 A1 2/2018 Moskowitz et al.
 2018/0055510 A1 3/2018 Schmid et al.
 2018/0055513 A1 3/2018 Shelton, IV et al.
 2018/0055524 A1 3/2018 Shelton, IV et al.
 2018/0055525 A1 3/2018 Shelton, IV et al.
 2018/0055526 A1 3/2018 Shelton, IV et al.
 2018/0064437 A1 3/2018 Yates et al.
 2018/0064440 A1 3/2018 Shelton, IV et al.
 2018/0064441 A1 3/2018 Shelton, IV et al.
 2018/0064442 A1 3/2018 Shelton, IV et al.
 2018/0064443 A1 3/2018 Shelton, IV et al.
 2018/0070939 A1 3/2018 Giordano et al.
 2018/0070942 A1 3/2018 Shelton, IV et al.
 2018/0070946 A1* 3/2018 Shelton, IV A61B 17/072
 2018/0074535 A1 3/2018 Shelton, IV et al.
 2018/0078248 A1 3/2018 Swayze et al.
 2018/0085116 A1 3/2018 Yates et al.
 2018/0085117 A1 3/2018 Shelton, IV et al.
 2018/0095487 A1 4/2018 Leimbach et al.
 2018/0103952 A1 4/2018 Aronhalt et al.
 2018/0103953 A1 4/2018 Shelton, IV et al.
 2018/0103955 A1 4/2018 Shelton, IV et al.
 2018/0110516 A1 4/2018 Baxter, III et al.
 2018/0110518 A1 4/2018 Overmyer et al.
 2018/0110519 A1 4/2018 Lytle, IV et al.
 2018/0110520 A1 4/2018 Shelton, IV et al.
 2018/0110521 A1 4/2018 Shelton, IV et al.
 2018/0110522 A1 4/2018 Shelton, IV et al.
 2018/0110523 A1 4/2018 Shelton, IV
 2018/0110574 A1 4/2018 Shelton, IV et al.
 2018/0110575 A1 4/2018 Shelton, IV et al.
 2018/0116658 A1 5/2018 Aronhalt, IV et al.
 2018/0116662 A1 5/2018 Shelton, IV et al.
 2018/0116665 A1 5/2018 Hall et al.
 2018/0125481 A1 5/2018 Yates et al.
 2018/0125488 A1 5/2018 Morgan et al.
 2018/0125489 A1 5/2018 Leimbach et al.
 2018/0125590 A1 5/2018 Giordano et al.
 2018/0126504 A1 5/2018 Shelton, IV et al.
 2018/0132845 A1 5/2018 Schmid et al.
 2018/0132850 A1 5/2018 Leimbach et al.
 2018/0132851 A1 5/2018 Hall et al.
 2018/0132952 A1 5/2018 Spivey et al.
 2018/0133856 A1 5/2018 Shelton, IV et al.
 2018/0140299 A1 5/2018 Weaner et al.
 2018/0140368 A1 5/2018 Shelton, IV et al.
 2018/0146960 A1 5/2018 Shelton, IV et al.
 2018/0153542 A1 6/2018 Shelton, IV et al.
 2018/0161034 A1 6/2018 Scheib et al.
 2018/0168575 A1 6/2018 Simms et al.
 2018/0168576 A1 6/2018 Hunter et al.
 2018/0168577 A1 6/2018 Aronhalt et al.
 2018/0168578 A1 6/2018 Aronhalt et al.
 2018/0168579 A1 6/2018 Aronhalt et al.
 2018/0168580 A1 6/2018 Hunter et al.
 2018/0168581 A1 6/2018 Hunter et al.
 2018/0168582 A1 6/2018 Swayze et al.
 2018/0168583 A1 6/2018 Hunter et al.
 2018/0168584 A1 6/2018 Harris et al.
 2018/0168589 A1 6/2018 Swayze et al.
 2018/0168590 A1 6/2018 Overmyer et al.
 2018/0168591 A1 6/2018 Swayze et al.
 2018/0168592 A1 6/2018 Overmyer et al.
 2018/0168593 A1 6/2018 Overmyer et al.
 2018/0168594 A1 6/2018 Shelton, IV et al.

2018/0168595 A1 6/2018 Overmyer et al.
 2018/0168596 A1 6/2018 Beckman et al.
 2018/0168597 A1 6/2018 Fanelli et al.
 2018/0168598 A1 6/2018 Shelton, IV et al.
 2018/0168599 A1 6/2018 Bakos et al.
 2018/0168600 A1 6/2018 Shelton, IV et al.
 2018/0168601 A1 6/2018 Bakos et al.
 2018/0168602 A1 6/2018 Bakos et al.
 2018/0168603 A1 6/2018 Morgan et al.
 2018/0168604 A1 6/2018 Shelton, IV et al.
 2018/0168605 A1 6/2018 Baber et al.
 2018/0168606 A1 6/2018 Shelton, IV et al.
 2018/0168607 A1 6/2018 Shelton, IV et al.
 2018/0168608 A1 6/2018 Shelton, IV et al.
 2018/0168609 A1 6/2018 Fanelli et al.
 2018/0168610 A1 6/2018 Shelton, IV et al.
 2018/0168611 A1 6/2018 Shelton, IV et al.
 2018/0168612 A1 6/2018 Shelton, IV et al.
 2018/0168613 A1 6/2018 Shelton, IV et al.
 2018/0168614 A1 6/2018 Shelton, IV et al.
 2018/0168615 A1 6/2018 Shelton, IV et al.
 2018/0168618 A1 6/2018 Scott et al.
 2018/0168619 A1 6/2018 Scott et al.
 2018/0168620 A1 6/2018 Huang et al.
 2018/0168621 A1 6/2018 Shelton, IV et al.
 2018/0168622 A1 6/2018 Shelton, IV et al.
 2018/0168623 A1 6/2018 Simms et al.
 2018/0168624 A1 6/2018 Shelton, IV et al.
 2018/0168625 A1 6/2018 Posada et al.
 2018/0168626 A1 6/2018 Shelton, IV et al.
 2018/0168627 A1 6/2018 Weaner et al.
 2018/0168628 A1 6/2018 Hunter et al.
 2018/0168629 A1 6/2018 Shelton, IV et al.
 2018/0168630 A1 6/2018 Shelton, IV et al.
 2018/0168631 A1 6/2018 Harris et al.
 2018/0168632 A1 6/2018 Harris et al.
 2018/0168633 A1 6/2018 Shelton, IV et al.
 2018/0168634 A1 6/2018 Harris et al.
 2018/0168635 A1 6/2018 Shelton, IV et al.
 2018/0168636 A1 6/2018 Shelton, IV et al.
 2018/0168637 A1 6/2018 Harris et al.
 2018/0168638 A1 6/2018 Harris et al.
 2018/0168639 A1 6/2018 Shelton, IV et al.
 2018/0168640 A1 6/2018 Shelton, IV et al.
 2018/0168641 A1 6/2018 Harris et al.
 2018/0168642 A1 6/2018 Shelton, IV et al.
 2018/0168644 A1 6/2018 Shelton, IV et al.
 2018/0168645 A1 6/2018 Shelton, IV et al.
 2018/0168646 A1 6/2018 Shelton, IV et al.
 2018/0168649 A1 6/2018 Shelton, IV et al.
 2018/0168651 A1 6/2018 Shelton, IV et al.
 2018/0199940 A1 7/2018 Zergiebel et al.
 2018/0206843 A1 7/2018 Yates et al.
 2018/0206906 A1 7/2018 Moua et al.
 2018/0214147 A1 8/2018 Merchant et al.
 2018/0221046 A1 8/2018 Demmy et al.
 2018/0221050 A1 8/2018 Kostrzewski et al.
 2018/0228490 A1 8/2018 Richard et al.
 2018/0250001 A1 9/2018 Aronhalt et al.
 2018/0256184 A1 9/2018 Shelton, IV et al.
 2018/0256185 A1 9/2018 Shelton, IV et al.
 2018/0271520 A1 9/2018 Shelton, IV et al.
 2018/0280020 A1 10/2018 Hess et al.
 2018/0280021 A1 10/2018 Timm et al.
 2018/0280022 A1 10/2018 Timm et al.
 2018/0280023 A1 10/2018 Timm et al.
 2018/0296211 A1 10/2018 Timm et al.
 2018/0296215 A1 10/2018 Baxter, III et al.
 2018/0296216 A1 10/2018 Shelton, IV et al.
 2018/0296217 A1 10/2018 Moore et al.

FOREIGN PATENT DOCUMENTS

AU 2011218702 B2 6/2013
 AU 2012200178 B2 7/2013
 CA 1015829 A 8/1977
 CA 1125615 A 6/1982
 CA 2458946 A1 3/2003
 CA 2477181 A1 4/2004

(56)

References Cited

FOREIGN PATENT DOCUMENTS

CA	2512960	A1	1/2006	CN	101023879	B	3/2013
CA	2514274	A1	1/2006	CN	101507624	B	3/2013
CA	2639177	A1	2/2009	CN	101327137	B	6/2013
CA	2576347	C	8/2015	CN	101401736	B	6/2013
CN	86100996	A	9/1986	CN	101332110	B	7/2013
CN	1163558	A	10/1997	CN	101683281	B	1/2014
CN	2488482	Y	5/2002	CN	103648408	A	3/2014
CN	1424891	A	6/2003	CN	203564285	U	4/2014
CN	1523725	A	8/2004	CN	203564287	U	4/2014
CN	1545154	A	11/2004	CN	203597997	U	5/2014
CN	1634601	A	7/2005	CN	103829983	A	6/2014
CN	1636525	A	7/2005	CN	103908313	A	7/2014
CN	1636526	A	7/2005	CN	203736251	U	7/2014
CN	2716900	Y	8/2005	CN	102783741	B	10/2014
CN	2738962	Y	11/2005	CN	102973300	B	10/2014
CN	1726874	A	2/2006	CN	102793571	B	12/2014
CN	1726878	A	2/2006	CN	104337556	A	2/2015
CN	1868411	A	11/2006	CN	102166129	B	3/2015
CN	1915180	A	2/2007	CN	102469995	B	3/2015
CN	2868212	Y	2/2007	CN	102113902	B	4/2015
CN	1960679	A	5/2007	CN	102247177	B	2/2016
CN	101011286	A	8/2007	CN	103750872	B	5/2016
CN	200942099	Y	9/2007	DE	273689	C	5/1914
CN	200991269	Y	12/2007	DE	1775926	A	1/1972
CN	101095621	A	1/2008	DE	3036217	A1	4/1982
CN	101111196	A	1/2008	DE	3212828	A1	11/1982
CN	201001747	Y	1/2008	DE	3210466	A1	9/1983
CN	101137402	A	3/2008	DE	3709067	A1	9/1988
CN	101143105	A	3/2008	DE	4228909	A1	3/1994
CN	201029899	Y	3/2008	DE	9412228	U1	9/1994
CN	101224122	A	7/2008	DE	19509116	A1	9/1996
CN	101224124	A	7/2008	DE	19534043	A1	3/1997
CN	101254126	A	9/2008	DE	19707373	C1	2/1998
CN	101507620	A	8/2009	DE	19851291	A1	1/2000
CN	101507622	A	8/2009	DE	19924311	A1	11/2000
CN	101507623	A	8/2009	DE	69328576	T2	1/2001
CN	101507625	A	8/2009	DE	20016423	U1	2/2001
CN	101507628	A	8/2009	DE	19941859	A1	3/2001
CN	101534724	A	9/2009	DE	10052679	A1	5/2001
CN	101626731	A	1/2010	DE	20112837	U1	10/2001
CN	101669833	A	3/2010	DE	20121753	U1	4/2003
CN	101675898	A	3/2010	DE	10314827	B3	4/2004
CN	101683280	A	3/2010	DE	202004012389	U1	9/2004
CN	101721236	A	6/2010	DE	10314072	A1	10/2004
CN	101801284	A	8/2010	DE	202007003114	U1	6/2007
CN	101828940	A	9/2010	DE	102010013150	A1	9/2011
CN	101868203	A	10/2010	EP	0000756	A1	2/1979
CN	101873834	A	10/2010	EP	0033633	A2	8/1981
CN	101073509	B	12/2010	EP	0122046	A1	10/1984
CN	101912285	A	12/2010	EP	0070230	B1	4/1985
CN	101028205	B	1/2011	EP	0156774	A2	10/1985
CN	101933824	A	1/2011	EP	0072754	B1	4/1986
CN	101934098	A	1/2011	EP	0033548	B1	5/1986
CN	201719298	U	1/2011	EP	0077262	B1	8/1986
CN	102038531	A	5/2011	EP	0189807	A2	8/1986
CN	102038532	A	5/2011	EP	0212278	A2	3/1987
CN	101534722	B	6/2011	EP	0129442	B1	11/1987
CN	201879759	U	6/2011	EP	0255631	A1	2/1988
CN	101361666	B	8/2011	EP	0276104	A2	7/1988
CN	201949071	U	8/2011	EP	0178940	B1	1/1991
CN	101224119	B	9/2011	EP	0178941	B1	1/1991
CN	101336835	B	9/2011	EP	0169044	B1	6/1991
CN	102188270	A	9/2011	EP	0248844	B1	1/1993
CN	101779977	B	12/2011	EP	0539762	A1	5/1993
CN	101534723	B	1/2012	EP	0541950	A1	5/1993
CN	101310680	B	4/2012	EP	0545029	A1	6/1993
CN	101912284	B	7/2012	EP	0548998	A1	6/1993
CN	202397539	U	8/2012	EP	0379721	B1	9/1993
CN	202426586	U	9/2012	EP	0277959	B1	10/1993
CN	101317782	B	10/2012	EP	0233940	B1	11/1993
CN	202489990	U	10/2012	EP	0261230	B1	11/1993
CN	101507639	B	11/2012	EP	0324636	B1	3/1994
CN	101541251	A	11/2012	EP	0591946	A1	4/1994
CN	102835977	A	12/2012	EP	0593920	A1	4/1994
CN	101507633	B	2/2013	EP	0594148	A1	4/1994
				EP	0427949	B1	6/1994
				EP	0523174	B1	6/1994
				EP	0600182	A2	6/1994
				EP	0310431	B1	11/1994

(56)

References Cited

FOREIGN PATENT DOCUMENTS

EP	0375302	B1	11/1994	EP	1053720	A1	11/2000
EP	0376562	B1	11/1994	EP	1055399	A1	11/2000
EP	0623311	A2	11/1994	EP	1055400	A1	11/2000
EP	0630612	A1	12/1994	EP	1058177	A1	12/2000
EP	0630614	A1	12/1994	EP	1080694	A1	3/2001
EP	0634144	A1	1/1995	EP	1090592	A1	4/2001
EP	0639349	A2	2/1995	EP	1095627	A1	5/2001
EP	0646356	A2	4/1995	EP	0806914	B1	9/2001
EP	0646357	A1	4/1995	EP	0768840	B1	12/2001
EP	0505036	B1	5/1995	EP	0908152	B1	1/2002
EP	0653189	A2	5/1995	EP	0717959	B1	2/2002
EP	0669104	A1	8/1995	EP	0872213	B1	5/2002
EP	0387980	B1	10/1995	EP	0862386	B1	6/2002
EP	0511470	B1	10/1995	EP	0949886	B1	9/2002
EP	0674876	A2	10/1995	EP	1238634	A2	9/2002
EP	0676173	B1	10/1995	EP	0858295	B1	12/2002
EP	0679367	A2	11/1995	EP	0656188	B1	1/2003
EP	0392547	B1	12/1995	EP	0717960	B1	2/2003
EP	0685204	A1	12/1995	EP	1284120	A1	2/2003
EP	0686374	A2	12/1995	EP	1287788	A1	3/2003
EP	0364216	B1	1/1996	EP	0717966	B1	4/2003
EP	0699418	A1	3/1996	EP	0717967	B1	5/2003
EP	0702937	A1	3/1996	EP	0869742	B1	5/2003
EP	0488768	B1	4/1996	EP	0829235	B1	6/2003
EP	0705571	A1	4/1996	EP	0887046	B1	7/2003
EP	0528478	B1	5/1996	EP	1323384	A2	7/2003
EP	0711611	A2	5/1996	EP	0852480	B1	8/2003
EP	0541987	B1	7/1996	EP	0891154	B1	9/2003
EP	0667119	B1	7/1996	EP	0813843	B1	10/2003
EP	0737446	A1	10/1996	EP	0873089	B1	10/2003
EP	0741996	B1	11/1996	EP	0856326	B1	11/2003
EP	0748614	A1	12/1996	EP	1374788	A1	1/2004
EP	0708618	B1	3/1997	EP	0814712	B1	2/2004
EP	0770355	A1	5/1997	EP	1402837	A1	3/2004
EP	0503662	B1	6/1997	EP	0705570	B1	4/2004
EP	0447121	B1	7/1997	EP	0959784	B1	4/2004
EP	0621009	B1	7/1997	EP	1407719	A2	4/2004
EP	0625077	B1	7/1997	EP	1411626	A2	4/2004
EP	0633749	B1	8/1997	EP	1086713	B1	5/2004
EP	0710090	B1	8/1997	EP	0996378	B1	6/2004
EP	0578425	B1	9/1997	EP	1426012	A1	6/2004
EP	0623312	B1	9/1997	EP	0833593	B2	7/2004
EP	0621006	B1	10/1997	EP	1442694	A1	8/2004
EP	0625335	B1	11/1997	EP	0888749	B1	9/2004
EP	0552423	B1	1/1998	EP	0959786	B1	9/2004
EP	0592244	B1	1/1998	EP	1453432	A2	9/2004
EP	0648476	B1	1/1998	EP	1459695	A1	9/2004
EP	0649290	B1	3/1998	EP	1254636	B1	10/2004
EP	0598618	B1	9/1998	EP	1473819	A1	11/2004
EP	0678007	B1	9/1998	EP	1477119	A1	11/2004
EP	0869104	A1	10/1998	EP	1479345	A1	11/2004
EP	0603472	B1	11/1998	EP	1479347	A1	11/2004
EP	0605351	B1	11/1998	EP	1479348	A1	11/2004
EP	0878169	A1	11/1998	EP	0754437	B2	12/2004
EP	0879742	A1	11/1998	EP	1025807	B1	12/2004
EP	0695144	B1	12/1998	EP	1001710	B1	1/2005
EP	0722296	B1	12/1998	EP	1496805	A2	1/2005
EP	0760230	B1	2/1999	EP	1256318	B1	2/2005
EP	0623316	B1	3/1999	EP	1520521	A1	4/2005
EP	0650701	B1	3/1999	EP	1520522	A1	4/2005
EP	0537572	B1	6/1999	EP	1520523	A1	4/2005
EP	0923907	A1	6/1999	EP	1520525	A1	4/2005
EP	0640317	B1	9/1999	EP	1522264	A1	4/2005
EP	0843906	B1	3/2000	EP	1523942	A2	4/2005
EP	0552050	B1	5/2000	EP	1550408	A1	7/2005
EP	0833592	B1	5/2000	EP	1557129	A1	7/2005
EP	0832605	B1	6/2000	EP	1064883	B1	8/2005
EP	0484677	B2	7/2000	EP	1067876	B1	8/2005
EP	0830094	B1	9/2000	EP	0870473	B1	9/2005
EP	1034747	A1	9/2000	EP	1157666	B1	9/2005
EP	1034748	A1	9/2000	EP	0880338	B1	10/2005
EP	0726632	B1	10/2000	EP	1158917	B1	11/2005
EP	0694290	B1	11/2000	EP	1344498	B1	11/2005
EP	1050278	A1	11/2000	EP	0906764	B1	12/2005
EP	1053719	A1	11/2000	EP	1330989	B1	12/2005
				EP	0771176	B2	1/2006
				EP	1621138	A2	2/2006
				EP	1621139	A2	2/2006
				EP	1621141	A2	2/2006

(56)

References Cited

FOREIGN PATENT DOCUMENTS

EP	1621143	A2	2/2006	EP	1943957	A2	7/2008
EP	1621145	A2	2/2006	EP	1943959	A1	7/2008
EP	1621151	A2	2/2006	EP	1943962	A2	7/2008
EP	1034746	B1	3/2006	EP	1943964	A1	7/2008
EP	1201196	B1	3/2006	EP	1943976	A2	7/2008
EP	1632191	A2	3/2006	EP	1593337	B1	8/2008
EP	1647231	A1	4/2006	EP	1970014	A1	9/2008
EP	1065981	B1	5/2006	EP	1974678	A2	10/2008
EP	1082944	B1	5/2006	EP	1980213	A2	10/2008
EP	1230899	B1	5/2006	EP	1980214	A2	10/2008
EP	1652481	A2	5/2006	EP	1759645	B1	11/2008
EP	1382303	B1	6/2006	EP	1987780	A2	11/2008
EP	1253866	B1	7/2006	EP	1990014	A2	11/2008
EP	1676539	A1	7/2006	EP	1992296	A1	11/2008
EP	1032318	B1	8/2006	EP	1552795	B1	12/2008
EP	1045672	B1	8/2006	EP	1693008	B1	12/2008
EP	1617768	B1	8/2006	EP	1759640	B1	12/2008
EP	1693015	A2	8/2006	EP	1997439	A2	12/2008
EP	1400214	B1	9/2006	EP	2000101	A2	12/2008
EP	1702567	A2	9/2006	EP	2000102	A2	12/2008
EP	1129665	B1	11/2006	EP	2005894	A2	12/2008
EP	1400206	B1	11/2006	EP	2005897	A2	12/2008
EP	1721568	A1	11/2006	EP	2005901	A1	12/2008
EP	1723914	A1	11/2006	EP	2008595	A2	12/2008
EP	1256317	B1	12/2006	EP	2025293	A1	2/2009
EP	1285633	B1	12/2006	EP	1736104	B1	3/2009
EP	1728473	A1	12/2006	EP	1749486	B1	3/2009
EP	1736105	A1	12/2006	EP	1782743	B1	3/2009
EP	1011494	B1	1/2007	EP	2039302	A2	3/2009
EP	1479346	B1	1/2007	EP	2039308	A2	3/2009
EP	1484024	B1	1/2007	EP	2039316	A2	3/2009
EP	1749485	A1	2/2007	EP	1721576	B1	4/2009
EP	1754445	A2	2/2007	EP	1733686	B1	4/2009
EP	1759812	A1	3/2007	EP	2044890	A1	4/2009
EP	1767157	A1	3/2007	EP	2055243	A2	5/2009
EP	1767163	A1	3/2007	EP	1550409	B1	6/2009
EP	1563792	B1	4/2007	EP	1550413	B1	6/2009
EP	1769756	A1	4/2007	EP	1719461	B1	6/2009
EP	1769758	A1	4/2007	EP	1834594	B1	6/2009
EP	1581128	B1	5/2007	EP	1709911	B1	7/2009
EP	1780825	A1	5/2007	EP	2077093	A2	7/2009
EP	1785097	A2	5/2007	EP	1745748	B1	8/2009
EP	1790293	A2	5/2007	EP	2090231	A1	8/2009
EP	1790294	A1	5/2007	EP	2090237	A1	8/2009
EP	1563793	B1	6/2007	EP	2090241	A1	8/2009
EP	1791473	A2	6/2007	EP	2090245	A1	8/2009
EP	1800610	A1	6/2007	EP	2090254	A1	8/2009
EP	1300117	B1	8/2007	EP	2090256	A2	8/2009
EP	1813199	A1	8/2007	EP	2095777	A2	9/2009
EP	1813200	A2	8/2007	EP	2098170	A2	9/2009
EP	1813201	A1	8/2007	EP	2100562	A2	9/2009
EP	1813202	A1	8/2007	EP	2110082	A1	10/2009
EP	1813203	A2	8/2007	EP	2110083	A2	10/2009
EP	1813207	A1	8/2007	EP	2110084	A2	10/2009
EP	1813209	A1	8/2007	EP	2111803	A2	10/2009
EP	1815950	A1	8/2007	EP	1813208	B1	11/2009
EP	1330991	B1	9/2007	EP	1908426	B1	11/2009
EP	1837041	A1	9/2007	EP	2116195	A1	11/2009
EP	0922435	B1	10/2007	EP	2116197	A2	11/2009
EP	1487359	B1	10/2007	EP	1607050	B1	12/2009
EP	1599146	B1	10/2007	EP	1762190	B8	12/2009
EP	1839596	A1	10/2007	EP	1815804	B1	12/2009
EP	1679096	B1	11/2007	EP	1875870	B1	12/2009
EP	1857057	A2	11/2007	EP	1878395	B1	1/2010
EP	1402821	B1	12/2007	EP	2151204	A1	2/2010
EP	1872727	A1	1/2008	EP	1813211	B1	3/2010
EP	1550410	B1	2/2008	EP	2165654	A1	3/2010
EP	1671593	B1	2/2008	EP	2165656	A2	3/2010
EP	1897502	A1	3/2008	EP	2165660	A2	3/2010
EP	1611856	B1	4/2008	EP	2165663	A2	3/2010
EP	1908417	A2	4/2008	EP	2165664	A2	3/2010
EP	1917929	A1	5/2008	EP	1566150	B1	4/2010
EP	1330201	B1	6/2008	EP	1813206	B1	4/2010
EP	1702568	B1	7/2008	EP	2184014	A2	5/2010
EP	1943955	A2	7/2008	EP	1769754	B1	6/2010
				EP	1854416	B1	6/2010
				EP	1911408	B1	6/2010
				EP	2198787	A1	6/2010
				EP	2214610	A1	8/2010

(56)

References Cited

FOREIGN PATENT DOCUMENTS

EP 2218409 A1 8/2010
 EP 1647286 B1 9/2010
 EP 1825821 B1 9/2010
 EP 1535565 B1 10/2010
 EP 1702570 B1 10/2010
 EP 1785098 B1 10/2010
 EP 2005896 B1 10/2010
 EP 2030578 B1 11/2010
 EP 2036505 B1 11/2010
 EP 2245993 A2 11/2010
 EP 2245994 A1 11/2010
 EP 2253280 A1 11/2010
 EP 1627605 B1 12/2010
 EP 2027811 B1 12/2010
 EP 2130498 B1 12/2010
 EP 2258282 A2 12/2010
 EP 2263568 A2 12/2010
 EP 1994890 B1 1/2011
 EP 2005900 B1 1/2011
 EP 2277667 A1 1/2011
 EP 2283780 A2 2/2011
 EP 2286738 A2 2/2011
 EP 1494595 B1 3/2011
 EP 1690502 B1 3/2011
 EP 1884201 B1 3/2011
 EP 2292153 A1 3/2011
 EP 1769755 B1 4/2011
 EP 2090240 B1 4/2011
 EP 2305135 A1 4/2011
 EP 2308388 A1 4/2011
 EP 2314254 A2 4/2011
 EP 2316345 A1 5/2011
 EP 2316366 A2 5/2011
 EP 2319443 A1 5/2011
 EP 2324776 A2 5/2011
 EP 1813205 B1 6/2011
 EP 2042107 B1 6/2011
 EP 2090243 B1 6/2011
 EP 2329773 A1 6/2011
 EP 2090239 B1 7/2011
 EP 2340771 A2 7/2011
 EP 1728475 B1 8/2011
 EP 2353545 A1 8/2011
 EP 2361562 A1 8/2011
 EP 2377472 A1 10/2011
 EP 1836986 B1 11/2011
 EP 1908414 B1 11/2011
 EP 2153781 B1 11/2011
 EP 2387943 A2 11/2011
 EP 2389928 A2 11/2011
 EP 1847225 B1 12/2011
 EP 2397079 A1 12/2011
 EP 2399538 A2 12/2011
 EP 1785102 B1 1/2012
 EP 1316290 B1 2/2012
 EP 1962711 B1 2/2012
 EP 2415416 A1 2/2012
 EP 2090253 B1 3/2012
 EP 2430986 A2 3/2012
 EP 1347638 B1 5/2012
 EP 1943956 B1 5/2012
 EP 2446834 A1 5/2012
 EP 2455007 A2 5/2012
 EP 2457519 A1 5/2012
 EP 2462878 A1 6/2012
 EP 2462880 A2 6/2012
 EP 1813204 B1 7/2012
 EP 2189121 B1 7/2012
 EP 2248475 B1 7/2012
 EP 2478845 A2 7/2012
 EP 2005895 B1 8/2012
 EP 2090248 B1 8/2012
 EP 2481359 A1 8/2012
 EP 2484304 A2 8/2012
 EP 2486860 A2 8/2012

EP 2486862 A2 8/2012
 EP 2486868 A2 8/2012
 EP 1908412 B1 9/2012
 EP 1935351 B1 9/2012
 EP 2497431 A1 9/2012
 EP 1550412 B2 10/2012
 EP 1616549 B1 10/2012
 EP 2030579 B1 10/2012
 EP 2090252 B1 10/2012
 EP 2517637 A1 10/2012
 EP 2517638 A1 10/2012
 EP 2517642 A2 10/2012
 EP 2517645 A2 10/2012
 EP 2517649 A2 10/2012
 EP 2517651 A2 10/2012
 EP 2526877 A1 11/2012
 EP 2526883 A1 11/2012
 EP 1884206 B1 3/2013
 EP 2286735 B1 3/2013
 EP 2090238 B1 4/2013
 EP 1806103 B1 5/2013
 EP 2586380 A1 5/2013
 EP 2586383 A2 5/2013
 EP 2606812 A1 6/2013
 EP 2606834 A2 6/2013
 EP 1982657 B1 7/2013
 EP 2614782 A2 7/2013
 EP 2617369 A1 7/2013
 EP 2620117 A1 7/2013
 EP 2090234 B1 9/2013
 EP 2633830 A1 9/2013
 EP 2090244 B1 10/2013
 EP 2644124 A1 10/2013
 EP 2644209 A2 10/2013
 EP 2649948 A1 10/2013
 EP 2649949 A1 10/2013
 EP 1997438 B1 11/2013
 EP 2684529 A2 1/2014
 EP 2687164 A2 1/2014
 EP 2700367 A1 2/2014
 EP 2713902 A1 4/2014
 EP 1772105 B1 5/2014
 EP 2743042 A2 6/2014
 EP 2759267 A2 7/2014
 EP 2764826 A1 8/2014
 EP 2764827 A2 8/2014
 EP 2767243 A2 8/2014
 EP 2772206 A2 9/2014
 EP 2772209 A1 9/2014
 EP 2777520 A1 9/2014
 EP 2777524 A2 9/2014
 EP 2777528 A2 9/2014
 EP 2777537 A1 9/2014
 EP 2777538 A2 9/2014
 EP 2786714 A2 10/2014
 EP 2792313 A2 10/2014
 EP 2803324 A2 11/2014
 EP 2815704 A1 12/2014
 EP 2446835 B1 1/2015
 EP 2842500 A1 3/2015
 EP 2845545 A1 3/2015
 EP 1943960 B1 4/2015
 EP 2090255 B1 4/2015
 EP 2853220 A1 4/2015
 EP 2923647 A2 9/2015
 EP 2923653 A2 9/2015
 EP 2923660 A2 9/2015
 EP 2932913 A1 10/2015
 EP 2944270 A1 11/2015
 EP 1774914 B1 12/2015
 EP 2090235 B1 4/2016
 EP 2823773 B1 4/2016
 EP 2131750 B1 5/2016
 EP 2298220 B1 6/2016
 EP 2510891 B1 6/2016
 EP 1915957 B1 8/2016
 EP 2296559 B1 8/2016
 EP 2586379 B1 8/2016
 EP 2777533 B1 10/2016

(56)

References Cited

FOREIGN PATENT DOCUMENTS

EP	2364651	B1	11/2016	JP	H07163574	A	6/1995
EP	2747235	B1	11/2016	JP	H07171163	A	7/1995
EP	2116192	B1	3/2017	JP	H07255735	A	10/1995
EP	2789299	B1	5/2017	JP	H07285089	A	10/1995
EP	2311386	B1	6/2017	JP	H07299074	A	11/1995
EP	2839787	B1	6/2017	JP	H0833641	A	2/1996
EP	2745782	B1	10/2017	JP	H0833642	A	2/1996
ES	2396594	T3	2/2013	JP	H08164141	A	6/1996
FR	459743	A	11/1913	JP	H08173437	A	7/1996
FR	999646	A	2/1952	JP	H08182684	A	7/1996
FR	1112936	A	3/1956	JP	H08215201	A	8/1996
FR	2452275	B1	4/1983	JP	H08507708	A	8/1996
FR	2598905	A1	11/1987	JP	H08229050	A	9/1996
FR	2689749	B1	7/1994	JP	H08289895	A	11/1996
FR	2765794	A1	1/1999	JP	H08336540	A	12/1996
FR	2815842	A1	5/2002	JP	H08336544	A	12/1996
GB	939929	A	10/1963	JP	H09501081	A	2/1997
GB	1210522	A	10/1970	JP	H09501577	A	2/1997
GB	1217159	A	12/1970	JP	H09164144	A	6/1997
GB	1339394	A	12/1973	JP	H09-323068	A	12/1997
GB	2024012	A	1/1980	JP	H10113352	A	5/1998
GB	2109241	A	6/1983	JP	H10118090	A	5/1998
GB	2090534	B	6/1984	JP	H10-200699	A	7/1998
GB	2272159	A	5/1994	JP	H 10296660	A	11/1998
GB	2284242	A	5/1995	JP	H10512465	A	12/1998
GB	2286435	A	8/1995	JP	H10512469	A	12/1998
GB	2336214	A	10/1999	JP	2000014632	A	1/2000
GB	2425903	A	11/2006	JP	2000033071	A	2/2000
GB	2426391	A	11/2006	JP	2000112002	A	4/2000
GB	2423199	B	5/2009	JP	3056672	B2	6/2000
GB	2509523	A	7/2014	JP	2000166932	A	6/2000
GR	930100110	A	11/1993	JP	2000171730	A	6/2000
JP	S4711908	Y1	5/1972	JP	2000287987	A	10/2000
JP	S5033988	U	4/1975	JP	2000325303	A	11/2000
JP	S56112235	A	9/1981	JP	2001037763	A	2/2001
JP	S5850053	A	1/1983	JP	2001046384	A	2/2001
JP	S58501360	A	8/1983	JP	2001087272	A	4/2001
JP	S59174920	A	10/1984	JP	2001514541	A	9/2001
JP	S60100955	A	6/1985	JP	2001276091	A	10/2001
JP	S60212152	A	10/1985	JP	2001286477	A	10/2001
JP	S6198249	A	5/1986	JP	2001517473	A	10/2001
JP	S61502036	A	9/1986	JP	2002051974	A	2/2002
JP	S62170011	U	10/1987	JP	2002054903	A	2/2002
JP	S6359764	A	3/1988	JP	2002085415	A	3/2002
JP	S63147449	A	6/1988	JP	2002143078	A	5/2002
JP	S63203149	A	8/1988	JP	2002204801	A	7/2002
JP	S63270040	A	11/1988	JP	2002528161	A	9/2002
JP	H0129503	B2	6/1989	JP	2002314298	A	10/2002
JP	H02279149	A	11/1990	JP	2002369820	A	12/2002
JP	H0312126	A	1/1991	JP	2002542186	A	12/2002
JP	H0318354	A	1/1991	JP	2003000603	A	1/2003
JP	H0378514	U	8/1991	JP	2003500153	A	1/2003
JP	H0385009	U	8/1991	JP	2003504104	A	2/2003
JP	H04215747	A	8/1992	JP	2003135473	A	5/2003
JP	H04131860	U	12/1992	JP	2003148903	A	5/2003
JP	H0584252	A	4/1993	JP	2003164066	A	6/2003
JP	H05123325	A	5/1993	JP	2003521301	A	7/2003
JP	H05212039	A	8/1993	JP	2003521304	A	7/2003
JP	H 05226945	A	9/1993	JP	2003523251	A	8/2003
JP	H067357	A	1/1994	JP	2003523254	A	8/2003
JP	H0630945	A	2/1994	JP	2003524431	A	8/2003
JP	H0654857	A	3/1994	JP	3442423	B2	9/2003
JP	H0663054	A	3/1994	JP	2003300416	A	10/2003
JP	H0626812	U	4/1994	JP	2004147701	A	5/2004
JP	H06121798	A	5/1994	JP	2004162035	A	6/2004
JP	H06125913	A	5/1994	JP	2004229976	A	8/2004
JP	H06197901	A	7/1994	JP	2004524076	A	8/2004
JP	H06237937	A	8/1994	JP	2004531280	A	10/2004
JP	H06327684	A	11/1994	JP	2004532084	A	10/2004
JP	H079622	U	2/1995	JP	2004532676	A	10/2004
JP	H0731623	A	2/1995	JP	2004-535217	A	11/2004
JP	H0747070	A	2/1995	JP	2004329624	A	11/2004
JP	H0751273	A	2/1995	JP	2004337617	A	12/2004
JP	H07124166	A	5/1995	JP	2004344662	A	12/2004
JP	H07163573	A	6/1995	JP	2004344663	A	12/2004
				JP	2005013573	A	1/2005
				JP	2005028147	A	2/2005
				JP	2005028148	A	2/2005
				JP	2005028149	A	2/2005

(56)

References Cited

FOREIGN PATENT DOCUMENTS

JP 2005505309 A 2/2005
 JP 2005505322 A 2/2005
 JP 2005505334 A 2/2005
 JP 2005080702 A 3/2005
 JP 2005103280 A 4/2005
 JP 2005103281 A 4/2005
 JP 2005103293 A 4/2005
 JP 2005511131 A 4/2005
 JP 2005511137 A 4/2005
 JP 2005131163 A 5/2005
 JP 2005131164 A 5/2005
 JP 2005131173 A 5/2005
 JP 2005131211 A 5/2005
 JP 2005131212 A 5/2005
 JP 2005137423 A 6/2005
 JP 2005137919 A 6/2005
 JP 2005144183 A 6/2005
 JP 2005152416 A 6/2005
 JP 2005516714 A 6/2005
 JP 2005187954 A 7/2005
 JP 2005521109 A 7/2005
 JP 2005523105 A 8/2005
 JP 2005524474 A 8/2005
 JP 2005296412 A 10/2005
 JP 2005529675 A 10/2005
 JP 2005529677 A 10/2005
 JP 2005328882 A 12/2005
 JP 2005335432 A 12/2005
 JP 2005342267 A 12/2005
 JP 2006034975 A 2/2006
 JP 2006034977 A 2/2006
 JP 2006034978 A 2/2006
 JP 2006034980 A 2/2006
 JP 2006043451 A 2/2006
 JP 2006506106 A 2/2006
 JP 2006510879 A 3/2006
 JP 3791856 B2 6/2006
 JP 2006187649 A 7/2006
 JP 2006218228 A 8/2006
 JP 2006218297 A 8/2006
 JP 2006223872 A 8/2006
 JP 2006281405 A 10/2006
 JP 2006289064 A 10/2006
 JP 2006334412 A 12/2006
 JP 2006334417 A 12/2006
 JP 2006346445 A 12/2006
 JP 2007000634 A 1/2007
 JP 2007050253 A 3/2007
 JP 2007061628 A 3/2007
 JP 3906843 B2 4/2007
 JP 2007083051 A 4/2007
 JP 2007098130 A 4/2007
 JP 2007105481 A 4/2007
 JP 2007117725 A 5/2007
 JP 2007130471 A 5/2007
 JP 2007130479 A 5/2007
 JP 3934161 B2 6/2007
 JP 2007203047 A 8/2007
 JP 2007203049 A 8/2007
 JP 2007203051 A 8/2007
 JP 2007203055 A 8/2007
 JP 2007203057 A 8/2007
 JP 2007524435 A 8/2007
 JP 2007222615 A 9/2007
 JP 2007229448 A 9/2007
 JP 2007526026 A 9/2007
 JP 4001860 B2 10/2007
 JP 2007252916 A 10/2007
 JP 2007307373 A 11/2007
 JP 2007325922 A 12/2007
 JP 2008068073 A 3/2008
 JP 2008510515 A 4/2008
 JP 2008516669 A 5/2008
 JP 2008528203 A 7/2008
 JP 2008-220032 A 9/2008

JP 2008206967 A 9/2008
 JP 2008212637 A 9/2008
 JP 2008212638 A 9/2008
 JP 2008212640 A 9/2008
 JP 2008220956 A 9/2008
 JP 2008237881 A 10/2008
 JP 2008259860 A 10/2008
 JP 2008264535 A 11/2008
 JP 2008283459 A 11/2008
 JP 2008307393 A 12/2008
 JP 2009000531 A 1/2009
 JP 2009006137 A 1/2009
 JP 2009502351 A 1/2009
 JP 2009502352 A 1/2009
 JP 2009022742 A 2/2009
 JP 2009506799 A 2/2009
 JP 2009507526 A 2/2009
 JP 2009072595 A 4/2009
 JP 2009072599 A 4/2009
 JP 2009090113 A 4/2009
 JP 2009106752 A 5/2009
 JP 2009189821 A 8/2009
 JP 2009189823 A 8/2009
 JP 2009189836 A 8/2009
 JP 2009189837 A 8/2009
 JP 2009189838 A 8/2009
 JP 2009189846 A 8/2009
 JP 2009189847 A 8/2009
 JP 2009201998 A 9/2009
 JP 2009207260 A 9/2009
 JP 2009226028 A 10/2009
 JP 2009536082 A 10/2009
 JP 2009261944 A 11/2009
 JP 2009268908 A 11/2009
 JP 2009538684 A 11/2009
 JP 2009539420 A 11/2009
 JP 2009291604 A 12/2009
 JP 2010504808 A 2/2010
 JP 2010504809 A 2/2010
 JP 2010504813 A 2/2010
 JP 2010504846 A 2/2010
 JP 2010505524 A 2/2010
 JP 2010069307 A 4/2010
 JP 2010069310 A 4/2010
 JP 2010075694 A 4/2010
 JP 2010075695 A 4/2010
 JP 2010088876 A 4/2010
 JP 2010094514 A 4/2010
 JP 2010098844 A 4/2010
 JP 4461008 B2 5/2010
 JP 2010-520025 A 6/2010
 JP 2010-148879 A 7/2010
 JP 2010142636 A 7/2010
 JP 4549018 B2 9/2010
 JP 2010214166 A 9/2010
 JP 2010-240429 A 10/2010
 JP 2010240411 A 10/2010
 JP 2010246948 A 11/2010
 JP 2010-540041 A 12/2010
 JP 2010279690 A 12/2010
 JP 2010540192 A 12/2010
 JP 2011005260 A 1/2011
 JP 2011504391 A 2/2011
 JP 2011509786 A 3/2011
 JP 2011072574 A 4/2011
 JP 2011072797 A 4/2011
 JP 2011078763 A 4/2011
 JP 2011-115594 A 6/2011
 JP 2011-520564 A 7/2011
 JP 4722849 B2 7/2011
 JP 4783373 B2 9/2011
 JP 2011524199 A 9/2011
 JP 2011251156 A 12/2011
 JP 2012040398 A 3/2012
 JP 2012507356 A 3/2012
 JP 2012517289 A 8/2012
 JP 5140421 B2 2/2013
 JP 5154710 B1 2/2013
 JP 5162595 B2 3/2013

(56)

References Cited

FOREIGN PATENT DOCUMENTS

JP 2013517891 A 5/2013
 JP 2013526342 A 6/2013
 JP 2013128791 A 7/2013
 JP 5333899 B2 11/2013
 JP 2016-512057 A 4/2016
 KR 20100110134 A 10/2010
 KR 20110003229 A 1/2011
 RU 1814161 C 5/1993
 RU 2008830 C1 3/1994
 RU 2052979 C1 1/1996
 RU 2066128 C1 9/1996
 RU 2098025 C1 12/1997
 RU 2141279 C1 11/1999
 RU 2144791 C1 1/2000
 RU 2161450 C1 1/2001
 RU 2181566 C2 4/2002
 RU 2187249 C2 8/2002
 RU 2189091 C2 9/2002
 RU 32984 U1 10/2003
 RU 2225170 C2 3/2004
 RU 42750 U1 12/2004
 RU 61114 U1 2/2007
 RU 61122 U1 2/2007
 RU 2007103563 A 8/2008
 SU 189517 A 1/1967
 SU 297156 A 5/1971
 SU 328636 A 9/1972
 SU 511939 A1 4/1976
 SU 674747 A1 7/1979
 SU 728848 A1 4/1980
 SU 886900 A1 12/1981
 SU 1009439 A 4/1983
 SU 1022703 A1 6/1983
 SU 1271497 A1 11/1986
 SU 1333319 A2 8/1987
 SU 1377052 A1 2/1988
 SU 1377053 A1 2/1988
 SU 1443874 A1 12/1988
 SU 1509051 A1 9/1989
 SU 1561964 A1 5/1990
 SU 1708312 A1 1/1992
 SU 1722476 A1 3/1992
 SU 1752361 A1 8/1992
 SU 1814161 A1 5/1993
 WO WO-8202824 A1 9/1982
 WO WO-8602254 A1 4/1986
 WO WO-9115157 A1 10/1991
 WO WO-9220295 A1 11/1992
 WO WO-9221300 A1 12/1992
 WO WO-9308755 A1 5/1993
 WO WO-9313718 A1 7/1993
 WO WO-9314690 A1 8/1993
 WO WO-9315648 A1 8/1993
 WO WO-9315850 A1 8/1993
 WO WO-9319681 A1 10/1993
 WO WO-9400060 A1 1/1994
 WO WO-9411057 A1 5/1994
 WO WO-94/14129 A1 6/1994
 WO WO-9412108 A1 6/1994
 WO WO-9417737 A1 8/1994
 WO WO-9418893 A1 9/1994
 WO WO-9420030 A1 9/1994
 WO WO-9422378 A1 10/1994
 WO WO-9423659 A1 10/1994
 WO WO-9424943 A1 11/1994
 WO WO-9424947 A1 11/1994
 WO WO-9502369 A1 1/1995
 WO WO-9503743 A1 2/1995
 WO WO-9506817 A1 3/1995
 WO WO-9509576 A1 4/1995
 WO WO-9509577 A1 4/1995
 WO WO-9514436 A1 6/1995
 WO WO-9517855 A1 7/1995
 WO WO-9518383 A1 7/1995
 WO WO-9518572 A1 7/1995

WO WO-9519739 A1 7/1995
 WO WO-9520360 A1 8/1995
 WO WO-9523557 A1 9/1995
 WO WO-9524865 A1 9/1995
 WO WO-9525471 A3 9/1995
 WO WO-9526562 A1 10/1995
 WO WO-9529639 A1 11/1995
 WO WO-9604858 A1 2/1996
 WO WO-9618344 A2 6/1996
 WO WO-9619151 A1 6/1996
 WO WO-9619152 A1 6/1996
 WO WO-9620652 A1 7/1996
 WO WO-9621119 A1 7/1996
 WO WO-9622055 A1 7/1996
 WO WO-9623448 A1 8/1996
 WO WO-9624301 A1 8/1996
 WO WO-9627337 A1 9/1996
 WO WO-9631155 A1 10/1996
 WO WO-9635464 A1 11/1996
 WO WO-9639085 A1 12/1996
 WO WO-9639086 A1 12/1996
 WO WO-9639087 A1 12/1996
 WO WO-9639088 A1 12/1996
 WO WO-9639089 A1 12/1996
 WO WO-9700646 A1 1/1997
 WO WO-9700647 A1 1/1997
 WO WO-9701989 A1 1/1997
 WO WO-9706582 A1 2/1997
 WO WO-9710763 A1 3/1997
 WO WO-9710764 A1 3/1997
 WO WO-9711648 A2 4/1997
 WO WO-9711649 A1 4/1997
 WO WO-9715237 A1 5/1997
 WO WO-9724073 A1 7/1997
 WO WO-9724993 A1 7/1997
 WO WO-9730644 A1 8/1997
 WO WO-9730659 A1 8/1997
 WO WO-9734533 A1 9/1997
 WO WO-9737598 A1 10/1997
 WO WO-9739688 A2 10/1997
 WO WO-9741767 A2 11/1997
 WO WO-9801080 A1 1/1998
 WO WO-9817180 A1 4/1998
 WO WO-9822154 A2 5/1998
 WO WO-9827880 A1 7/1998
 WO WO-9830153 A1 7/1998
 WO WO-9847436 A1 10/1998
 WO WO-9858589 A1 12/1998
 WO WO-9902090 A1 1/1999
 WO WO-9903407 A1 1/1999
 WO WO-9903408 A1 1/1999
 WO WO-9903409 A1 1/1999
 WO WO-9912483 A1 3/1999
 WO WO-9912487 A1 3/1999
 WO WO-9912488 A1 3/1999
 WO WO-9915086 A1 4/1999
 WO WO-9915091 A1 4/1999
 WO WO-9923933 A2 5/1999
 WO WO-9923959 A1 5/1999
 WO WO-9925261 A1 5/1999
 WO WO-9929244 A1 6/1999
 WO WO-9934744 A1 7/1999
 WO WO-9945849 A1 9/1999
 WO WO-9948430 A1 9/1999
 WO WO-9951158 A1 10/1999
 WO WO-0024322 A1 5/2000
 WO WO-0024330 A1 5/2000
 WO WO-0033755 A1 6/2000
 WO WO-0041638 A1 7/2000
 WO WO-0048506 A1 8/2000
 WO WO-0053112 A2 9/2000
 WO WO-0054653 A1 9/2000
 WO WO-0057796 A1 10/2000
 WO WO-0064365 A1 11/2000
 WO WO-0072762 A1 12/2000
 WO WO-0072765 A1 12/2000
 WO WO-0078222 A1 12/2000
 WO WO-0103587 A1 1/2001
 WO WO-0105702 A1 1/2001

(56)

References Cited

FOREIGN PATENT DOCUMENTS

WO	WO-0110482	A1	2/2001	WO	WO-2004032783	A1	4/2004
WO	WO-0135845	A1	5/2001	WO	WO-2004034875	A2	4/2004
WO	WO-0154594	A1	8/2001	WO	WO-2004047626	A1	6/2004
WO	WO-0158371	A1	8/2001	WO	WO-2004047653	A2	6/2004
WO	WO-0162158	A2	8/2001	WO	WO-2004049956	A2	6/2004
WO	WO-0162161	A1	8/2001	WO	WO-2004050971	A2	6/2004
WO	WO-0162162	A1	8/2001	WO	WO-2004052426	A2	6/2004
WO	WO-0162163	A1	8/2001	WO	WO-2004056276	A1	7/2004
WO	WO-0162164	A2	8/2001	WO	WO-2004056277	A1	7/2004
WO	WO-0162169	A2	8/2001	WO	WO-2004062516	A1	7/2004
WO	WO-0178605	A2	10/2001	WO	WO-2004064600	A2	8/2004
WO	WO-0180757	A2	11/2001	WO	WO-2004078050	A2	9/2004
WO	WO-0191646	A1	12/2001	WO	WO-2004078051	A2	9/2004
WO	WO-0200121	A1	1/2002	WO	WO-2004078236	A2	9/2004
WO	WO-0207608	A2	1/2002	WO	WO-2004086987	A1	10/2004
WO	WO-0207618	A1	1/2002	WO	WO-2004096015	A2	11/2004
WO	WO-0217799	A1	3/2002	WO	WO-2004096057	A2	11/2004
WO	WO-0219920	A1	3/2002	WO	WO-2004103157	A2	12/2004
WO	WO-0219932	A1	3/2002	WO	WO-2004105593	A1	12/2004
WO	WO-0226143	A1	4/2002	WO	WO-2004105621	A1	12/2004
WO	WO-0230297	A2	4/2002	WO	WO-2004112618	A2	12/2004
WO	WO-0232322	A2	4/2002	WO	WO-2004112652	A2	12/2004
WO	WO-0236028	A1	5/2002	WO	WO-2005027983	A2	3/2005
WO	WO-0243571	A2	6/2002	WO	WO-2005037329	A2	4/2005
WO	WO-02058568	A1	8/2002	WO	WO-2005042041	A1	5/2005
WO	WO-02060328	A1	8/2002	WO	WO-2005044078	A2	5/2005
WO	WO-02065933	A2	8/2002	WO	WO-2005048809	A1	6/2005
WO	WO-02067785	A2	9/2002	WO	WO-2005055846	A1	6/2005
WO	WO-02080781	A2	10/2002	WO	WO-2005072634	A2	8/2005
WO	WO-02085218	A2	10/2002	WO	WO-2005078892	A1	8/2005
WO	WO-02087586	A1	11/2002	WO	WO-2005079675	A2	9/2005
WO	WO-02098302	A1	12/2002	WO	WO-2005087128	A1	9/2005
WO	WO-03000138	A2	1/2003	WO	WO-2005096954	A2	10/2005
WO	WO-03001329	A2	1/2003	WO	WO-2005110243	A2	11/2005
WO	WO-03001986	A2	1/2003	WO	WO-2005112806	A2	12/2005
WO	WO-03013363	A1	2/2003	WO	WO-2005112808	A1	12/2005
WO	WO-03013372	A2	2/2003	WO	WO-2005115251	A1	12/2005
WO	WO-03015604	A2	2/2003	WO	WO-2005115253	A2	12/2005
WO	WO-03020106	A2	3/2003	WO	WO-2005117735	A1	12/2005
WO	WO-03020139	A2	3/2003	WO	WO-2005122936	A1	12/2005
WO	WO-03024339	A1	3/2003	WO	WO-2006026520	A2	3/2006
WO	WO-03030743	A2	4/2003	WO	WO-2006023486	A1	3/2006
WO	WO-03037193	A1	5/2003	WO	WO-2006023578	A2	3/2006
WO	WO-03055402	A1	7/2003	WO	WO-2006027014	A1	3/2006
WO	WO-03057048	A1	7/2003	WO	WO-2006028314	A1	3/2006
WO	WO-03057058	A1	7/2003	WO	WO-2006044490	A2	4/2006
WO	WO-03063694	A1	8/2003	WO	WO-2006044581	A2	4/2006
WO	WO-03077769	A1	9/2003	WO	WO-2006044810	A2	4/2006
WO	WO-03079911	A1	10/2003	WO	WO-2006049852	A2	5/2006
WO	WO-03082126	A1	10/2003	WO	WO-2006050360	A1	5/2006
WO	WO-03086206	A1	10/2003	WO	WO-2006051252	A1	5/2006
WO	WO-03088845	A2	10/2003	WO	WO-2006057702	A2	6/2006
WO	WO-03047436	A3	11/2003	WO	WO-2006059067	A1	6/2006
WO	WO-03090630	A2	11/2003	WO	WO-2006073581	A2	7/2006
WO	WO-03094743	A1	11/2003	WO	WO-2006083748	A1	8/2006
WO	WO-03094745	A1	11/2003	WO	WO-2006085389	A1	8/2006
WO	WO-03094746	A1	11/2003	WO	WO-2006092563	A1	9/2006
WO	WO-03094747	A1	11/2003	WO	WO-2006092565	A1	9/2006
WO	WO-03101313	A1	12/2003	WO	WO-2006115958	A1	11/2006
WO	WO-03105698	A2	12/2003	WO	WO-2006125940	A1	11/2006
WO	WO-03105702	A2	12/2003	WO	WO-2006132992	A2	12/2006
WO	WO-2004004578	A1	1/2004	WO	WO-2007002180	A2	1/2007
WO	WO-2004006980	A2	1/2004	WO	WO-2007014355	A2	2/2007
WO	WO-2004011037	A2	2/2004	WO	WO-2007016290	A2	2/2007
WO	WO-2004014238	A2	2/2004	WO	WO-2007018898	A2	2/2007
WO	WO-03079909	A3	3/2004	WO	WO-2007034161	A2	3/2007
WO	WO-2004019769	A1	3/2004	WO	WO-2007051000	A2	5/2007
WO	WO-2004019803	A1	3/2004	WO	WO-2007059233	A2	5/2007
WO	WO-2004021868	A2	3/2004	WO	WO-2007074430	A1	7/2007
WO	WO-2004028585	A2	4/2004	WO	WO-2007089603	A2	8/2007
WO	WO-2004030554	A1	4/2004	WO	WO-2007098220	A2	8/2007
WO	WO-2004032754	A2	4/2004	WO	WO-2007121579	A1	11/2007
WO	WO-2004032760	A2	4/2004	WO	WO-2007129121	A1	11/2007
WO	WO-2004032762	A1	4/2004	WO	WO-2007131110	A2	11/2007
WO	WO-2004032763	A2	4/2004	WO	WO-2007137304	A2	11/2007
				WO	WO-2007139734	A2	12/2007
				WO	WO-2007142625	A2	12/2007
				WO	WO-2007145825	A2	12/2007
				WO	WO-2007146987	A2	12/2007

(56) References Cited

FOREIGN PATENT DOCUMENTS

WO WO-2007147439 A1 12/2007
 WO WO-2008020964 A2 2/2008
 WO WO-2008021687 A1 2/2008
 WO WO-2008021969 A2 2/2008
 WO WO-2008027972 A1 3/2008
 WO WO-2008039237 A1 4/2008
 WO WO-2008039249 A1 4/2008
 WO WO-2008039270 A1 4/2008
 WO WO-2008045383 A2 4/2008
 WO WO-2008/061566 A1 5/2008
 WO WO-2008057281 A2 5/2008
 WO WO-2008070763 A1 6/2008
 WO WO-2008080148 A2 7/2008
 WO WO-2008089404 A2 7/2008
 WO WO-2008101080 A1 8/2008
 WO WO-2008101228 A2 8/2008
 WO WO-2008103797 A2 8/2008
 WO WO-2008109123 A2 9/2008
 WO WO-2008109125 A1 9/2008
 WO WO-2008112912 A2 9/2008
 WO WO-2008118728 A1 10/2008
 WO WO-2008118928 A2 10/2008
 WO WO-2008124748 A1 10/2008
 WO WO-2008131357 A1 10/2008
 WO WO-2009005969 A2 1/2009
 WO WO-2009022614 A1 2/2009
 WO WO-2009023851 A1 2/2009
 WO WO-2009033057 A2 3/2009
 WO WO-2009039506 A1 3/2009
 WO WO-2009046394 A1 4/2009
 WO WO-2009066105 A1 5/2009
 WO WO-2009067649 A2 5/2009
 WO WO-2009091497 A2 7/2009
 WO WO-2009120944 A2 10/2009
 WO WO-2009137761 A2 11/2009
 WO WO-2009143092 A1 11/2009
 WO WO-2009143331 A1 11/2009
 WO WO-2009150650 A2 12/2009
 WO WO-2009152307 A1 12/2009
 WO WO-2010028332 A2 3/2010
 WO WO-2010030434 A1 3/2010
 WO WO-2010045425 A1 4/2010
 WO WO-2010050771 A2 5/2010
 WO WO-2010054404 A1 5/2010
 WO WO-2010056714 A1 5/2010
 WO WO-2010063795 A1 6/2010
 WO WO-2010090940 A1 8/2010
 WO WO-2010093333 A1 8/2010
 WO WO-2010098871 A2 9/2010
 WO WO-2010134913 A1 11/2010
 WO WO-2011008672 A2 1/2011
 WO WO-2011013103 A1 2/2011
 WO WO-2011044343 A2 4/2011
 WO WO-2011056458 A1 5/2011
 WO WO-2011060311 A2 5/2011
 WO WO-2011084969 A1 7/2011
 WO WO-2011127137 A1 10/2011
 WO WO-2012006306 A2 1/2012
 WO WO-2012009431 A2 1/2012
 WO WO-2012/013577 A1 2/2012
 WO WO-2012021671 A1 2/2012
 WO WO-2012040438 A1 3/2012
 WO WO-2012044551 A1 4/2012
 WO WO-2012044554 A1 4/2012
 WO WO-2012044597 A1 4/2012
 WO WO-2012044606 A2 4/2012
 WO WO-2012044820 A1 4/2012
 WO WO-2012044844 A2 4/2012
 WO WO-2012044853 A1 4/2012
 WO WO-2012044854 A1 4/2012
 WO WO-2012058213 A2 5/2012
 WO WO-2012068156 A2 5/2012
 WO WO-2012109760 A1 8/2012
 WO WO-2012127462 A1 9/2012
 WO WO-2012135705 A1 10/2012

WO WO-2012143913 A2 10/2012
 WO WO-2012148667 A2 11/2012
 WO WO-2012148668 A2 11/2012
 WO WO-2012148703 A2 11/2012
 WO WO-2012160163 A1 11/2012
 WO WO-2012166503 A1 12/2012
 WO WO-2013009252 A2 1/2013
 WO WO-2013009699 A2 1/2013
 WO WO-2013023114 A1 2/2013
 WO WO-2013036409 A1 3/2013
 WO WO-2013043707 A2 3/2013
 WO WO-2013043717 A1 3/2013
 WO WO-2013043721 A2 3/2013
 WO WO-2013062978 A2 5/2013
 WO WO-2013116869 A1 8/2013
 WO WO-2013148762 A2 10/2013
 WO WO-2013151888 A1 10/2013
 WO WO-2013167427 A1 11/2013
 WO WO-2013188130 A1 12/2013
 WO WO-2014/008289 A2 1/2014
 WO WO-2014004199 A1 1/2014
 WO WO-2014004294 A2 1/2014
 WO WO-2014/113438 A1 7/2014
 WO WO-2014/134034 A2 9/2014
 WO WO-2014/172213 A2 10/2014
 WO WO-2014158882 A2 10/2014
 WO WO-2015/032797 A1 3/2015
 WO WO-2015/148136 A1 10/2015
 WO WO-2015148141 A1 10/2015
 WO WO-2015153642 A1 10/2015
 WO WO-2015187107 A1 12/2015

OTHER PUBLICATIONS

"Indian Standard: Automotive Vehicles—Brakes and Braking Systems (IS 11852-1:2001)", Mar. 1, 2001.
 Allegro MicroSystems, LLC, Automotive Full Bridge MOSFET Driver, A3941-DS, Rev. 5, 21 pages, <http://www.allegromicro.com/~media/Files/Datasheets/A3941-Datasheet.ashx?la=en>.
 Anonymous, Analog Devices Wiki, Chapter 11: The Current Mirror, Aug. 20, 2017, 22 pages. <https://wiki.analog.com/university/courses/electronics/text/chapter-11?rev=1503222341>.
 Anonymous: "Sense & Control Application Note Current Sensing Using Linear Hall Sensors," Feb. 3, 2009, pp. 1-18. Retrieved from the Internet: URL: http://www.infineon.com/dgdl/Current_Sensing_Rev.1.1.pdf?fileId=db3a304332d040720132d939503e5f17 [retrieved on Oct. 18, 2016].
 ASTM procedure D2240-00, "Standard Test Method for Rubber Property-Durometer Hardness," (Published Aug. 2000).
 ASTM procedure D2240-05, "Standard Test Method for Rubber Property-Durometer Hardness," (Published Apr. 2010).
 B.R. Coolman, DVM, MS et al., "Comparison of Skin Staples With Sutures for Anastomosis of the Small Intestine in Dogs," Abstract; <http://www.blackwell-synergy.com/doi/abs/10.1053/jvet.2000.7539?cookieSet=1&journalCode=vsu> which redirects to <http://www3.interscience.wiley.com/journal/119040681/abstract?CRETRY=1&SRETRY=0>; [online] accessed: Sep. 22, 2008 (2 pages).
 Brar et al., "Investigation of the mechanical and degradation properties of Mg—Sr and Mg—Zn—Sr alloys for use as potential biodegradable implant materials," J. Mech. Behavior of Biomed. Mater. 7 (2012) pp. 87-95.
 Breedveld et al., "A New, Easily Miniaturized Sterrable Endoscope," IEEE Engineering in Medicine and Biology Magazine (Nov./Dec. 2005).
 Byrne et al., "Molecular Imprinting Within Hydrogels," Advanced Drug Delivery Reviews, 54 (2002) pp. 149-161.
 C.C. Thompson et al., "Peroral Endoscopic Reduction of Dilated Gastrojejunal Anastomosis After Roux-en-Y Gastric Bypass: A Possible New Option for Patients with Weight Regain," Surg Endosc (2006) vol. 20., pp. 1744-1748.
 Chen et al., "Elastomeric Biomaterials for Tissue Engineering," Progress in Polymer Science 38 (2013), pp. 584-671.
 Covidien "iDrive™ Ultra Powered Stapling System, A Guide for Surgeons," (6 pages).

(56)

References Cited

OTHER PUBLICATIONS

- Covidien "iDrive™ Ultra Powered Stapling System, Cleaning and Sterilization Guide," (2 pages).
- Covidien Brochure "iDrive™ Ultra Powered Stapling System," (6 pages).
- Covidien Brochure, "Endo GIA™ Curved Tip Reload with Tri-Staple™ Technology," (2012), 2 pages.
- Covidien Brochure, "Endo GIA™ Reloads with Tri-Staple™ Technology and Endo GIA™ Ultra Universal Staplers," (2010), 2 pages.
- Covidien Brochure, "Endo GIA™ Reloads with Tri-Staple™ Technology," (2010), 1 page.
- Covidien Brochure, "Endo GIA™ Reloads with Tri-Staple™ Technology," (2010), 2 pages.
- Covidien Brochure, "Endo GIA™ Black Reload with Tri-Staple™ Technology," (2012), 2 pages.
- Covidien Brochure, "Endo GIA™ Ultra Universal Stapler," (2010), 2 pages.
- Covidien iDrive™ Ultra in Service Reference Card, "iDrive™ Ultra Powered Stapling Device," (4 pages).
- Covidien iDrive™ Ultra Powered Stapling System brochure, "The Power of iDrive™ Ultra Powered Stapling System and Tri-Staple™ Technology," (23 pages).
- Cuper et al., "The Use of Near-Infrared Light for Safe and Effective Visualization of Subsurface Blood Vessels to Facilitate Blood Withdrawal in Children," *Medical Engineering & Physics*, vol. 35, No. 4, pp. 433-440 (2013).
- D. Tuite, Ed., "Get the Lowdown on Ultracapacitors," Nov. 15, 2007; [online] URL: <http://electronicdesign.com/Articles/Print.cfm?ArticleID=17465>, accessed Jan. 15, 2008 (5 pages).
- Data Sheet of LM4F230H5QR, 2007.
- Datasheet for Panasonic TK Relays Ultra Low Profile 2 A Polarized Relay, Copyright Matsushita Electric Works, Ltd. (Known of at least as early as Aug. 17, 2010), 5 pages.
- Disclosed Anonymously, "Motor-Driven Surgical Stapler Improvements," Research Disclosure Database No. 526041, Published: Feb. 2008.
- Ebara, "Carbohydrate-Derived Hydrogels and Microgels," *Engineered Carbohydrate-Based Materials for Biomedical Applications: Polymers, Surfaces, Dendrimers, Nanoparticles, and Hydrogels*, Edited by Ravin Narain, 2011, pp. 337-345.
- Fast, Versatile Blackfin Processors Handle Advanced RFID Reader Applications; *Analog Dialogue*: vol. 40—Sep. 2006; <http://www.analog.com/library/analogDialogue/archives/40-09/rfid.pdf>; Wayback Machine to Feb. 15, 2012.
- Hoffman, "Hydrogels for Biomedical Applications," *Advanced Drug Delivery Reviews*, 43 (2002) pp. 3-12.
- Hoffman, "Hydrogels for Biomedical Applications," *Advanced Drug Delivery Reviews*, 54 (2002) pp. 3-12.
- <http://ninpgan.net/publications/51-100/89.pdf>; 2004, Ning Pan, On Uniqueness of Fibrous Materials, *Design & Nature II*. Eds: Colins, M. and Brebbia, C. WIT Press, Boston, 493-504.
- Jeong et al., "Thermosensitive Sol-Gel Reversible Hydrogels," *Advanced Drug Delivery Reviews*, 54 (2002) pp. 37-51.
- Lyon et al. "The Relationship Between Current Load and Temperature for Quasi-Steady State and Transient Conditions," *SPIE—International Society for Optical Engineering. Proceedings*, vol. 4020, (pp. 62-70), Mar. 30, 2000.
- Matsuda, "Thermodynamics of Formation of Porous Polymeric Membrane from Solutions," *Polymer Journal*, vol. 23, No. 5, pp. 435-444 (1991).
- Miyata et al., "Biomolecule-Sensitive Hydrogels," *Advanced Drug Delivery Reviews*, 54 (2002) pp. 79-98.
- Mouser Electronics, "LM317 3-Terminal Adjustable Regulator with Overcurrent/Overtemperature Self Protection", Sep. 30, 2016 (Sep. 30, 2016), XP0555246104, Retrieved from the Internet: URL: <http://www.mouser.com/ds/2/405/lm317m-440423.pdf>, pp. 1-9.
- Mouser Electronics, "LM317M 3-Terminal Adjustable Regulator with Overcurrent/Overtemperature Self Protection", Mar. 31, 2014 (Mar. 31, 2014), XP0555246104, Retrieved from the Internet: URL: <http://www.mouser.com/ds/2/405/lm317m-440423.pdf>, pp. 1-8.
- Patrick J. Sweeney: "RFID for Dummies", Mar. 11, 2010, pp. 365-365, XP055150775, ISBN: 978-1-11-805447-5, Retrieved from the Internet: URL: books.google.de/books?isbn=1118054474 [retrieved on Nov. 4, 2014]—book not attached.
- Pellicer et al. "On the biodegradability, mechanical behavior, and cytocompatibility of amorphous Mg72Zn23Ca5 and crystalline Mg70Zn23Ca5Pd2 alloys as temporary implant materials," *J Biomed Mater Res Part A*, 2013:101A:502-517.
- Peppas, "Physiologically Responsive Hydrogels," *Journal of Bioactive and Compatible Polymers*, vol. 6 (Jul. 1991) pp. 241-246.
- Peppas, Editor "Hydrogels in Medicine and Pharmacy," vol. I, Fundamentals, CRC Press, 1986.
- Pitt et al., "Attachment of Hyaluronan to Metallic Surfaces," *J. Biomed. Mater. Res.* 68A: pp. 95-106, 2004.
- Qiu et al., "Environment-Sensitive Hydrogels for Drug Delivery," *Advanced Drug Delivery Reviews*, 53 (2001) pp. 321-339.
- Schellhammer et al., "Poly-Lactic-Acid for Coating of Endovascular Stents: Preliminary Results in Canine Experimental Av-Fistulae," *Mat.-wiss. u. Werkstofftech.*, 32, pp. 193-199 (2001).
- Seils et al., Covidien Summary: Clinical Study "UCONN Biodynamics: Final Report on Results," (2 pages).
- Serial Communication Protocol; Michael Lemmon Feb. 1, 2009; <http://www3.nd.edu/~lemmon/courses/ee224/web-manual/web-manual/lab12/node2.html>; Wayback Machine to Apr. 29, 2012.
- Solorio et al., "Gelatin Microspheres Crosslinked with Genipin for Local Delivery of Growth Factors," *J. Tissue Eng. Regen. Med.* (2010), 4(7): pp. 514-523.
- Texas Instruments: "Current Recirculation and Decay Modes," Application Report SLVA321—Mar. 2009; Retrieved from the Internet: URL: <http://www.ti.com/lit/an/slva321/slva321> [retrieved on Apr. 25, 2017], 7 pages.
- The Sodem Aseptic Battery Transfer Kit, Sodem Systems, 2000, 3 pages.
- Van Meer et al., "A Disposable Plastic Compact Wrist for Smart Minimally Invasive Surgical Tools," *LAAS/CNRS* (Aug. 2005).
- Yan et al, Comparison of the effects of Mg—6Zn and Ti—3Al—2.5V alloys on TGF-β/TNF-α/VEGF/b-FGF in the healing of the intestinal track in vivo, *Biomed. Mater.* 9 (2014), 11 pages.
- Yan et al., "Comparison of the effects of Mg—6Zn and titanium on intestinal tract in vivo," *J Mater Sci: Mater Med* (2013), 11 pages.
- Young, "Microcellular foams via phase separation," *Journal of Vacuum Science & Technology A* 4(3), (May/Jun. 1986).

* cited by examiner

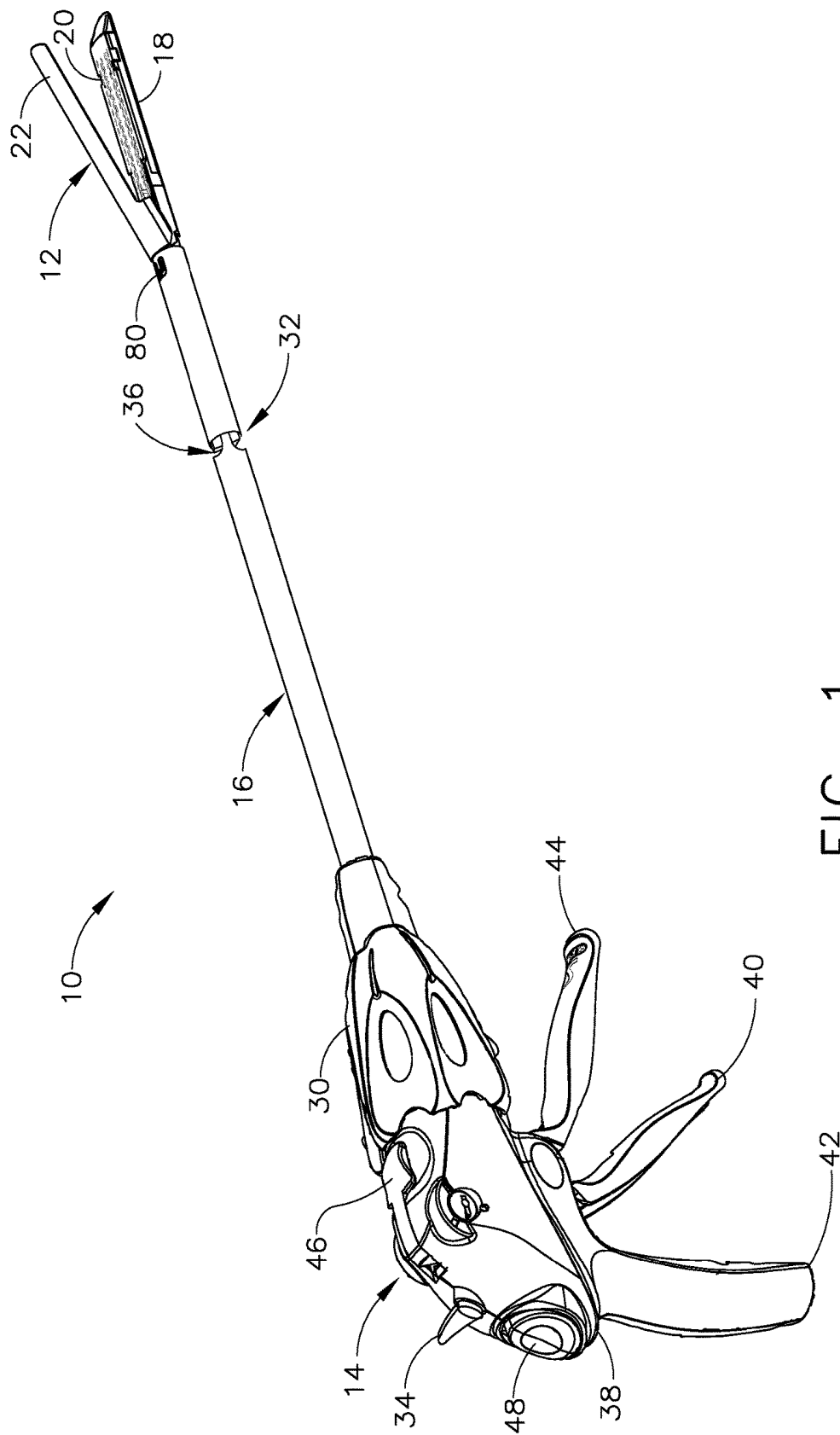


FIG. 1

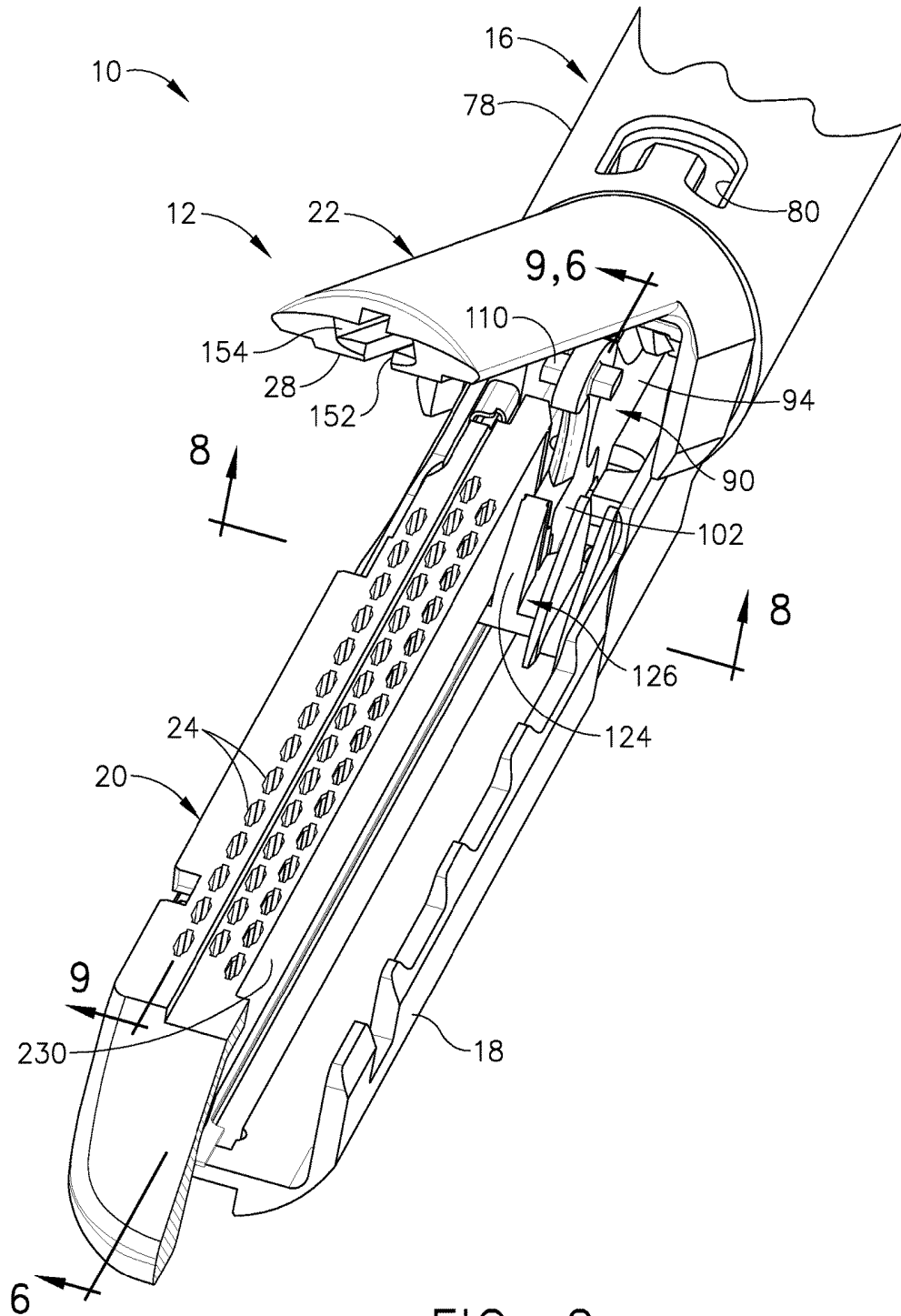
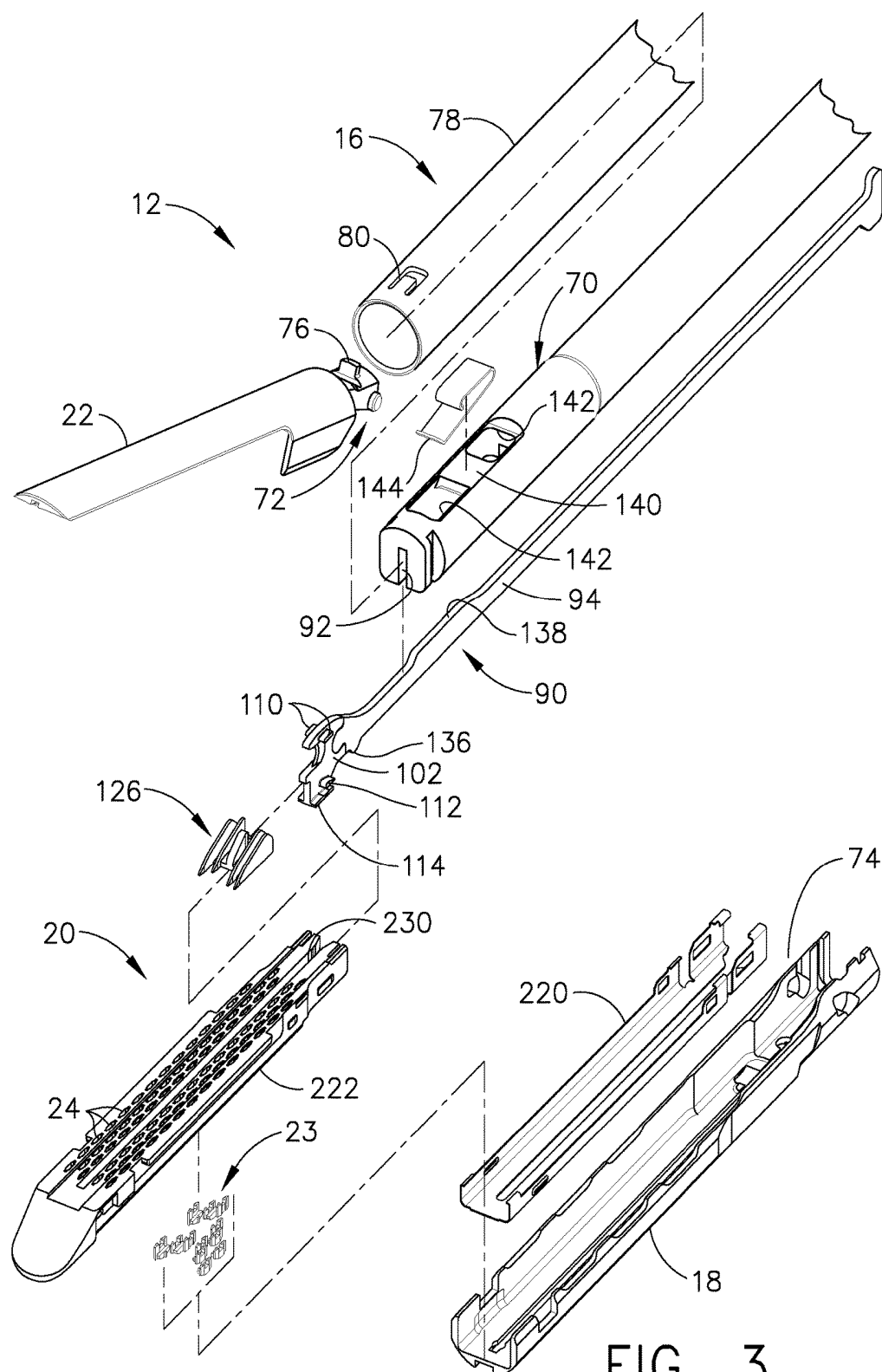
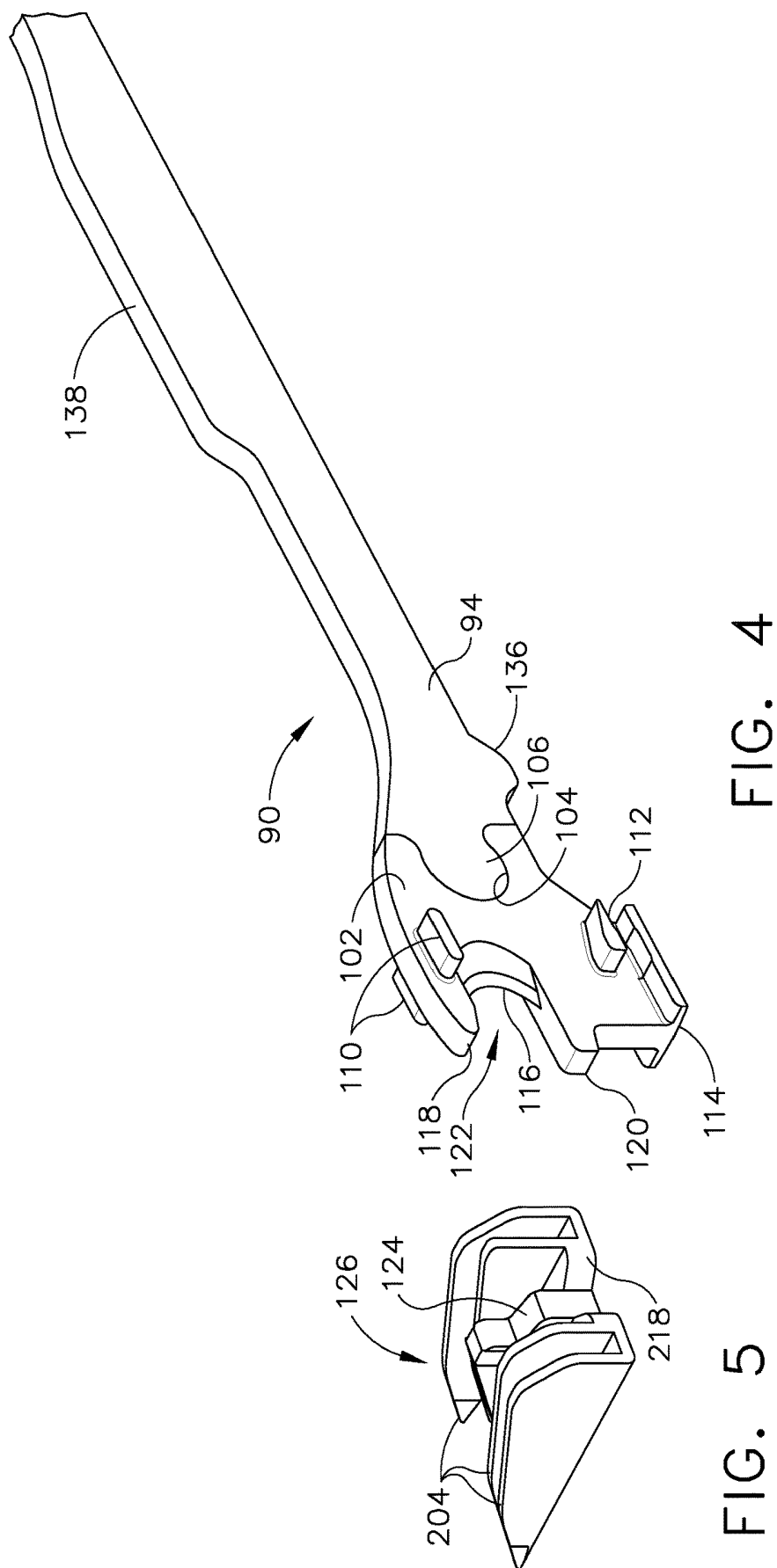


FIG. 2





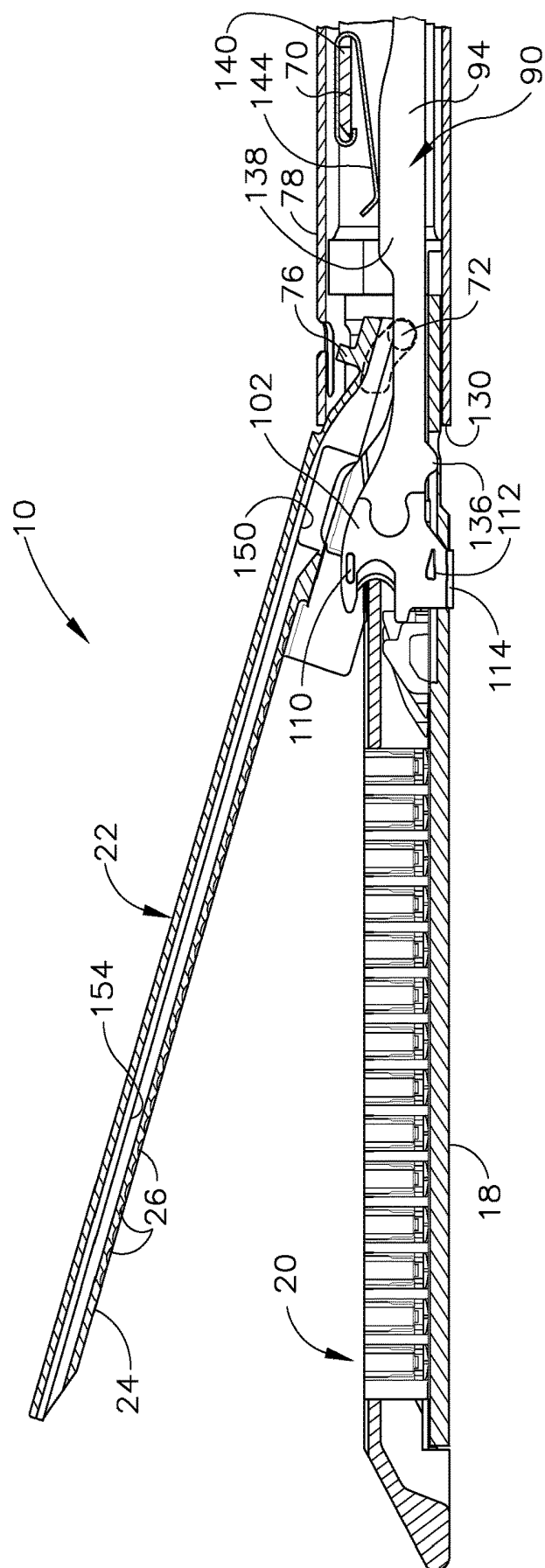


FIG. 6

FIG. 7

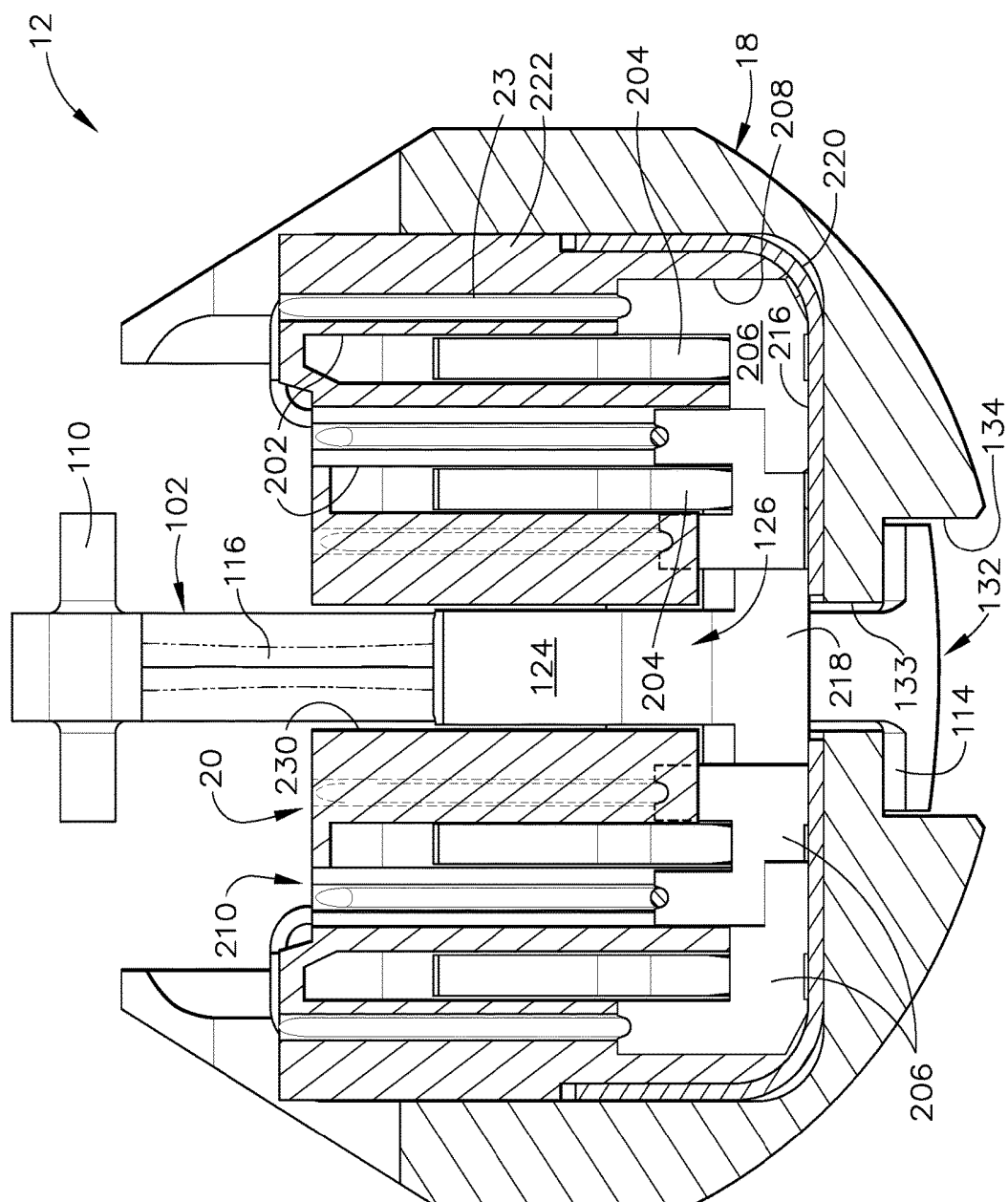


Fig. 8

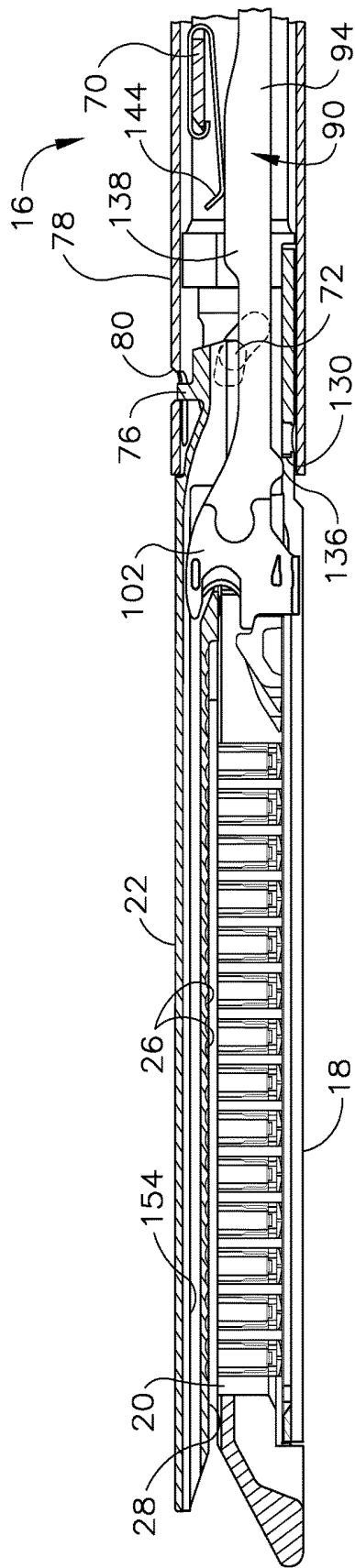


FIG. 9

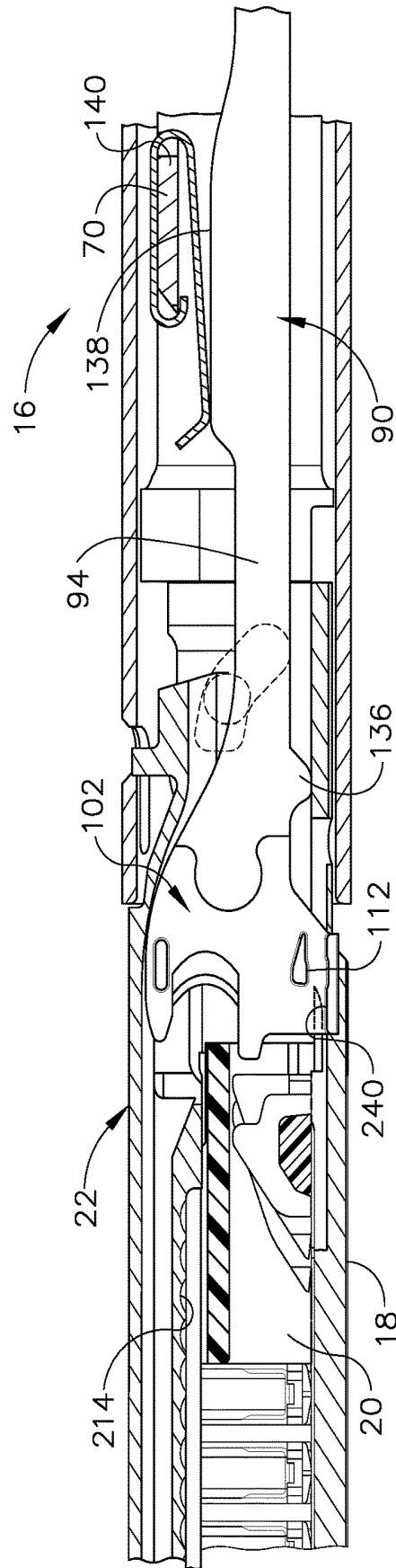


FIG. 10

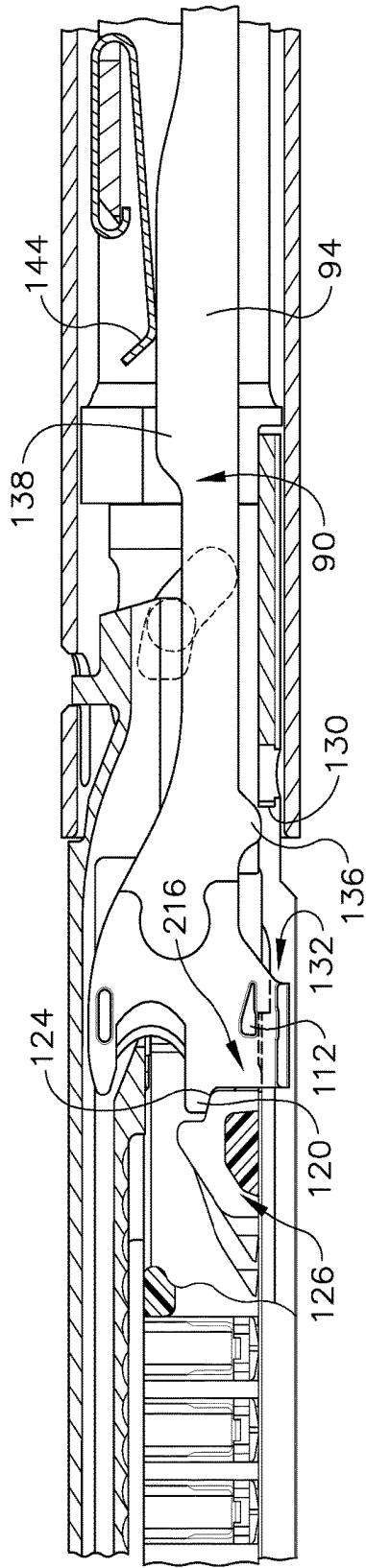


FIG. 11

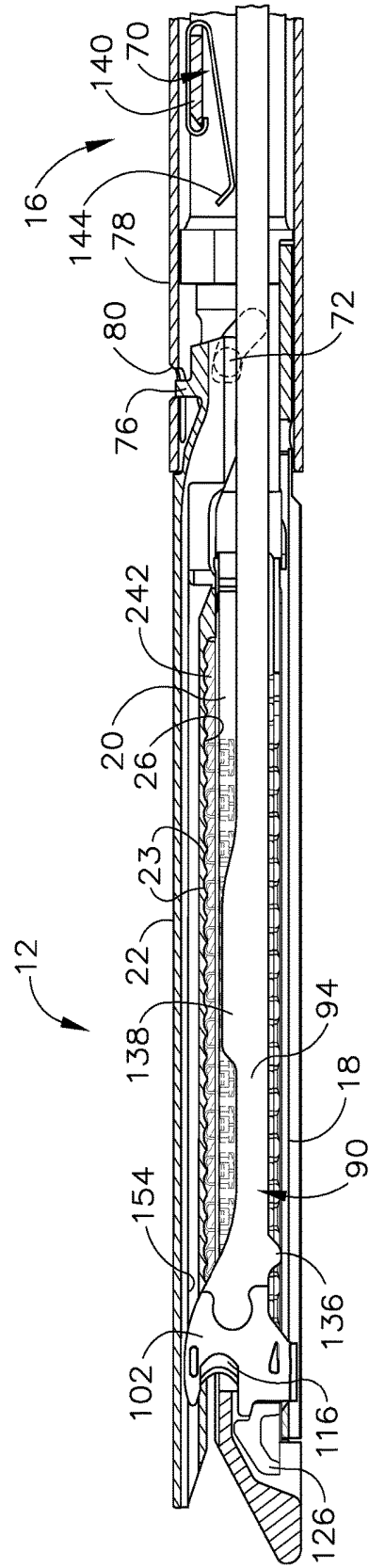
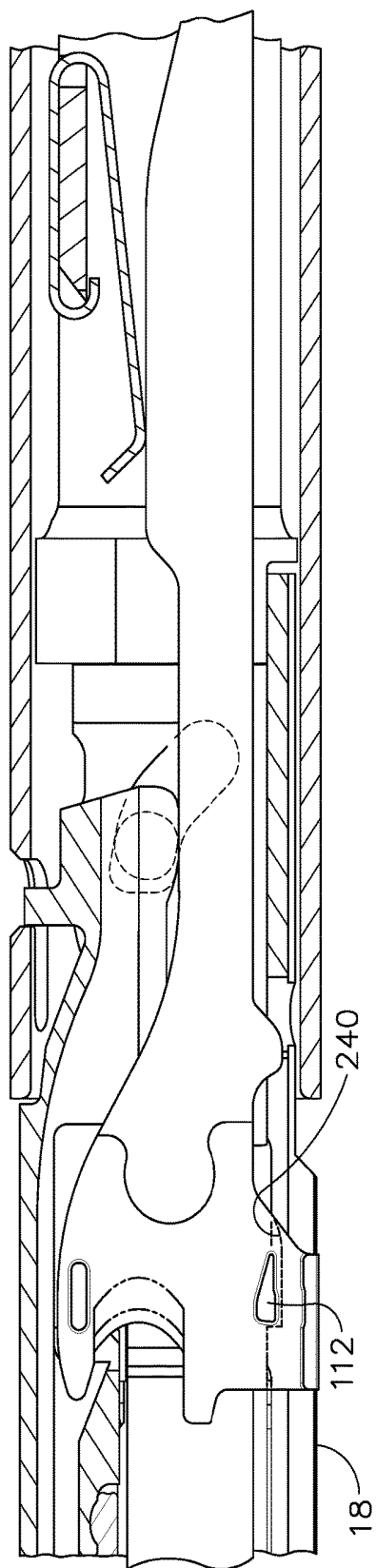
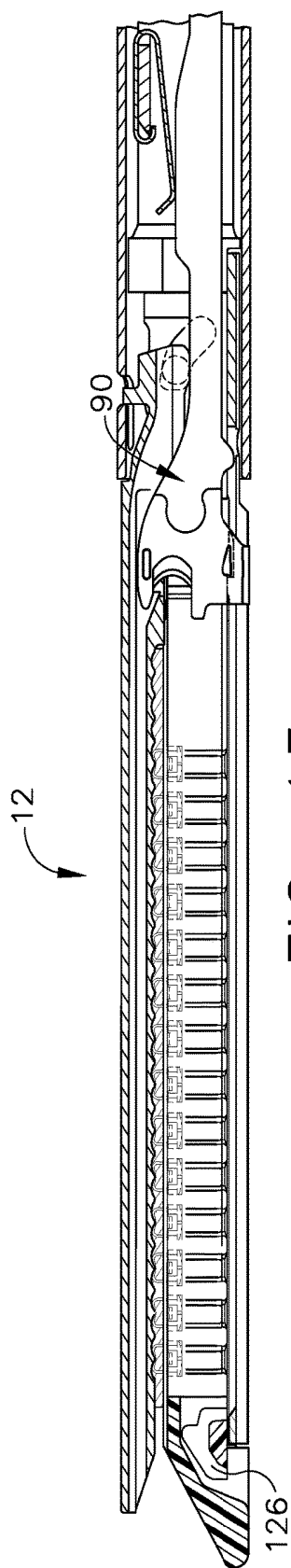
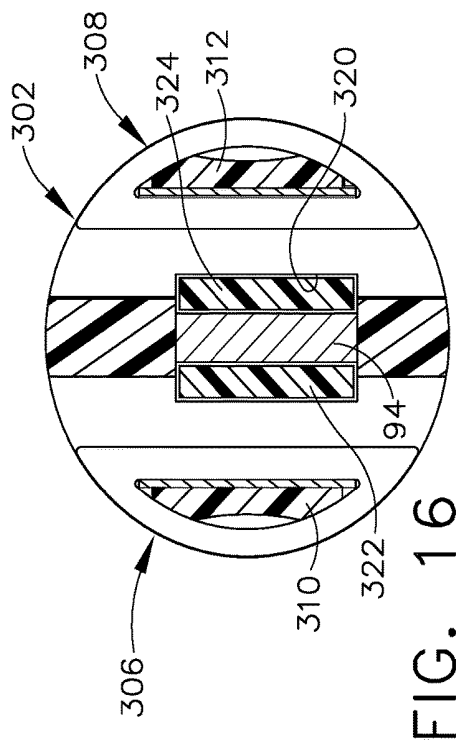
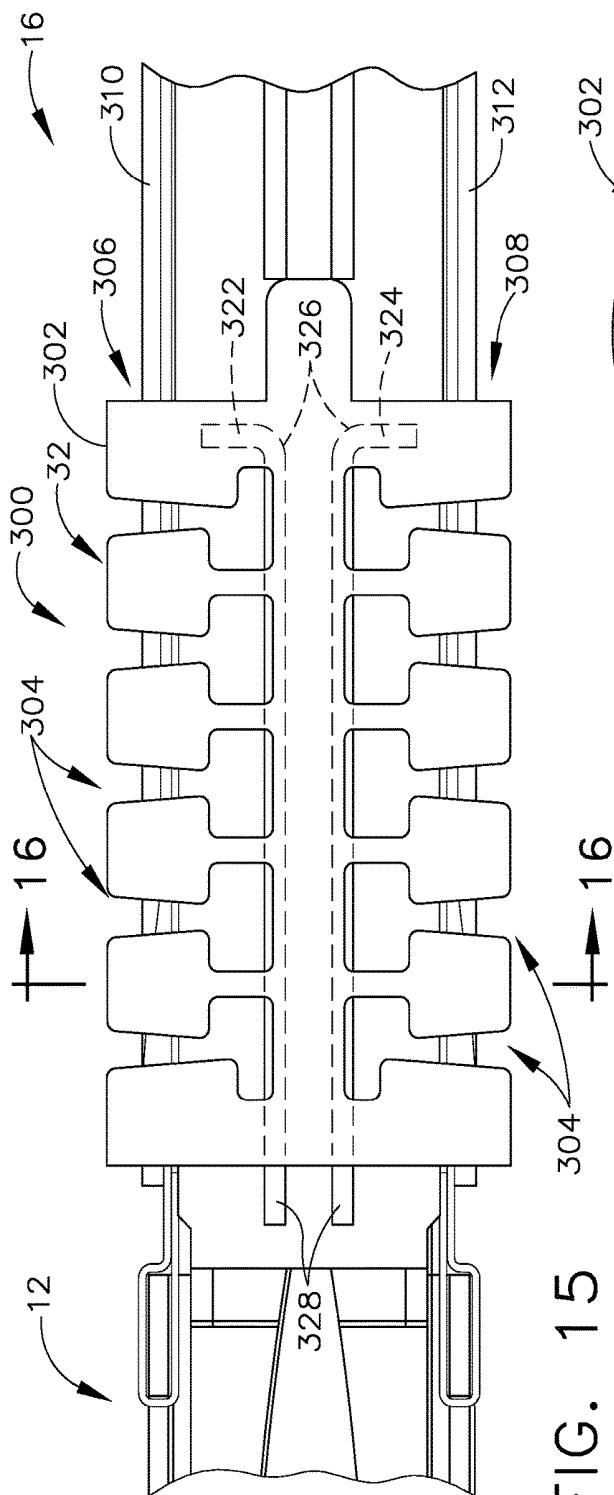


FIG. 12





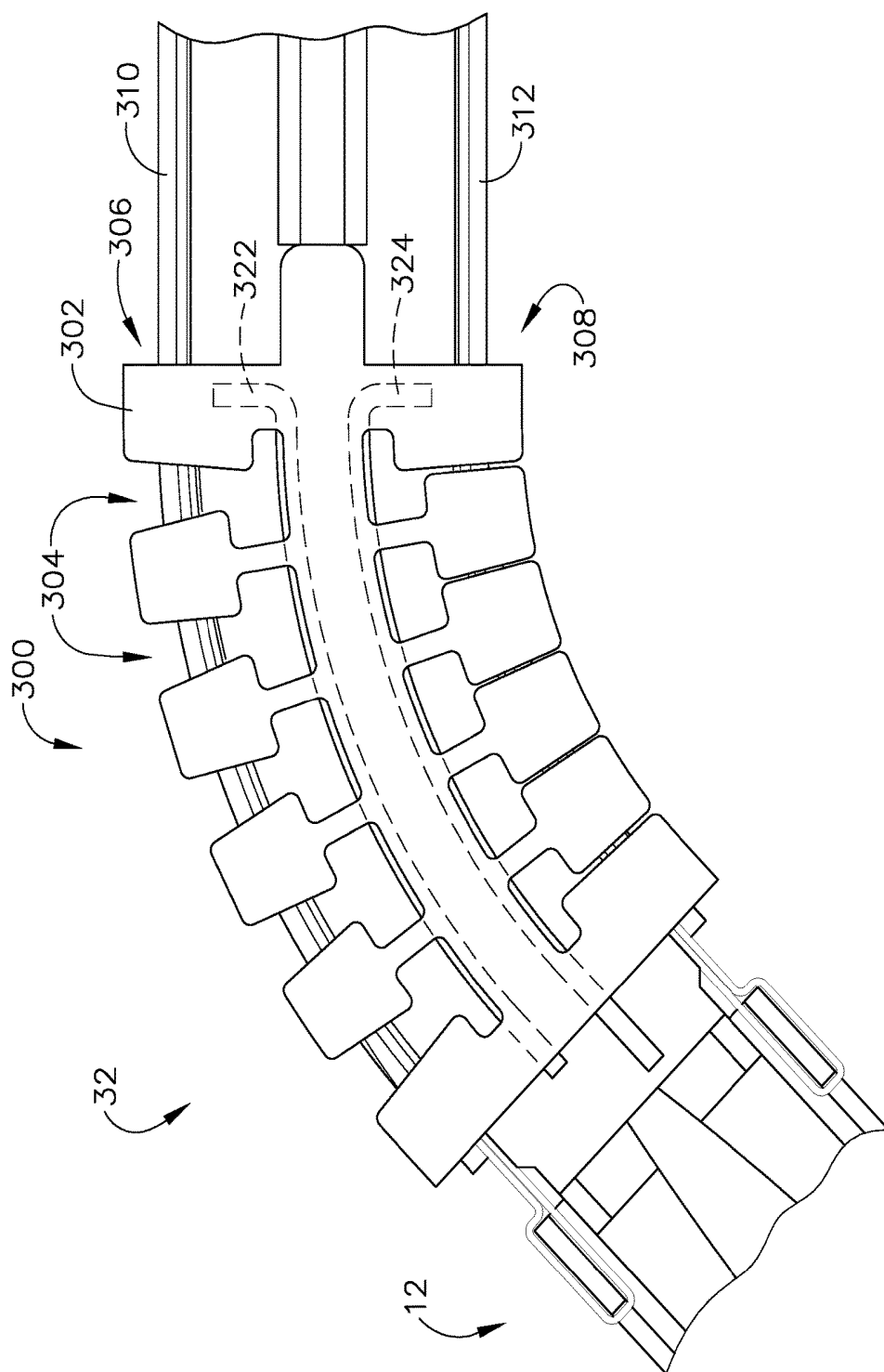
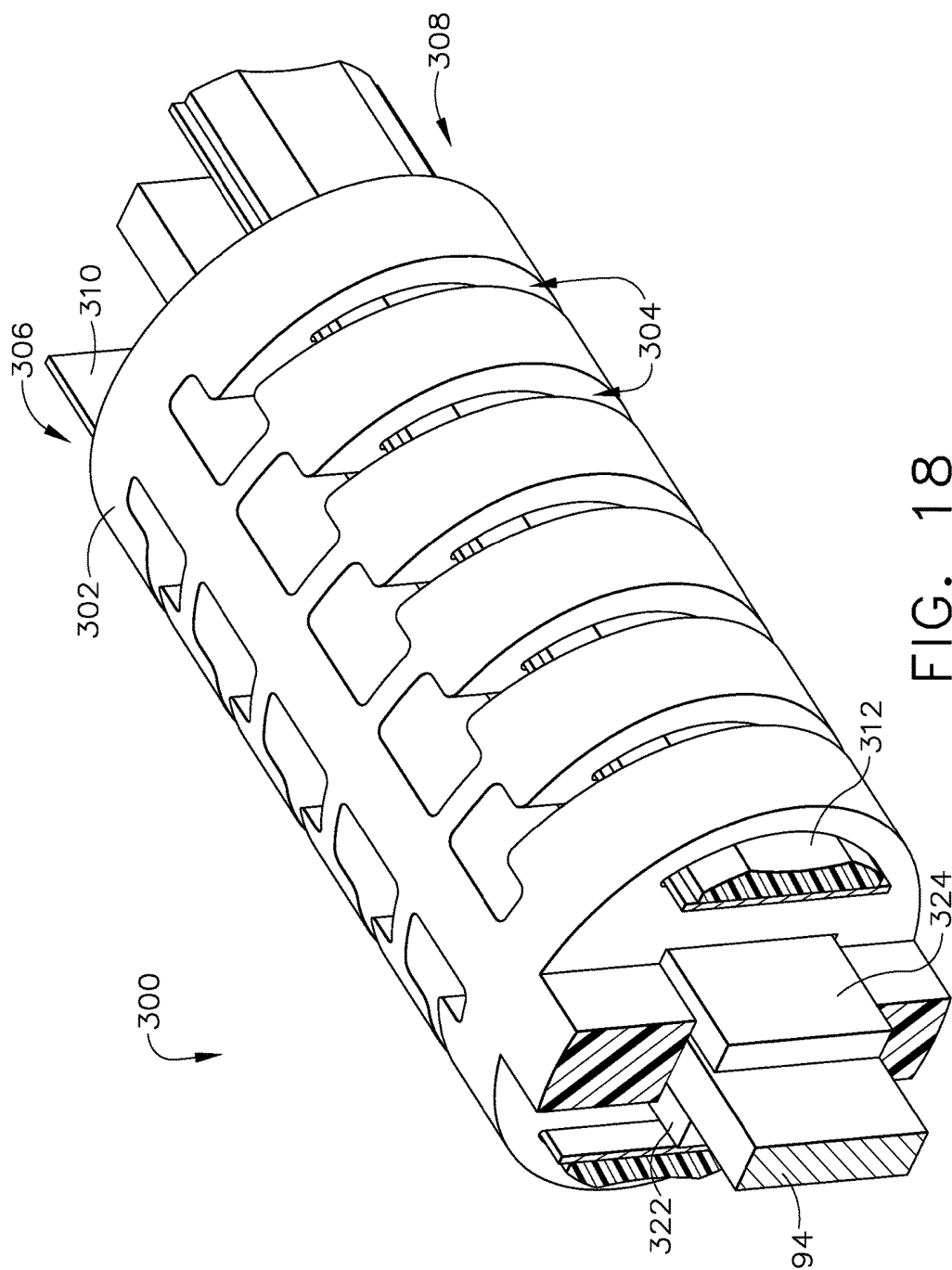


FIG. 17



ARTICULATING SURGICAL STAPLING INSTRUMENT INCORPORATING A FIRING MECHANISM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation application claiming priority under 35 U.S.C. § 120 to U.S. patent application Ser. No. 14/850,030, entitled ARTICULATION SURGICAL STAPLING INSTRUMENT INCORPORATING A TWO-PIECE E-BEAM FIRING MECHANISM, filed Sep. 10, 2015, which issued on Aug. 22, 2017 as U.S. Pat. No. 9,737,303, which is a continuation application claiming priority under 35 U.S.C. § 120 to U.S. patent application Ser. No. 14/521,748, entitled STAPLE CARTRIDGE, filed Oct. 23, 2014, which issued on Dec. 6, 2016 as U.S. Pat. No. 9,510,830, which is a continuation application claiming priority under 35 U.S.C. § 120 to U.S. patent application Ser. No. 14/175,148, entitled SURGICAL STAPLING INSTRUMENT, filed Feb. 7, 2014, which issued on Mar. 15, 2016 as U.S. Pat. No. 9,282,966, which is a continuation application claiming priority under 35 U.S.C. § 120 to U.S. patent application Ser. No. 13/369,601, entitled ROBOTICALLY-CONTROLLED SURGICAL END EFFECTOR SYSTEM, filed on Feb. 9, 2012, which issued on Jul. 22, 2014 as U.S. Pat. No. 8,783,541, which is a continuation application claiming priority under 35 U.S.C. § 120 to U.S. patent application Ser. No. 13/118,246, entitled ROBOTICALLY-DRIVEN SURGICAL INSTRUMENT WITH E-BEAM DRIVER, filed on May 27, 2011, which issued on Jun. 23, 2015 as U.S. Pat. No. 9,060,770, which is a continuation-in-part application claiming priority under 35 U.S.C. § 120 to U.S. patent application Ser. No. 11/538,154, entitled ARTICULATING SURGICAL STAPLING INSTRUMENT INCORPORATING A TWO-PIECE E-BEAM FIRING MECHANISM, filed on Oct. 3, 2006, now U.S. Patent Application Publication No. 2007/0084897, the entire disclosures of which are hereby incorporated by reference herein. This application is a continuation application claiming priority under 35 U.S.C. § 120 to U.S. patent application Ser. No. 14/850,030, entitled ARTICULATION SURGICAL STAPLING INSTRUMENT INCORPORATING A TWO-PIECE E-BEAM FIRING MECHANISM, filed Sep. 10, 2015, which issued on Aug. 22, 2017 as U.S. Pat. No. 9,737,303, which is a continuation application under 35 U.S.C. § 120 to U.S. patent application Ser. No. 14/521,748, entitled STAPLE CARTRIDGE, filed Oct. 23, 2014, which issued on Dec. 6, 2016 as U.S. Pat. No. 9,510,830, which is a continuation application claiming priority under 35 U.S.C. § 120 to U.S. patent application Ser. No. 14/175,148, entitled SURGICAL STAPLING INSTRUMENT, filed Feb. 7, 2014, which issued on Mar. 15, 2016 as U.S. Pat. No. 9,282,966, which is a continuation application claiming priority under 35 U.S.C. § 120 to U.S. patent application Ser. No. 11/141,753, entitled SURGICAL STAPLING INSTRUMENT HAVING AN ELECTROACTIVE POLYMER ACTUATED MEDICAL SUBSTANCE DISPENSER, filed on Jun. 1, 2005, which issued on Dec. 9, 2014 as U.S. Pat. No. 8,905,977, which claims the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Patent Application Ser. No. 60/591,694, entitled SURGICAL INSTRUMENT INCORPORATING AN ELECTRICALLY ACTUATED ARTICULATION MECHANISM, filed on Jul. 28, 2004, the entire disclosures of which are hereby incorporated by reference herein.

FIELD OF THE INVENTION

The present invention relates in general to surgical instruments that are suitable for endoscopically inserting an end effector that is actuated by a longitudinally driven firing member, and more particularly a surgical stapling and severing instrument that has an articulating shaft.

BACKGROUND OF THE INVENTION

Endoscopic surgical instruments are often preferred over traditional open surgical devices since a smaller incision tends to reduce the post-operative recovery time and complications. Consequently, significant development has gone into a range of endoscopic surgical instruments that are suitable for precise placement of a distal end effector at a desired surgical site through a cannula of a trocar. These distal end effectors engage the tissue in a number of ways to achieve a diagnostic or therapeutic effect (e.g., endocutter, grasper, cutter, staplers, clip applier, access device, drug/gene therapy delivery device, and energy device using ultrasound, RF, laser, etc.).

Positioning the end effector is constrained by the trocar. Generally these endoscopic surgical instruments include a long shaft between the end effector and a handle portion manipulated by the clinician. This long shaft enables insertion to a desired depth and rotation about the longitudinal axis of the shaft, thereby positioning the end effector to a degree. With judicious placement of the trocar and use of graspers, for instance, through another trocar, often this amount of positioning is sufficient. Surgical stapling and severing instruments, such as described in U.S. Pat. No. 5,465,895, are an example of an endoscopic surgical instrument that successfully positions an end effector by insertion and rotation.

More recently, U.S. patent application Ser. No. 10/443,617, entitled SURGICAL STAPLING INSTRUMENT INCORPORATING AN E-BEAM FIRING MECHANISM, filed on May 20, 2003, now U.S. Pat. No. 6,978,921, which is incorporated by reference in its entirety, describes an improved "E-beam" firing bar for severing tissue and actuating staples. Some of the additional advantages include affirmatively spacing the jaws of the end effector, or more specifically a staple applying assembly, even if slightly too much or too little tissue is clamped for optimal staple formation. Moreover, the E-beam firing bar engages the end effector and staple cartridge in a way that enables several beneficial lockouts to be incorporated.

Depending upon the nature of the operation, it may be desirable to further adjust the positioning of the end effector of an endoscopic surgical instrument. In particular, it is often desirable to orient the end effector at an axis transverse to the longitudinal axis of the shaft of the instrument. The transverse movement of the end effector relative to the instrument shaft is conventionally referred to as "articulation". This is typically accomplished by a pivot (or articulation) joint being placed in the extended shaft just proximal to the staple applying assembly. This allows the surgeon to articulate the staple applying assembly remotely to either side for better surgical placement of the staple lines and easier tissue manipulation and orientation. This articulated positioning permits the clinician to more easily engage tissue in some instances, such as behind an organ. In addition, articulated positioning advantageously allows an endoscope to be positioned behind the end effector without being blocked by the instrument shaft.

Approaches to articulating a surgical stapling and severing instrument tend to be complicated by integrating control of the articulation along with the control of closing the end effector to clamp tissue and fire the end effector (i.e., stapling and severing) within the small diameter constraints of an endoscopic instrument. Generally, the three control motions are all transferred through the shaft as longitudinal translations. For instance, U.S. Pat. No. 5,673,840 discloses an accordion-like articulation mechanism ("flex-neck") that is articulated by selectively drawing back one of two connecting rods through the implement shaft, each rod offset respectively on opposite sides of the shaft centerline. The connecting rods ratchet through a series of discrete positions.

Another example of longitudinal control of an articulation mechanism is U.S. Pat. No. 5,865,361 that includes an articulation link offset from a camming pivot such that pushing or pulling longitudinal translation of the articulation link effects articulation to a respective side. Similarly, U.S. Pat. No. 5,797,537 discloses a similar rod passing through the shaft to effect articulation.

In commonly-owned U.S. patent application Ser. No. 10/615,973, entitled SURGICAL INSTRUMENT INCORPORATING AN ARTICULATION MECHANISM HAVING ROTATION ABOUT THE LONGITUDINAL AXIS, now U.S. Pat. No. 7,111,769, the disclosure of which is hereby incorporated by reference in its entirety, a rotational motion is used to transfer articulation motion as an alternative to a longitudinal motion.

In the application entitled SURGICAL STAPLING INSTRUMENT INCORPORATING AN E-BEAM FIRING MECHANISM, U.S. patent application Ser. No. 10/443,617, filed on May 20, 2003, now U.S. Pat. No. 6,978,921, the disclosure of which was previously incorporated by reference in its entirety, a surgical severing and stapling instrument, suitable for laparoscopic and endoscopic clinical procedures, clamps tissue within an end effector of an elongate channel pivotally opposed by an anvil. An E-beam firing bar moves distally through the clamped end effector to sever tissue and to drive staples on each side of the cut. The E-beam firing bar affirmatively spaces the anvil from the elongate channel to assure properly formed closed staples, especially when an amount of tissue is clamped that is inadequate to space the end effector. In particular, an upper pin of the firing bar longitudinally moves through an anvil slot and a channel slot is captured between a lower cap and a middle pin of the firing bar to assure a minimum spacing. While this E-beam firing bar has a number of advantages, additional features are desirable to enhance manufacturability and to minimize dimensional variations.

Consequently, a significant need exists for a surgical instrument with a firing bar that advantageously assures proper spacing between clamped jaws of an end effector and which facilitates articulation of its shaft.

BRIEF DESCRIPTION OF THE FIGURES

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the invention, and, together with the general description of the invention given above, and the detailed description of the embodiments given below, serve to explain the principles of the present invention.

FIG. 1 is a perspective view of an endoscopic surgical stapling instrument for surgical stapling and severing in an open, unarticulated state.

FIG. 2 is a left, front perspective view of an open staple applying assembly of the surgical stapling instrument of

FIG. 1 with a right half portion of a replaceable staple cartridge included in a staple channel.

FIG. 3 is an exploded perspective view of the staple applying assembly of FIG. 2 with a complete replaceable staple cartridge and an alternative nonarticulating shaft configuration.

FIG. 4 is a perspective view of a two-piece knife and firing bar ("E-beam") of the staple applying assembly of FIG. 2.

FIG. 5 is a perspective view of a wedge sled of a staple cartridge of the staple applying assembly of FIG. 1.

FIG. 6 is a left side view in elevation taken in longitudinal cross section along a centerline line 6-6 of the staple applying assembly of FIG. 2.

FIG. 7 is a perspective view of the open staple applying assembly of FIG. 2 without the replaceable staple cartridge, a portion of the staple channel proximate to a middle pin of two-piece knife and firing bar, and without a distal portion of a staple channel.

FIG. 8 is a front view in elevation taken in cross section along line 8-8 of the staple applying assembly of FIG. 2 depicting internal staple drivers of the staple cartridge and portions of the two-piece knife and firing bar.

FIG. 9 is a left side view in elevation taken generally along the longitudinal axis of line 6-6 of a closed staple applying assembly of FIG. 2 to include center contact points between the two-piece knife and wedge sled but also laterally offset to show staples and staple drivers within the staple cartridge.

FIG. 10 is a left side detail view in elevation of the staple applying assembly of FIG. 9 with the two-piece knife retracted slightly more as typical for staple cartridge replacement.

FIG. 11 is a left side detail view in elevation of the staple applying assembly of FIG. 10 with the two-piece knife beginning to fire, corresponding to the configuration depicted in FIG. 9.

FIG. 12 is a left side cross-sectional view in elevation of the closed staple applying assembly of FIG. 9 after the two-piece knife and firing bar has distally fired.

FIG. 13 is a left side cross-sectional view in elevation of the closed staple applying assembly of FIG. 12 after firing of the staple cartridge and retraction of the two-piece knife.

FIG. 14 is a left side cross-sectional detail view in elevation of the staple applying assembly of FIG. 13 with the two-piece knife allowed to drop into a lockout position.

FIG. 15 is a top view in section taken along lines 15-15 of an articulation joint (flex neck) of the surgical stapling instrument of FIG. 1.

FIG. 16 is a front view in elevation taken in vertical cross section along lines 16-16 of the articulation joint of FIG. 15, showing electroactive polymer (EAP) plate articulation actuators and EAP support plates for a firing bar.

FIG. 17 is a top view in section along lines 15-15 of the articulation joint of FIG. 16 after articulation.

FIG. 18 is a perspective view of the articulation joint of FIG. 15.

DETAILED DESCRIPTION OF THE INVENTION

The entire disclosure of U.S. patent application Ser. No. 11/082,495, entitled SURGICAL INSTRUMENT INCORPORATING AN ELECTRICALLY ACTUATED ARTICULATION MECHANISM, filed on Mar. 17, 2005, now U.S. Pat. No. 7,506,790, is incorporated herein by reference. The entire disclosure of U.S. Pat. No. 6,667,825, entitled

STABLE CONJUGATED POLYMER ELECTROCHROMIC DEVICES INCORPORATING IONIC LIQUIDS, issued on Jan. 3, 2002, is incorporated herein by reference. The entire disclosure of U.S. patent application Ser. No. 11/061,908, entitled SURGICAL INSTRUMENT INCORPORATING A FLUID TRANSFER CONTROLLED ARTICULATION MECHANISM, filed on Feb. 18, 2005, now U.S. Pat. No. 7,559,450, is incorporated herein by reference.

In FIGS. 1-3, a surgical stapling instrument 10 has at its distal end an end effector, depicted as a staple applying assembly 12, spaced apart from a handle 14 (FIG. 2) by an elongate shaft 16. The staple applying assembly 12 includes a staple channel 18 for receiving a replaceable staple cartridge 20. Pivotaly attached to the staple channel 18 is an anvil 22 that clamps tissue to the staple cartridge 20 and serves to deform staples 23 (FIG. 3) driven up from staple holes 24 in the staple cartridge 20 against staple forming recesses 26 (FIG. 6) in an anvil undersurface 28 into a closed shape. When the staple applying assembly 12 is closed, its cross sectional area, as well as the elongate shaft 16 are suitable for insertion through a small surgical opening, such as through a cannula of a trocar (not shown).

With particular reference to FIG. 1, correct placement and orientation of the staple applying assembly 12 is facilitated by controls on the handle 14. In particular, a rotation knob 30 causes rotation of the shaft 16 about its longitudinal axis, and hence rotation of the staple applying assembly 12. Additional positioning is enabled at an articulation joint 32 in the shaft 16 that pivots the staple applying assembly 12 in an arc from the longitudinal axis of the shaft 16, thereby allowing placement behind an organ or allowing other instruments such as an endoscope (not shown) to be oriented behind the staple applying assembly 12. This articulation is advantageously effected by an articulation control switch 34 on the handle 14 that transmits an electrical signal to the articulation joint 32 to an Electroactive Polymer (EAP) actuator 36, powered by an EAP controller and power supply 38 contained within the handle 14.

Once positioned with tissue in the staple applying assembly 12, a surgeon closes the anvil 22 by drawing a closure trigger 40 proximally toward a pistol grip 42. Once clamped thus, the surgeon may grasp a more distally presented firing trigger 44, drawing it back to effect firing of the staple applying assembly 12, which in some applications is achieved in one single firing stroke and in other applications by multiple firing strokes. Firing accomplishes simultaneously stapling of at least two rows of staples while severing the tissue therebetween.

Retraction of the firing components may be automatically initiated upon full travel. Alternatively, a retraction lever 46 may be drawn aft to effect retraction. With the firing components retracted, the staple applying assembly 12 may be unclamped and opened by the surgeon slightly drawing the closure trigger 40 aft toward the pistol grip 42 and depressing a closure release button 48 and then releasing the closure trigger 40, thereby releasing the two stapled ends of severed tissue from the staple applying assembly 12.

Staple Applying Assembly

While an articulation joint 32 is depicted in FIG. 1, for clarity and as an alternative application, the surgical stapling instrument 10 of FIGS. 2-14 omit an articulation joint 32. It should be appreciated, however, that aspects of the present invention have particular advantages for articulation as described below with regard to FIGS. 15-18.

In FIGS. 1-3, the staple applying assembly 12 accomplishes the functions of clamping onto tissue, driving staples

and severing tissue by two distinct motions transferred longitudinally down the shaft 16 over a shaft frame 70. This shaft frame 70 is proximally attached to the handle 14 and coupled for rotation with the rotation knob 30. An illustrative multi-stroke handle 14 for the surgical stapling and severing instrument 10 of FIG. 1 is described in greater detail in the commonly-owned U.S. patent application Ser. No. 10/674,026, entitled SURGICAL STAPLING INSTRUMENT INCORPORATING A MULTISTROKE FIRING POSITION INDICATOR AND RETRACTION MECHANISM, now U.S. Pat. No. 7,364,061, the disclosure of which is hereby incorporated by reference in its entirety, with additional features and variation as described herein. While a multi-stroke handle 14 advantageously supports applications with high firing forces over a long distance, applications consistent with the present invention may incorporate a single firing stroke, such as described in commonly-owned U.S. patent application Ser. No. 10/441,632, entitled SURGICAL STAPLING INSTRUMENT HAVING SEPARATE DISTINCT CLOSING AND FIRING SYSTEMS, now U.S. Pat. No. 7,000,818, the disclosure of which is hereby incorporated by reference in its entirety.

With particular reference to FIG. 3, the distal end of the shaft frame 70 is attached to the staple channel 18. The anvil 22 has a proximal pivoting end 72 that is pivotally received within a proximal end 74 of the staple channel 18, just distal to its engagement to the shaft frame 70. The pivoting end 72 of the anvil 22 includes a closure feature 76 proximate but distal to its pivotal attachment with the staple channel 18. Thus, a closure tube 78, whose distal end includes a horseshoe aperture 80 that engages this closure feature 76, selectively imparts an opening motion to the anvil 22 during proximal longitudinal motion and a closing motion to the anvil 22 during distal longitudinal motion of the closure tube 78 sliding over the shaft frame 70 in response to the closure trigger 40.

The shaft frame 70 encompasses and guides a firing motion from the handle 14 through a longitudinally reciprocating, two-piece knife and firing bar 90. In particular, the shaft frame 70 includes a longitudinal firing bar slot 92 that receives a proximal portion of the two-piece knife and firing bar 90, specifically a laminate tapered firing bar 94. It should be appreciated that the laminated tapered firing bar 94 may be substituted with a solid firing bar or of other materials in applications not intended to pass through an articulation joint, such as depicted in FIGS. 2-14.

An E-beam 102 is the distal portion of the two-piece knife and firing bar 90, which facilitates separate closure and firing as well as spacing of the anvil 22 from the elongate staple channel 18 during firing. With particular reference to FIGS. 3-4, in addition to any attachment treatment such as brazing or an adhesive, the knife and firing bar 90 are formed of a female vertical attachment aperture 104 proximally formed in the E-beam 102 that receives a corresponding male attachment member 106 distally presented by the laminated tapered firing bar 94, allowing each portion to be formed of a selected material and process suitable for their disparate functions (e.g., strength, flexibility, friction). The E-beam 102 may be advantageously formed of a material having suitable material properties for forming a pair of top pins 110, a pair of middle pins 112 and a bottom pin or foot 114, as well as being able to acquire a sharp cutting edge 116. In addition, integrally formed and proximally projecting top guide 118 and middle guide 120 bracketing each vertical end of the cutting edge 116 further define a tissue staging area 122 assisting in guiding tissue to the sharp cutting edge 116 prior to being severed. The middle guide

120 also serves to engage and fire the staple applying apparatus 12 by abutting a stepped central member 124 of a wedge sled 126 (FIG. 5) that effects staple formation by the staple applying assembly 12, as described in greater detail below.

Forming these features (e.g., top pins 110, middle pins 112, and bottom foot 114) integrally with the E-beam 102 facilitates manufacturing at tighter tolerances relative to one another as compared to being assembled from a plurality of parts, ensuring desired operation during firing and/or effective interaction with various lockout features of the staple applying assembly 12.

In FIGS. 6-7, the surgical stapling instrument 10 is shown open, with the E-beam 102 fully retracted. During assembly, the lower foot 114 of the E-beam 102 is dropped through a widened hole 130 in the staple channel 18 and the E-beam 102 is then advanced such that the E-beam 102 slides distally along a lower track 132 formed in the staple channel 18. In particular, the lower track 132 includes a narrow slot 133 that opens up as a widened slot 134 on an undersurface of the staple channel 18 to form an inverted T-shape in lateral cross section, as depicted particularly in FIGS. 7 and 8, which communicates with the widened hole 130. Once assembled, the components proximally coupled to the laminate tapered firing bar 94 do not allow the lower foot 114 to proximally travel again to the widened hole 130 to permit disengagement.

In FIG. 9, the laminate tapered firing bar 94 facilitates insertion of the staple applying assembly 12 through a trocar. In particular, a more distal, downward projection 136 raises the E-beam 102 when fully retracted. This is accomplished by placement of the downward projection 136 at a point where it cams upwardly on a proximal edge of the widened hole 130 in the staple channel 18.

In FIG. 10, the laminate tapered firing bar 94 also enhances operation of certain lockout features that may be incorporated into the staple channel 18 by including a more proximal upward projection 138 that is urged downwardly by the shaft frame 70 during an initial portion of the firing travel. In particular, a lateral bar 140 is defined between a pair of square apertures 142 in the shaft frame 70 (FIG. 3). A clip spring 144 that encompasses the lateral bar 140 downwardly urges a portion of the laminate tapered firing bar 94 projecting distally out of the longitudinal firing bar slot 92, which ensures certain advantageous lockout features are engaged when appropriate. This urging is more pronounced or confined solely to that portion of the firing travel when the upward projection 138 contacts the clip spring 144.

In FIGS. 6-7, the E-beam 102 is retracted with the top pins 110 thereof residing within an anvil pocket 150 near the pivoting proximal end of the anvil 22. A downwardly open vertical anvil slot 152 (FIG. 2) laterally widens in the anvil 22 into an anvil internal track 154 that captures the top pins 110 of the E-beam 102 as they distally advance during firing, as depicted in FIGS. 9-10, affirmatively spacing the anvil 22 from the staple channel 18. Thus, with the E-beam 102 retracted, the surgeon is able to repeatably open and close the staple applying assembly 12 until satisfied with the placement and orientation of tissue captured therein for stapling and severing, yet the E-beam 102 assists in proper positioning of tissue even for a staple applying assembly 12 of reduced diameter and correspondingly reduced rigidity.

In FIGS. 2-3, 5-6, 8-14, the staple applying assembly 12 is shown with the replaceable staple cartridge 20 that includes the wedge sled 126. Longitudinally aligned and parallel plurality of downwardly open wedge slots 202 (FIG. 8) receive respective wedges 204 integral to the wedge sled

126. In FIGS. 8-10, the wedge sled 126 thus cams upwardly a plurality of staple drivers 206 that are vertically slidable within staple driver recesses 208. In this illustrative version, each staple driver 206 includes two vertical prongs, each translating upwardly into a respective staple hole 210 to upwardly force out and deform a staple 23 resting thereupon against a staple forming surface 214 (FIG. 10) of the anvil 22. A central firing recess 216 (FIG. 3) defined within the staple cartridge 20 proximate to the staple channel 18 allows the passage of the bottom, horizontal portion 218 (FIG. 5) of the wedge sled 126 as well as the middle pins 112 of the E-beam 102. Specifically, a staple cartridge tray 220 (FIGS. 3, 8) attaches to and underlies a polymer staple cartridge body 222 that has the staple driver recesses 208, staple holes 210, and central firing recess 216 formed therein. As staples 23 are thus formed to either side, the sharp cutting edge 116 enters a vertical through slot 230 passing through the longitudinal axis of the staple cartridge 20, excepting only a most distal end thereof.

Firing the staple applying assembly 12 begins as depicted in FIG. 10 with the two-piece knife and firing bar 90 proximally drawn until the downward projection 136 cams the middle guide 120 on the E-beam 102 upward and aft, allowing a new staple cartridge 20 to be inserted into the staple channel 18 when the anvil 22 is open as depicted in FIGS. 2, 6.

In FIG. 11, the two-piece knife and firing bar 90 has been distally advanced a small distance, allowing the downward projection 136 to drop into the widened hole 130 of the lower track 132 under the urging of the clip spring 144 against the upward projection 138 of the laminate tapered firing bar 94. The middle guide 120 prevents further downward rotation by resting upon the stepped central member 124 of the wedge sled 126, thus maintaining the middle pin 112 of the E-beam within the central firing recess 216.

In FIG. 12, the two-piece knife and firing bar 90 has been distally fired, advancing the wedge sled 126 to cause formation of staples 23 while severing tissue 242 clamped between the anvil 22 and staple cartridge 20 with the sharp cutting edge 116. Thereafter, in FIG. 13, the two-piece knife and firing bar 90 is retracted, leaving the wedge sled 126 distally positioned.

In FIG. 14, the middle pin 112 is allowed to translate down into a lockout recess 240 formed in the staple channel 18 (also see FIGS. 7, 10). Thus, the operator would receive a tactile indication as the middle pin 112 encounters the distal edge of the lockout recess 240 when the wedge sled 126 (not shown in FIG. 14) is not proximally positioned (i.e., missing staple cartridge 20 or spent staple cartridge 20).

In FIG. 1, an articulation joint 32 is depicted that advantageously benefits from the flexible strength of the two-piece knife and firing bar 90. In FIGS. 15-18, the articulation joint 32 is depicted as a flex neck joint 300 formed by vertebral column body 302 having laterally symmetric pairs of arcing recesses 304 that allow articulation in an articulation plane. It is generally known to simultaneously compress and expand respective lateral sides 306, 308 by selective movement of control rods (not shown) that longitudinally pass through the respective lateral sides 306, 308. Depicted, however, are EAP plate actuators 310, 312, each capable of powered deflection to one or both lateral directions.

A central passage 320 (FIG. 16) defined longitudinally through the vertebral column body 302 receives a pair of support plates 322, 324 that prevent buckling and binding of the laminate tapered firing bar 94. In the illustrative version, each support plate 322, 324 has a proximal fixed end 326 (FIG. 15) and a sliding end 328 to accommodate changes in

radial distance during articulation. Having a firing bar **94** of a thinner thickness is thus supported.

While the present invention has been illustrated by description of several embodiments and while the illustrative embodiments have been described in considerable detail, it is not the intention of the applicant to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications may readily appear to those skilled in the art.

For example, while there are a number of advantages to having a wedge sled integral to a staple cartridge, in some applications consistent with aspects of the present invention, the wedge sled may be integral instead to an E-beam. For instance, an entire end effector may be replaceable rather than just the staple cartridge.

What is claimed is:

1. A surgical instrument comprising:

a handle portion operable to produce a firing motion;
a shaft extending from the handle portion, wherein the shaft comprises an articulation joint; and

an implement portion responsive to the firing motion from the handle portion, the implement portion comprising:
an elongate channel coupled to the handle portion and including a channel slot;

a staple cartridge received by the elongate channel and incorporating a proximally-positioned wedge member aligned to cam upward a driver supporting a staple;

an anvil pivotally coupled to the elongate channel and including an anvil channel;

a firing device including a distally-presented cutting edge longitudinally received between the elongate channel and the anvil, an upper member engageable to the anvil channel, a lower member engaging the channel slot, and a middle member operable to actuate the staple cartridge by distally translating the proximally-positioned wedge member of the staple cartridge during a staple firing stroke, the firing device positively engaging both the elongate channel and the anvil during longitudinal firing travel to provide spacing therebetween for staple formation; and

a lockout disabled by the proximally-positioned wedge member, wherein the lockout permits the staple firing stroke when the lockout is disabled, and wherein the lockout prevents the staple firing stroke when the lockout is not disabled.

2. The surgical instrument of claim 1, further comprising an articulation actuator extending through the articulation joint, wherein the implement portion further comprises a mount, and wherein the articulation actuator is operably engaged with the mount.

3. The surgical instrument of claim 2, further comprising an electrically-actuated articulation driver, wherein the handle portion comprises an articulation control system configured to operate the electrically-actuated articulation driver.

4. A surgical instrument, comprising:

a handle operable to produce a firing motion;

a shaft extending from the handle, wherein the shaft comprises an articulation joint; and

an end effector rotatably connected to the shaft about the articulation joint, comprising:

an elongate channel;

a staple cartridge received by the elongate channel, comprising:

staples removably stored therein;

staple drivers supporting the staples; and

a wedge sled aligned to cam the staple drivers and eject the staples from the staple cartridge during a staple firing stroke, wherein the wedge sled is stored in the staple cartridge in a proximal position and movable distally during the staple firing stroke;

an anvil;

a firing member responsive to the firing motion from the handle, comprising:

a distally-presented cutting edge;

a first member configured to engage the anvil;

a second member configured to engage the elongate channel, wherein the firing member engages both the elongate channel and the anvil during the staple firing stroke to space the anvil and staple cartridge for staple formation; and

a feature comprising a lateral face that passes through the elongate channel when the wedge sled is in its proximal position at the beginning of the staple firing stroke; and

a lockout that engages the lateral face of the firing member and prevents the staple firing stroke when the wedge sled is not in its proximal position at the beginning of the staple firing stroke.

5. The surgical instrument of claim 4, further comprising an articulation actuator extending through the articulation joint, wherein the end effector further comprises a mount, and wherein the articulation actuator is operably engaged with the mount.

6. The surgical instrument of claim 5, further comprising an electrically-actuated articulation driver, wherein the handle comprises an articulation control system configured to operate the electrically-actuated articulation driver.

7. A surgical instrument, comprising:

a handle operable to produce a firing motion;

a shaft extending from the handle, wherein the shaft comprises an articulation joint; and

an end effector rotatably connected to the shaft about the articulation joint, wherein the end effector is configurable in an open configuration and a closed configuration, and wherein the end effector comprises:

an elongate channel;

a staple cartridge received by the elongate channel, comprising:

staples removably stored therein;

staple drivers supporting the staples; and

a wedge sled aligned to cam the staple drivers and eject the staples from the staple cartridge during a staple firing stroke, wherein the wedge sled is stored in the staple cartridge in a proximal position and movable distally during the staple firing stroke;

an anvil;

a firing member responsive to the firing motion from the handle, comprising:

a distally-presented cutting edge;

a first member configured to engage the anvil;

a second member configured to engage the elongate channel, wherein the firing member engages both the elongate channel and the anvil during the staple firing stroke to space the anvil and the staple cartridge for staple formation; and

a feature comprising a lateral face that passes through the elongate channel during the staple firing stroke; and

a lockout;

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configured to prevent the staple firing stroke; and
configured to be disabled by the wedge sled when the
wedge sled is in its proximal position at the
beginning of the staple firing stroke and the end
effector is in its closed configuration.

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8. The surgical instrument of claim 7, further comprising
an articulation actuator extending through the articulation
joint, wherein the end effector further comprises a mount,
and wherein the articulation actuator is operably engaged
with the mount.

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9. The surgical instrument of claim 8, further comprising
an electrically-actuated articulation driver, wherein the
handle comprises an articulation control system configured
to operate the electrically-actuated articulation driver.

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专利名称(译)	表现出结合了发射机构的外科缝合器械		
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[标]申请(专利权)人(译)	ETHICON , LLC		
申请(专利权)人(译)	ETHICON LLC		
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摘要(译)

适用于腹腔镜和内窥镜临床手术的外科切断和缝合器械将组织夹在末端执行器内，该末端执行器包括由砧座枢转地相对的细长通道。击发杆向远侧移动通过夹紧的末端执行器以切断组织并在切口的每侧驱动钉。击发杆肯定地将砧座与细长通道隔开，以确保适当形成的闭合钉。

