



US00D924400S

(12) **United States Design Patent** (10) **Patent No.:** **US D924,400 S**
Kimball (45) **Date of Patent:** **** Jul. 6, 2021**

(54) **SURGICAL INSTRUMENT**
(71) Applicant: **Ethicon LLC**, Guaynabo, PR (US)
(72) Inventor: **Cory G. Kimball**, Hamilton, OH (US)
(73) Assignee: **Cilag GmbH International**, Zug (CH)
(**) Term: **15 Years**
(21) Appl. No.: **29/690,185**
(22) Filed: **May 6, 2019**

2,743,726 A 5/1956 Grieshaber
2,748,967 A 6/1956 Roach
2,845,072 A 7/1958 Shafer
2,849,788 A 9/1958 Creek
2,867,039 A 1/1959 Zach
2,874,470 A 2/1959 Richards
2,990,616 A 7/1961 Balamuth et al.
RE25,033 E 8/1961 Balamuth et al.
(Continued)

FOREIGN PATENT DOCUMENTS

CA 2535467 A1 4/1993
CA 2214413 A1 9/1996
(Continued)

Related U.S. Application Data

(62) Division of application No. 29/574,530, filed on Aug. 16, 2016, now Pat. No. Des. 847,990.
(51) **LOC (13) Cl.** **24-02**
(52) **U.S. Cl.**
USPC **D24/145**
(58) **Field of Classification Search**
USPC D24/133, 145; D8/68-70
CPC A61B 17/320092; A61B 2017/2925; A61B 17/320068; A61B 2017/00424; A61B 2017/0042; A61B 18/1445
See application file for complete search history.

OTHER PUBLICATIONS

Technology Overview, printed from www.harmonicscalpel.com, Internet site, website accessed on Jun. 13, 2007, (3 pages).
(Continued)

Primary Examiner — Wan Laymon

(57) **CLAIM**

The ornamental design for a surgical instrument, as shown and described.

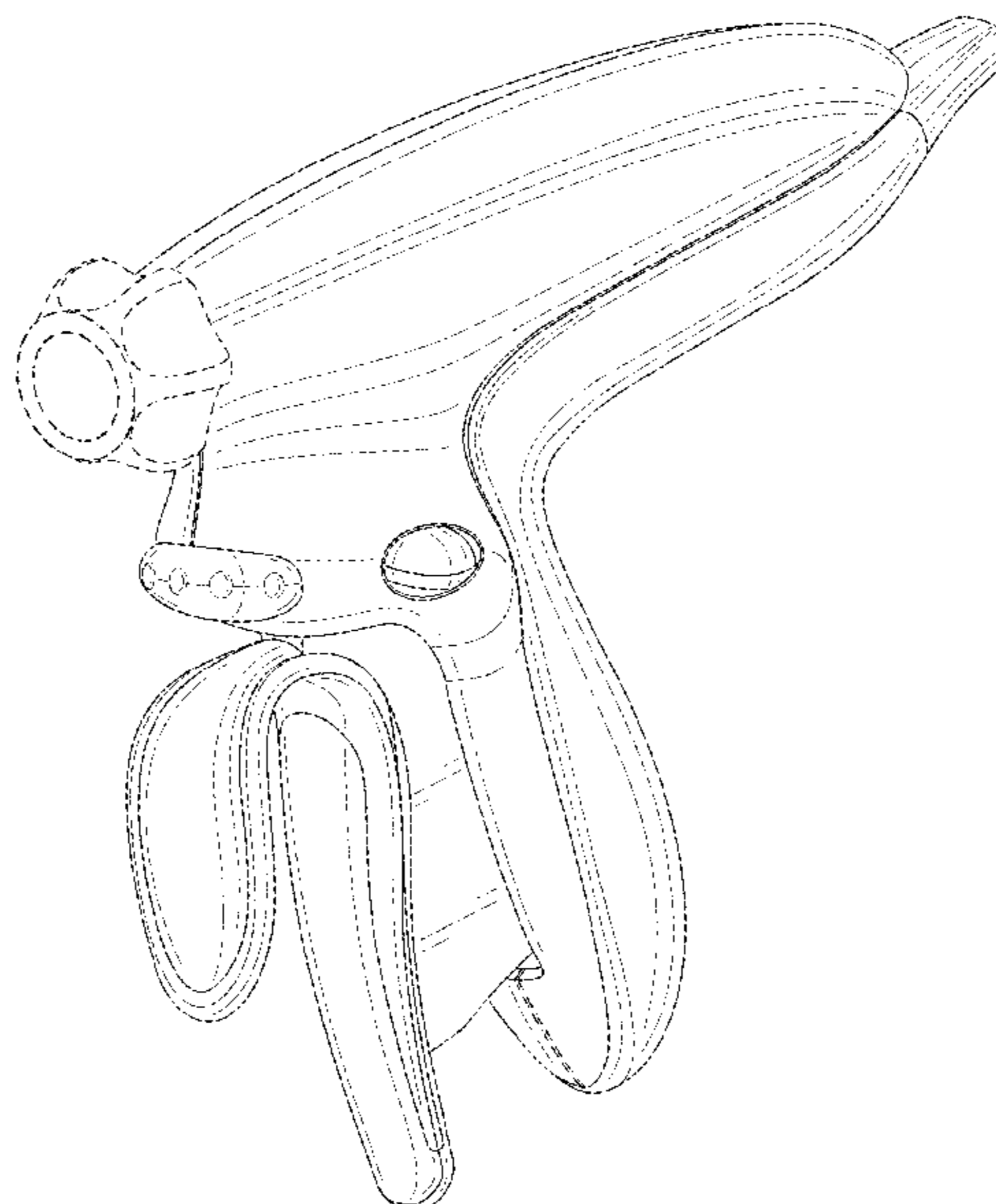
DESCRIPTION

FIG. 1 illustrates a front perspective view of a surgical instrument;
FIG. 2 illustrates a front elevation view thereof;
FIG. 3 illustrates a back elevation view thereof;
FIG. 4 illustrates a side elevation view thereof;
FIG. 5 illustrates a side elevation view thereof;
FIG. 6 illustrates a top plan view thereof; and,
FIG. 7 illustrates a bottom plan view thereof.
The broken lines shown in the drawings are for the purpose of illustrating portions of the surgical instrument and form no part of the claimed design.

1 Claim, 5 Drawing Sheets

(56) **References Cited**
U.S. PATENT DOCUMENTS

969,528 A 9/1910 Disbrow
1,570,025 A 1/1926 Young
1,813,902 A 7/1931 Bovie
2,188,497 A 1/1940 Calva
2,366,274 A 1/1945 Luth et al.
2,425,245 A 8/1947 Johnson
2,442,966 A 6/1948 Wallace
2,458,152 A 1/1949 Eakins
2,510,693 A 6/1950 Green
2,597,564 A 5/1952 Bugg
2,704,333 A 3/1955 Calosi et al.
2,736,960 A 3/1956 Armstrong



(56)

References Cited

U.S. PATENT DOCUMENTS

3,015,961 A	1/1962	Roney	4,512,344 A	4/1985	Barber
3,033,407 A	5/1962	Alfons	4,526,571 A	7/1985	Wuchinich
3,053,124 A	9/1962	Balamuth et al.	4,535,773 A	8/1985	Yoon
3,082,805 A	3/1963	Royce	4,541,638 A	9/1985	Ogawa et al.
3,166,971 A	1/1965	Stoecker	4,545,374 A	10/1985	Jacobson
3,322,403 A	5/1967	Murphy	4,545,926 A	10/1985	Fouts, Jr. et al.
3,432,691 A	3/1969	Shoh	4,550,870 A	11/1985	Krumme et al.
3,433,226 A	3/1969	Boyd	4,553,544 A	11/1985	Nomoto et al.
3,489,930 A	1/1970	Shoh	4,562,838 A	1/1986	Walker
3,503,396 A	3/1970	Pierie et al.	4,574,615 A	3/1986	Bower et al.
3,503,397 A	3/1970	Fogarty et al.	4,582,236 A	4/1986	Hirose
3,503,398 A	3/1970	Fogarty et al.	4,617,927 A	10/1986	Manes
3,513,848 A	5/1970	Winston et al.	4,633,119 A	12/1986	Thompson
3,514,856 A	6/1970	Camp et al.	4,633,874 A	1/1987	Chow et al.
3,525,912 A	8/1970	Wallin	4,634,420 A	1/1987	Spinosa et al.
3,526,219 A	9/1970	Balamuth	4,640,279 A	2/1987	Beard
3,554,198 A	1/1971	Tatoian et al.	4,641,053 A	2/1987	Takeda
3,580,841 A	5/1971	Cadotte et al.	4,646,738 A	3/1987	Trott
3,606,682 A	9/1971	Camp et al.	4,646,756 A	3/1987	Watmough et al.
3,614,484 A	10/1971	Shoh	4,649,919 A	3/1987	Thimsen et al.
3,616,375 A	10/1971	Inoue	4,662,068 A	5/1987	Polonsky
3,629,726 A	12/1971	Popescu	4,663,677 A	5/1987	Griffith et al.
3,636,943 A	1/1972	Balamuth	4,674,502 A	6/1987	Imonti
3,668,486 A	6/1972	Silver	4,696,667 A	9/1987	Masch
3,702,948 A	11/1972	Balamuth	4,708,127 A	11/1987	Abdelghani
3,703,651 A	11/1972	Blowers	4,712,722 A	12/1987	Hood et al.
3,776,238 A	12/1973	Peyman et al.	4,735,603 A	4/1988	Goodson et al.
3,777,760 A	12/1973	Essner	4,750,488 A	6/1988	Wuchinich et al.
3,792,701 A	2/1974	Kloz et al.	4,761,871 A	8/1988	O'Connor et al.
3,805,787 A	4/1974	Banko	4,783,997 A	11/1988	Lynnworth
3,809,977 A	5/1974	Balamuth et al.	4,808,154 A	2/1989	Freeman
3,830,098 A	8/1974	Antonevich	4,819,635 A	4/1989	Shapiro
3,832,776 A	9/1974	Sawyer	4,821,719 A	4/1989	Fogarty
3,854,737 A	12/1974	Gilliam, Sr.	4,827,911 A	5/1989	Broadwin et al.
3,862,630 A	1/1975	Balamuth	4,830,462 A	5/1989	Karny et al.
3,875,945 A	4/1975	Friedman	4,832,683 A	5/1989	Idemoto et al.
3,885,438 A	5/1975	Harris, Sr. et al.	4,836,186 A	6/1989	Scholz
3,900,823 A	8/1975	Sokal et al.	4,838,853 A	6/1989	Parisi
3,918,442 A	11/1975	Nikolaev et al.	4,844,064 A	7/1989	Thimsen et al.
3,924,335 A	12/1975	Balamuth et al.	4,849,133 A	7/1989	Yoshida et al.
3,946,738 A	3/1976	Newton et al.	4,850,354 A	7/1989	McGurk-Burleson et al.
3,955,859 A	5/1976	Stella et al.	4,852,578 A	8/1989	Companion et al.
3,956,826 A	5/1976	Perdreux, Jr.	4,860,745 A	8/1989	Farin et al.
3,989,952 A	11/1976	Hohmann	4,862,890 A	9/1989	Stasz et al.
4,005,714 A	2/1977	Hiltebrandt	4,865,159 A	9/1989	Jamison
4,012,647 A	3/1977	Balamuth et al.	4,867,157 A	9/1989	McGurk-Burleson et al.
4,034,762 A	7/1977	Cosens et al.	4,869,715 A	9/1989	Sherburne
4,058,126 A	11/1977	Leveen	4,878,493 A	11/1989	Pasternak et al.
4,074,719 A	2/1978	Semm	4,880,015 A	11/1989	Nierman
4,085,893 A	4/1978	Durley, III	4,881,550 A	11/1989	Kothe
4,156,187 A	5/1979	Murry et al.	4,896,009 A	1/1990	Pawlowski
4,167,944 A	9/1979	Banko	4,903,696 A	2/1990	Stasz et al.
4,169,984 A	10/1979	Parisi	4,910,389 A	3/1990	Sherman et al.
4,173,725 A	11/1979	Asai et al.	4,915,643 A	4/1990	Samejima et al.
4,188,927 A	2/1980	Harris	4,920,978 A	5/1990	Colvin
4,193,009 A	3/1980	Durley, III	4,922,902 A	5/1990	Wuchinich et al.
4,200,106 A	4/1980	Douvas et al.	4,936,842 A	6/1990	D'Amelio et al.
4,203,430 A	5/1980	Takahashi	4,954,960 A	9/1990	Lo et al.
4,203,444 A	5/1980	Bonnell et al.	4,965,532 A	10/1990	Sakurai
4,220,154 A	9/1980	Semm	4,978,067 A	12/1990	Berger et al.
4,237,441 A	12/1980	van Konynenburg et al.	4,979,952 A	12/1990	Kubota et al.
4,281,785 A	8/1981	Brooks	4,981,756 A	1/1991	Rhandhawa
4,300,083 A	11/1981	Heiges	4,983,160 A	1/1991	Steppe et al.
4,302,728 A	11/1981	Nakamura	5,013,956 A	5/1991	Kurozumi et al.
4,304,987 A	12/1981	van Konynenburg	5,015,227 A	5/1991	Broadwin et al.
4,306,570 A	12/1981	Matthews	5,020,514 A	6/1991	Heckele
4,314,559 A	2/1982	Allen	5,026,370 A	6/1991	Lottick
4,352,459 A	10/1982	Berger et al.	5,026,387 A	6/1991	Thomas
4,445,063 A	4/1984	Smith	5,035,695 A	7/1991	Weber, Jr. et al.
4,452,473 A	6/1984	Ruschke	5,042,461 A	8/1991	Inoue et al.
4,463,759 A	8/1984	Garito et al.	5,042,707 A	8/1991	Taheri
4,491,132 A	1/1985	Aikins	5,047,043 A	9/1991	Kubota et al.
4,492,231 A	1/1985	Auth	5,057,119 A	10/1991	Clark et al.
4,494,759 A	1/1985	Kieffer	5,058,570 A	10/1991	Idemoto et al.
4,504,264 A	3/1985	Kelman	5,059,210 A	10/1991	Clark et al.
			5,061,269 A	10/1991	Muller
			5,084,052 A	1/1992	Jacobs
			5,088,687 A	2/1992	Stender
			5,096,532 A	3/1992	Neuwirth et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

5,099,840 A	3/1992	Goble et al.	5,312,023 A	5/1994	Green et al.
5,104,025 A	4/1992	Main et al.	5,312,327 A	5/1994	Bales et al.
5,105,117 A	4/1992	Yamaguchi	5,312,425 A	5/1994	Evans et al.
5,106,538 A	4/1992	Barma et al.	5,318,525 A	6/1994	West et al.
5,108,383 A	4/1992	White	5,318,563 A	6/1994	Malis et al.
5,109,819 A	5/1992	Custer et al.	5,318,564 A	6/1994	Eggers
5,112,300 A	5/1992	Ureche	5,318,570 A	6/1994	Hood et al.
5,123,903 A	6/1992	Quaid et al.	5,318,589 A	6/1994	Lichtman
5,126,618 A	6/1992	Takahashi et al.	5,322,055 A	6/1994	Davison et al.
D327,872 S	7/1992	McMills et al.	5,323,055 A	6/1994	Yamazaki
D330,253 S	10/1992	Burek	5,324,297 A	6/1994	Hood et al.
5,152,762 A	10/1992	McElhenney	5,324,299 A	6/1994	Davison et al.
5,156,613 A	10/1992	Sawyer	5,326,013 A	7/1994	Green et al.
5,156,633 A	10/1992	Smith	5,326,342 A	7/1994	Pflueger et al.
5,159,226 A	10/1992	Montgomery	5,330,471 A	7/1994	Eggers
5,160,334 A	11/1992	Billings et al.	5,330,502 A	7/1994	Hassler et al.
5,162,044 A	11/1992	Gahn et al.	5,339,723 A	8/1994	Huitema
5,163,421 A	11/1992	Bernstein et al.	5,342,292 A	8/1994	Nita et al.
5,163,537 A	11/1992	Radev	5,342,359 A	8/1994	Rydell
5,167,619 A	12/1992	Wuchinich	5,344,420 A	9/1994	Hilal et al.
5,167,725 A	12/1992	Clark et al.	5,345,937 A	9/1994	Middleman et al.
5,172,344 A	12/1992	Ehrlich	5,346,502 A	9/1994	Estabrook et al.
5,174,276 A	12/1992	Crockard	5,353,474 A	10/1994	Good et al.
D332,660 S	1/1993	Rawson et al.	5,354,265 A	10/1994	Mackool
5,176,677 A	1/1993	Wuchinich	5,357,164 A	10/1994	Imabayashi et al.
5,176,695 A	1/1993	Dulebohn	5,357,423 A	10/1994	Weaver et al.
5,184,605 A	2/1993	Grzeszykowski	5,358,506 A	10/1994	Green et al.
5,188,102 A	2/1993	Idemoto et al.	5,359,994 A	11/1994	Krauter et al.
D334,173 S	3/1993	Liu et al.	5,361,583 A	11/1994	Huitema
5,190,518 A	3/1993	Takasu	5,366,466 A	11/1994	Christian et al.
5,190,541 A	3/1993	Abele et al.	5,368,557 A	11/1994	Nita et al.
5,196,007 A	3/1993	Ellman et al.	5,370,645 A	12/1994	Klicek et al.
5,205,459 A	4/1993	Brinkerhoff et al.	5,371,429 A	12/1994	Manna
5,205,817 A	4/1993	Idemoto et al.	5,372,585 A	12/1994	Tiefenbrun et al.
5,209,719 A	5/1993	Baruch et al.	5,374,813 A	12/1994	Shipp
5,209,776 A	5/1993	Bass et al.	D354,564 S	1/1995	Medema
5,213,103 A	5/1993	Martin et al.	5,381,067 A	1/1995	Greenstein et al.
5,213,569 A	5/1993	Davis	5,383,874 A	1/1995	Jackson et al.
5,214,339 A	5/1993	Naito	5,383,883 A	1/1995	Wilk et al.
5,217,460 A	6/1993	Knoepfler	5,387,207 A	2/1995	Dyer et al.
5,218,529 A	6/1993	Meyer et al.	5,387,215 A	2/1995	Fisher
5,221,282 A	6/1993	Wuchinich	5,389,098 A	2/1995	Tsuruta et al.
5,222,937 A	6/1993	Kagawa	5,391,144 A	2/1995	Sakurai et al.
5,226,909 A	7/1993	Evans et al.	5,394,187 A	2/1995	Shipp
5,226,910 A	7/1993	Kajiyama et al.	5,395,033 A	3/1995	Byrne et al.
5,234,428 A	8/1993	Kaufman	5,395,312 A	3/1995	Desai
5,234,436 A	8/1993	Eaton et al.	5,395,363 A	3/1995	Billings et al.
5,241,236 A	8/1993	Sasaki et al.	5,395,364 A	3/1995	Anderhub et al.
5,241,968 A	9/1993	Slater	5,396,266 A	3/1995	Brimhall
5,242,385 A	9/1993	Strukel	5,396,900 A	3/1995	Slater et al.
5,242,460 A	9/1993	Klein et al.	5,397,293 A	3/1995	Alliger et al.
5,254,129 A	10/1993	Alexander	5,400,267 A	3/1995	Denen et al.
5,257,988 A	11/1993	L'Esperance, Jr.	5,403,312 A	4/1995	Yates et al.
5,258,004 A	11/1993	Bales et al.	5,403,334 A	4/1995	Evans et al.
5,258,006 A	11/1993	Rydell et al.	5,406,503 A	4/1995	Williams, Jr. et al.
5,261,922 A	11/1993	Hood	5,408,268 A	4/1995	Shipp
5,263,957 A	11/1993	Davison	5,409,453 A	4/1995	Lundquist et al.
5,264,925 A	11/1993	Shipp et al.	D358,887 S	5/1995	Feinberg
5,269,297 A	12/1993	Weng et al.	5,411,481 A	5/1995	Allen et al.
5,275,166 A	1/1994	Vaitekunas et al.	5,413,107 A	5/1995	Oakley et al.
5,275,607 A	1/1994	Lo et al.	5,417,709 A	5/1995	Slater
5,275,609 A	1/1994	Pingleton et al.	5,419,761 A	5/1995	Narayanan et al.
5,282,800 A	2/1994	Foshee et al.	5,421,829 A	6/1995	Olichney et al.
5,282,817 A	2/1994	Hoogeboom et al.	5,423,844 A	6/1995	Miller
5,285,795 A	2/1994	Ryan et al.	5,428,504 A	6/1995	Bhatla
5,285,945 A	2/1994	Brinkerhoff et al.	5,429,131 A	7/1995	Scheinman et al.
5,289,436 A	2/1994	Terhune	5,438,997 A	8/1995	Sieben et al.
5,290,286 A	3/1994	Parins	5,441,499 A	8/1995	Fritsch
5,293,863 A	3/1994	Zhu et al.	5,443,463 A	8/1995	Stern et al.
5,300,068 A	4/1994	Rosar et al.	5,445,638 A	8/1995	Rydell et al.
5,304,115 A	4/1994	Pflueger et al.	5,445,639 A	8/1995	Kuslich et al.
5,306,280 A	4/1994	Bregen et al.	5,447,509 A	9/1995	Mills et al.
D347,474 S	5/1994	Olson	5,449,370 A	9/1995	Vaitekunas
5,307,976 A	5/1994	Olson et al.	5,451,220 A	9/1995	Ciervo
5,309,927 A	5/1994	Welch	5,451,227 A	9/1995	Michaelson
			5,456,684 A	10/1995	Schmidt et al.
			5,458,598 A	10/1995	Feinberg et al.
			5,462,604 A	10/1995	Shibano et al.
			5,465,895 A	11/1995	Knodel et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

5,471,988 A	12/1995	Fujio et al.	5,662,667 A	9/1997	Knodel
5,472,443 A	12/1995	Cordis et al.	5,665,085 A	9/1997	Nardella
5,476,479 A	12/1995	Green et al.	5,665,100 A	9/1997	Yoon
5,478,003 A	12/1995	Green et al.	5,669,922 A	9/1997	Hood
5,480,409 A	1/1996	Riza	5,674,219 A	10/1997	Monson et al.
5,483,501 A	1/1996	Park et al.	5,674,220 A	10/1997	Fox et al.
5,484,436 A	1/1996	Eggers et al.	5,674,235 A	10/1997	Parisi
5,486,162 A	1/1996	Brumbach	5,678,568 A	10/1997	Uchikubo et al.
5,486,189 A	1/1996	Mudry et al.	5,688,270 A	11/1997	Yates et al.
5,490,860 A	2/1996	Middle et al.	5,690,269 A	11/1997	Bolanos et al.
5,496,317 A	3/1996	Goble et al.	5,693,051 A	12/1997	Schulze et al.
5,496,411 A	3/1996	Candy	5,694,936 A	12/1997	Fujimoto et al.
5,499,992 A	3/1996	Meade et al.	5,695,510 A	12/1997	Hood
5,500,216 A	3/1996	Julian et al.	5,700,261 A	12/1997	Brinkerhoff
5,501,654 A	3/1996	Failla et al.	5,704,534 A	1/1998	Huitema et al.
5,504,650 A	4/1996	Katsui et al.	5,704,791 A	1/1998	Gillio
5,505,693 A	4/1996	Mackool	5,709,680 A	1/1998	Yates et al.
5,507,738 A	4/1996	Ciervo	5,711,472 A	1/1998	Bryan
5,509,922 A	4/1996	Aranyi et al.	5,713,896 A	2/1998	Nardella
5,511,556 A	4/1996	DeSantis	5,715,817 A	2/1998	Stevens-Wright et al.
5,520,704 A	5/1996	Castro et al.	5,716,366 A	2/1998	Yates
5,522,832 A	6/1996	Kugo et al.	5,717,306 A	2/1998	Shipp
5,522,839 A	6/1996	Pilling	5,720,742 A	2/1998	Zacharias
5,527,273 A	6/1996	Manna et al.	5,720,744 A	2/1998	Eggleston et al.
5,527,331 A	6/1996	Kresch et al.	5,722,980 A	3/1998	Schulz et al.
5,531,744 A	7/1996	Nardella et al.	5,728,130 A	3/1998	Ishikawa et al.
5,540,681 A	7/1996	Strul et al.	5,730,752 A	3/1998	Alden et al.
5,540,693 A	7/1996	Fisher	5,733,074 A	3/1998	Stock et al.
5,542,916 A	8/1996	Hirsch et al.	5,735,848 A	4/1998	Yates et al.
5,553,675 A	9/1996	Pitzen et al.	5,735,875 A	4/1998	Bonutti et al.
5,558,671 A	9/1996	Yates	5,741,226 A	4/1998	Strukel et al.
5,562,609 A	10/1996	Brumbach	5,743,906 A	4/1998	Parins et al.
5,562,610 A	10/1996	Brumbach	5,752,973 A	5/1998	Kieturakis
5,562,659 A	10/1996	Morris	5,755,717 A	5/1998	Yates et al.
5,562,703 A	10/1996	Desai	5,762,255 A	6/1998	Chrisman et al.
5,563,179 A	10/1996	Stone et al.	5,766,164 A	6/1998	Mueller et al.
5,569,164 A	10/1996	Lurz	5,772,659 A	6/1998	Becker et al.
5,571,121 A	11/1996	Heifetz	5,776,130 A	7/1998	Buysse et al.
5,573,424 A	11/1996	Poppe	5,776,155 A	7/1998	Beaupre et al.
5,573,534 A	11/1996	Stone	5,779,130 A	7/1998	Alesi et al.
5,575,799 A	11/1996	Bolanos et al.	5,779,701 A	7/1998	McBrayer et al.
5,577,654 A	11/1996	Bishop	5,782,834 A	7/1998	Lucey et al.
5,582,618 A	12/1996	Chin et al.	5,792,135 A	8/1998	Madhani et al.
5,584,830 A	12/1996	Ladd et al.	5,792,138 A	8/1998	Shipp
5,591,187 A	1/1997	Dekel	5,792,165 A	8/1998	Klieman et al.
5,593,414 A	1/1997	Shipp et al.	5,796,188 A	8/1998	Bays
5,599,350 A	2/1997	Schulze et al.	5,797,941 A	8/1998	Schulze et al.
5,601,601 A	2/1997	Tal et al.	5,797,959 A	8/1998	Castro et al.
5,603,773 A	2/1997	Campbell	5,800,432 A	9/1998	Swanson
5,607,436 A	3/1997	Pratt et al.	5,800,448 A	9/1998	Banko
5,607,450 A	3/1997	Zvenyatsky et al.	5,800,449 A	9/1998	Wales
5,609,573 A	3/1997	Sandock	5,805,140 A	9/1998	Rosenberg et al.
5,611,813 A	3/1997	Lichtman	5,807,310 A	9/1998	Hood
5,618,304 A	4/1997	Hart et al.	5,807,393 A	9/1998	Williamson, IV et al.
5,618,307 A	4/1997	Donlon et al.	5,808,396 A	9/1998	Boukhny
5,618,492 A	4/1997	Auten et al.	5,810,811 A	9/1998	Yates et al.
5,620,447 A	4/1997	Smith et al.	5,810,828 A	9/1998	Lightman et al.
5,624,452 A	4/1997	Yates	5,810,859 A	9/1998	DiMatteo et al.
5,626,587 A	5/1997	Bishop et al.	5,810,869 A	9/1998	Kaplan et al.
5,626,595 A	5/1997	Sklar et al.	5,817,033 A	10/1998	DeSantis et al.
5,628,760 A	5/1997	Knoepfler	5,817,084 A	10/1998	Jensen
5,630,420 A	5/1997	Vaitekunas	5,817,093 A	10/1998	Williamson, IV et al.
5,632,432 A	5/1997	Schulze et al.	5,817,119 A	10/1998	Klieman et al.
5,632,717 A	5/1997	Yoon	5,823,197 A	10/1998	Edwards
5,640,741 A	6/1997	Yano	5,827,323 A	10/1998	Klieman et al.
D381,077 S	7/1997	Hunt	5,828,160 A	10/1998	Sugishita
5,643,301 A	7/1997	Mollenauer	5,833,696 A	11/1998	Whitfield et al.
5,647,851 A	7/1997	Pokras	5,836,897 A	11/1998	Sakurai et al.
5,647,871 A	7/1997	Levine et al.	5,836,909 A	11/1998	Cosmescu
5,649,937 A	7/1997	Bito et al.	5,836,943 A	11/1998	Miller, III
5,649,955 A	7/1997	Hashimoto et al.	5,836,957 A	11/1998	Schulz et al.
5,651,780 A	7/1997	Jackson et al.	5,836,990 A	11/1998	Li
5,653,713 A	8/1997	Michelson	5,843,109 A	12/1998	Mehta et al.
5,658,281 A	8/1997	Heard	5,851,212 A	12/1998	Zirps et al.
5,662,662 A	9/1997	Bishop et al.	5,853,290 A	12/1998	Winston
			5,853,412 A	12/1998	Mayenberger
			5,858,018 A	1/1999	Shipp et al.
			5,865,361 A	2/1999	Milliman et al.
			5,873,873 A	2/1999	Smith et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

5,873,882 A	2/1999	Straub et al.	6,068,647 A	5/2000	Witt et al.
5,876,401 A	3/1999	Schulze et al.	6,074,389 A	6/2000	Levine et al.
5,878,193 A	3/1999	Wang et al.	6,077,285 A	6/2000	Boukhny
5,879,363 A	3/1999	Urich	6,083,191 A	7/2000	Rose
5,879,364 A	3/1999	Bromfield et al.	6,086,584 A	7/2000	Miller
5,880,668 A	3/1999	Hall	6,090,120 A	7/2000	Wright et al.
5,883,615 A	3/1999	Fago et al.	6,091,995 A	7/2000	Ingle et al.
5,891,142 A	4/1999	Eggers et al.	6,096,033 A	8/2000	Tu et al.
5,893,835 A	4/1999	Witt et al.	6,099,483 A	8/2000	Palmer et al.
5,893,880 A	4/1999	Egan et al.	6,099,542 A	8/2000	Cohn et al.
5,895,412 A	4/1999	Tucker	6,099,550 A	8/2000	Yoon
5,897,523 A	4/1999	Wright et al.	6,109,500 A	8/2000	Alli et al.
5,897,569 A	4/1999	Kellogg et al.	6,110,127 A	8/2000	Suzuki
5,903,607 A	5/1999	Tailliet	6,113,594 A	9/2000	Savage
5,904,681 A	5/1999	West, Jr.	6,113,598 A	9/2000	Baker
5,906,625 A	5/1999	Bito et al.	6,117,152 A	9/2000	Huitema
5,906,627 A	5/1999	Spaulding	6,120,519 A	9/2000	Weber et al.
5,906,628 A	5/1999	Miyawaki et al.	H1904 H	10/2000	Yates et al.
5,910,129 A	6/1999	Koblish et al.	6,126,629 A	10/2000	Perkins
5,910,150 A	6/1999	Saadat	6,129,735 A	10/2000	Okada et al.
5,911,699 A	6/1999	Anis et al.	6,129,740 A	10/2000	Michelson
5,916,229 A	6/1999	Evans	6,132,368 A	10/2000	Cooper
5,921,956 A	7/1999	Grinberg et al.	6,132,427 A	10/2000	Jones et al.
5,929,846 A	7/1999	Rosenberg et al.	6,132,448 A	10/2000	Perez et al.
5,935,143 A	8/1999	Hood	6,139,320 A	10/2000	Hahn
5,935,144 A	8/1999	Estabrook	6,139,561 A	10/2000	Shibata et al.
5,938,633 A	8/1999	Beaupre	6,142,615 A	11/2000	Qiu et al.
5,941,887 A	8/1999	Steen et al.	6,142,994 A	11/2000	Swanson et al.
5,944,718 A	8/1999	Austin et al.	6,144,402 A	11/2000	Norsworthy et al.
5,944,737 A	8/1999	Tsonton et al.	6,147,560 A	11/2000	Erhage et al.
5,947,984 A	9/1999	Whipple	6,152,902 A	11/2000	Christian et al.
5,954,736 A	9/1999	Bishop et al.	6,152,923 A	11/2000	Ryan
5,954,746 A	9/1999	Holthaus et al.	6,154,198 A	11/2000	Rosenberg
5,957,882 A	9/1999	Nita et al.	6,156,029 A	12/2000	Mueller
5,957,943 A	9/1999	Vaitekunas	6,159,160 A	12/2000	Hsei et al.
5,968,007 A	10/1999	Simon et al.	6,159,175 A	12/2000	Strukel et al.
5,968,060 A	10/1999	Kellogg	6,162,194 A	12/2000	Shipp
5,971,949 A	10/1999	Levin et al.	6,162,208 A	12/2000	Hipps
5,974,342 A	10/1999	Petrofsky	6,165,150 A	12/2000	Banko
D416,089 S	11/1999	Barton et al.	6,165,186 A	12/2000	Fogarty et al.
5,980,510 A	11/1999	Tsonton et al.	6,165,191 A	12/2000	Shibata et al.
5,980,546 A	11/1999	Hood	6,174,309 B1	1/2001	Wrublewski et al.
5,984,938 A	11/1999	Yoon	6,174,310 B1	1/2001	Kirwan, Jr.
5,989,274 A	11/1999	Davison et al.	6,176,857 B1	1/2001	Ashley
5,989,275 A	11/1999	Estabrook et al.	6,179,853 B1	1/2001	Sachse et al.
5,993,465 A	11/1999	Shipp et al.	6,183,426 B1	2/2001	Akisada et al.
5,993,972 A	11/1999	Reich et al.	6,187,003 B1	2/2001	Buysse et al.
5,994,855 A	11/1999	Lundell et al.	6,190,386 B1	2/2001	Rydell
6,001,120 A	12/1999	Levin	6,193,709 B1	2/2001	Miyawaki et al.
6,003,517 A	12/1999	Sheffield et al.	6,204,592 B1	3/2001	Hur
6,004,335 A	12/1999	Vaitekunas et al.	6,205,855 B1	3/2001	Pfeiffer
6,007,552 A	12/1999	Fogarty et al.	6,206,844 B1	3/2001	Reichel et al.
6,013,052 A	1/2000	Durman et al.	6,206,876 B1	3/2001	Levine et al.
6,024,741 A	2/2000	Williamson, IV et al.	6,206,877 B1	3/2001	Kese et al.
6,024,744 A	2/2000	Kese et al.	6,210,337 B1	4/2001	Dunham et al.
6,024,750 A	2/2000	Mastri et al.	6,210,402 B1	4/2001	Olsen et al.
6,027,515 A	2/2000	Cimino	6,210,403 B1	4/2001	Klicek
6,031,526 A	2/2000	Shipp	6,214,023 B1	4/2001	Whipple et al.
6,033,375 A	3/2000	Brumbach	6,217,591 B1	4/2001	Egan et al.
6,033,399 A	3/2000	Gines	6,228,080 B1	5/2001	Gines
6,036,667 A	3/2000	Manna et al.	6,228,104 B1	5/2001	Fogarty et al.
6,036,707 A	3/2000	Spaulding	6,231,565 B1	5/2001	Tovey et al.
6,039,734 A	3/2000	Goble	6,233,476 B1	5/2001	Strommer et al.
6,048,224 A	4/2000	Kay	6,238,366 B1	5/2001	Savage et al.
6,050,943 A	4/2000	Slayton et al.	6,241,724 B1	6/2001	Fleischman et al.
6,050,996 A	4/2000	Schmaltz et al.	6,245,065 B1	6/2001	Panescu et al.
6,051,010 A	4/2000	DiMatteo et al.	6,251,110 B1	6/2001	Wampler
6,053,906 A	4/2000	Honda et al.	6,252,110 B1	6/2001	Uemura et al.
6,056,735 A	5/2000	Okada et al.	D444,365 S	7/2001	Bass et al.
6,063,050 A	5/2000	Manna et al.	D445,092 S	7/2001	Lee
6,063,098 A	5/2000	Houser et al.	D445,764 S	7/2001	Lee
6,066,132 A	5/2000	Chen et al.	6,254,623 B1	7/2001	Haibel, Jr. et al.
6,066,151 A	5/2000	Miyawaki et al.	6,257,241 B1	7/2001	Wampler
6,068,627 A	5/2000	Orszulak et al.	6,258,034 B1	7/2001	Hanafy
6,068,629 A	5/2000	Haissaguerre et al.	6,259,230 B1	7/2001	Chou
			6,267,761 B1	7/2001	Ryan
			6,270,471 B1	8/2001	Hechel et al.
			6,270,831 B2	8/2001	Kumar et al.
			6,273,852 B1	8/2001	Lehe et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

6,273,902 B1	8/2001	Fogarty et al.	6,468,286 B2	10/2002	Mastri et al.
6,274,963 B1	8/2001	Estabrook et al.	6,475,211 B2	11/2002	Chess et al.
6,277,115 B1	8/2001	Saadat	6,475,215 B1	11/2002	Tanrisever
6,277,117 B1	8/2001	Tetzlaff et al.	6,480,796 B2	11/2002	Wiener
6,278,218 B1	8/2001	Madan et al.	6,485,490 B2	11/2002	Wampler et al.
6,280,407 B1	8/2001	Manna et al.	6,491,690 B1	12/2002	Goble et al.
6,283,981 B1	9/2001	Beaupre	6,491,701 B2	12/2002	Tierney et al.
6,287,344 B1	9/2001	Wampler et al.	6,491,708 B2	12/2002	Madan et al.
6,290,575 B1	9/2001	Shipp	6,497,715 B2	12/2002	Satou
6,292,700 B1	9/2001	Morrison et al.	6,498,421 B1	12/2002	Oh et al.
6,293,954 B1	9/2001	Fogarty et al.	6,500,112 B1	12/2002	Khoury
6,299,591 B1	10/2001	Banko	6,500,176 B1	12/2002	Truckai et al.
6,299,621 B1	10/2001	Fogarty et al.	6,500,188 B2	12/2002	Harper et al.
6,306,131 B1	10/2001	Hareyama et al.	6,500,312 B2	12/2002	Wedekamp
6,306,157 B1	10/2001	Shchervinsky	6,503,248 B1	1/2003	Levine
6,309,400 B2	10/2001	Beaupre	6,506,208 B2	1/2003	Hunt et al.
6,311,783 B1	11/2001	Harpell	6,511,478 B1	1/2003	Burnside et al.
6,312,445 B1	11/2001	Fogarty et al.	6,511,480 B1	1/2003	Tetzlaff et al.
6,319,221 B1	11/2001	Savage et al.	6,511,493 B1	1/2003	Moutafis et al.
6,325,795 B1	12/2001	Lindemann et al.	6,514,252 B2	2/2003	Nezhat et al.
6,325,799 B1	12/2001	Goble	6,514,267 B2	2/2003	Jewett
6,325,811 B1	12/2001	Messerly	6,517,565 B1	2/2003	Whitman et al.
6,328,751 B1	12/2001	Beaupre	6,524,251 B2	2/2003	Rabiner et al.
6,332,891 B1	12/2001	Himes	6,524,316 B1	2/2003	Nicholson et al.
6,333,488 B1	12/2001	Lawrence et al.	6,526,976 B1	3/2003	Baran
6,338,657 B1	1/2002	Harper et al.	6,527,736 B1	3/2003	Attinger et al.
6,340,352 B1	1/2002	Okada et al.	6,531,846 B1	3/2003	Smith
6,340,878 B1	1/2002	Oglesbee	6,533,784 B2	3/2003	Truckai et al.
6,350,269 B1	2/2002	Shipp et al.	6,537,272 B2	3/2003	Christopherson et al.
6,352,532 B1	3/2002	Kramer et al.	6,537,291 B2	3/2003	Friedman et al.
6,358,264 B2	3/2002	Banko	6,543,452 B1	4/2003	Lavigne
6,364,888 B1	4/2002	Niemeyer et al.	6,543,456 B1	4/2003	Freeman
6,379,320 B1	4/2002	Lafon et al.	6,544,260 B1	4/2003	Markel et al.
D457,958 S	5/2002	Dycus et al.	6,551,309 B1	4/2003	LePivert
6,383,194 B1	5/2002	Pothula	6,554,829 B2	4/2003	Schulze et al.
6,384,690 B1	5/2002	Wilhelmsson et al.	6,558,376 B2	5/2003	Bishop
6,387,094 B1	5/2002	Eitenmuller	6,561,983 B2	5/2003	Cronin et al.
6,387,109 B1	5/2002	Davison et al.	6,562,035 B1	5/2003	Levin
6,387,112 B1	5/2002	Fogarty et al.	6,562,037 B2	5/2003	Paton et al.
6,388,657 B1	5/2002	Natoli	6,562,059 B2	5/2003	Edwards et al.
6,391,026 B1	5/2002	Hung et al.	6,565,558 B1	5/2003	Lindenmeier et al.
6,391,042 B1	5/2002	Cimino	6,569,109 B2	5/2003	Sakurai et al.
6,398,779 B1	6/2002	Buyse et al.	6,569,178 B1	5/2003	Miyawaki et al.
6,402,743 B1	6/2002	Orszulak et al.	6,572,563 B2	6/2003	Ouchi
6,402,748 B1	6/2002	Schoenman et al.	6,572,632 B2	6/2003	Zisterer et al.
6,405,733 B1	6/2002	Fogarty et al.	6,572,639 B1	6/2003	Ingle et al.
6,409,722 B1	6/2002	Hoey et al.	6,575,929 B2	6/2003	Sussman et al.
6,409,743 B1	6/2002	Fenton, Jr.	6,575,969 B1	6/2003	Rittman, III et al.
H2037 H	7/2002	Yates et al.	6,582,427 B1	6/2003	Goble et al.
6,416,469 B1	7/2002	Phung et al.	6,582,451 B1	6/2003	Marucci et al.
6,416,486 B1	7/2002	Wampler	6,584,360 B2	6/2003	Francischelli et al.
6,416,525 B1	7/2002	Shibata	D477,408 S	7/2003	Bromley
6,419,675 B1	7/2002	Gallo, Sr.	6,585,735 B1	7/2003	Frazier et al.
6,423,073 B2	7/2002	Bowman	6,588,277 B2	7/2003	Giordano et al.
6,423,082 B1	7/2002	Houser et al.	6,589,200 B1	7/2003	Schwemberger et al.
6,425,906 B1	7/2002	Young et al.	6,589,239 B2	7/2003	Khandkar et al.
6,425,907 B1	7/2002	Shibata et al.	6,599,288 B2	7/2003	Maguire et al.
6,428,538 B1	8/2002	Blewett et al.	6,602,229 B2	8/2003	Coss
6,428,539 B1	8/2002	Baxter et al.	6,602,252 B2	8/2003	Mollenauer
6,430,446 B1	8/2002	Knowlton	6,607,540 B1	8/2003	Shipp
6,432,118 B1	8/2002	Messerly	6,610,059 B1	8/2003	West, Jr.
6,436,114 B1	8/2002	Novak et al.	6,610,060 B2	8/2003	Mulier et al.
6,436,115 B1	8/2002	Beaupre	6,616,450 B2	9/2003	Mossle et al.
6,440,062 B1	8/2002	Ouchi	6,619,529 B2	9/2003	Green et al.
6,443,968 B1	9/2002	Holthaus et al.	6,620,161 B2	9/2003	Schulze et al.
6,443,969 B1	9/2002	Novak et al.	6,622,731 B2	9/2003	Daniel et al.
6,449,006 B1	9/2002	Shipp	6,623,444 B2	9/2003	Babaev
6,454,781 B1	9/2002	Witt et al.	6,623,482 B2	9/2003	Pendekanti et al.
6,454,782 B1	9/2002	Schwemberger	6,623,500 B1	9/2003	Cook et al.
6,458,128 B1	10/2002	Schulze	6,623,501 B2	9/2003	Heller et al.
6,458,130 B1	10/2002	Frazier et al.	6,626,848 B2	9/2003	Neuenfeldt
6,458,142 B1	10/2002	Faller et al.	6,626,926 B2	9/2003	Friedman et al.
6,461,363 B1	10/2002	Gadberry et al.	6,629,974 B2	10/2003	Penny et al.
6,464,689 B1	10/2002	Qin et al.	6,633,234 B2	10/2003	Wiener et al.
6,464,702 B2	10/2002	Schulze et al.	6,635,057 B2	10/2003	Harano et al.
			6,644,532 B2	11/2003	Green et al.
			6,648,839 B2	11/2003	Manna et al.
			6,648,883 B2	11/2003	Francischelli et al.
			6,651,669 B1	11/2003	Burnside

(56)

References Cited

U.S. PATENT DOCUMENTS

- 7,044,949 B2 5/2006 Orszulak et al.
7,052,494 B2 5/2006 Goble et al.
7,052,496 B2 5/2006 Yamauchi
7,055,731 B2 6/2006 Shelton, IV et al.
7,063,699 B2 6/2006 Hess et al.
7,066,893 B2 6/2006 Hibner et al.
7,066,895 B2 6/2006 Podany
7,066,936 B2 6/2006 Ryan
7,070,597 B2 7/2006 Truckai et al.
7,074,218 B2 7/2006 Washington et al.
7,074,219 B2 7/2006 Levine et al.
7,077,039 B2 7/2006 Gass et al.
7,077,845 B2 7/2006 Hacker et al.
7,077,853 B2 7/2006 Kramer et al.
7,083,075 B2 8/2006 Swayze et al.
7,083,618 B2 8/2006 Couture et al.
7,083,619 B2 8/2006 Truckai et al.
7,087,054 B2 8/2006 Truckai et al.
7,090,672 B2 8/2006 Underwood et al.
7,094,235 B2 8/2006 Francischelli
7,101,371 B2 9/2006 Dycus et al.
7,101,372 B2 9/2006 Dycus et al.
7,101,373 B2 9/2006 Dycus et al.
7,101,378 B2 9/2006 Salameh et al.
7,104,834 B2 9/2006 Robinson et al.
7,108,695 B2 9/2006 Witt et al.
7,111,769 B2 9/2006 Wales et al.
7,112,201 B2 9/2006 Truckai et al.
D531,311 S 10/2006 Guerra et al.
7,117,034 B2 10/2006 Kronberg
7,118,564 B2 10/2006 Ritchie et al.
7,118,570 B2 10/2006 Tetzlaff et al.
7,119,516 B2 10/2006 Denning
7,124,932 B2 10/2006 Isaacson et al.
7,125,409 B2 10/2006 Truckai et al.
7,128,720 B2 10/2006 Podany
7,131,860 B2 11/2006 Sartor et al.
7,131,970 B2 11/2006 Moses et al.
7,131,983 B2 11/2006 Murakami
7,135,018 B2 11/2006 Ryan et al.
7,135,029 B2 11/2006 Makin et al.
7,135,030 B2 11/2006 Schwemberger et al.
7,137,980 B2 11/2006 Buysse et al.
7,143,925 B2 12/2006 Shelton, IV et al.
7,144,403 B2 12/2006 Booth
7,147,138 B2 12/2006 Shelton, IV
7,153,315 B2 12/2006 Miller
D536,093 S 1/2007 Nakajima et al.
7,156,189 B1 1/2007 Bar-Cohen et al.
7,156,201 B2 1/2007 Peshkovskiy et al.
7,156,846 B2 1/2007 Dycus et al.
7,156,853 B2 1/2007 Muratsu
7,157,058 B2 1/2007 Marhasin et al.
7,159,750 B2 1/2007 Racenet et al.
7,160,259 B2 1/2007 Tardy et al.
7,160,296 B2 1/2007 Pearson et al.
7,160,298 B2 1/2007 Lawes et al.
7,160,299 B2 1/2007 Baily
7,163,548 B2 1/2007 Stulen et al.
7,169,144 B2 1/2007 Hoey et al.
7,169,146 B2 1/2007 Truckai et al.
7,169,156 B2 1/2007 Hart
7,179,254 B2 2/2007 Pendekanti et al.
7,179,271 B2 2/2007 Friedman et al.
7,182,762 B2 2/2007 Bortkiewicz
7,186,253 B2 3/2007 Truckai et al.
7,189,233 B2 3/2007 Truckai et al.
7,195,631 B2 3/2007 Dumbauld
D541,418 S 4/2007 Schechter et al.
7,198,635 B2 4/2007 Danek et al.
7,204,820 B2 4/2007 Akahoshi
7,207,471 B2 4/2007 Heinrich et al.
7,207,997 B2 4/2007 Shipp et al.
7,208,005 B2 4/2007 Frecker et al.
7,210,881 B2 5/2007 Greenberg
7,211,079 B2 5/2007 Treat
7,217,128 B2 5/2007 Atkin et al.
7,217,269 B2 5/2007 El-Galley et al.
7,220,951 B2 5/2007 Truckai et al.
7,223,229 B2 5/2007 Inman et al.
7,225,964 B2 6/2007 Mastri et al.
7,226,448 B2 6/2007 Bertolero et al.
7,229,455 B2 6/2007 Sakurai et al.
7,232,440 B2 6/2007 Dumbauld et al.
7,235,071 B2 6/2007 Gonnering
7,235,073 B2 6/2007 Levine et al.
7,241,294 B2 7/2007 Reschke
7,244,262 B2 7/2007 Wiener et al.
7,251,531 B2 7/2007 Mosher et al.
7,252,667 B2 8/2007 Moses et al.
7,258,688 B1 8/2007 Shah et al.
7,264,618 B2 9/2007 Murakami et al.
7,267,677 B2 9/2007 Johnson et al.
7,267,685 B2 9/2007 Butaric et al.
7,269,873 B2 9/2007 Brewer et al.
7,273,483 B2 9/2007 Wiener et al.
D552,241 S 10/2007 Bromley et al.
7,282,048 B2 10/2007 Goble et al.
7,282,836 B2 10/2007 Kwon et al.
7,285,895 B2 10/2007 Beaupre
7,287,682 B1 10/2007 Ezzat et al.
7,300,431 B2 11/2007 Dubrovsky
7,300,435 B2 11/2007 Wham et al.
7,300,446 B2 11/2007 Beaupre
7,300,450 B2 11/2007 Vleugels et al.
7,303,531 B2 12/2007 Lee et al.
7,303,557 B2 12/2007 Wham et al.
7,306,597 B2 12/2007 Manzo
7,307,313 B2 12/2007 Ohyanagi et al.
7,309,849 B2 12/2007 Truckai et al.
7,311,706 B2 12/2007 Schoenman et al.
7,311,709 B2 12/2007 Truckai et al.
7,317,955 B2 1/2008 McGreevy
7,318,831 B2 1/2008 Alvarez et al.
7,318,832 B2 1/2008 Young et al.
7,326,236 B2 2/2008 Andreas et al.
7,329,257 B2 2/2008 Kanehira et al.
7,331,410 B2 2/2008 Yong et al.
7,335,165 B2 2/2008 Truwit et al.
7,335,997 B2 2/2008 Wiener
7,337,010 B2 2/2008 Howard et al.
7,338,463 B2 3/2008 Vigil
7,353,068 B2 4/2008 Tanaka et al.
7,354,440 B2 4/2008 Truckal et al.
7,357,287 B2 4/2008 Shelton, IV et al.
7,361,172 B2 4/2008 Cimino
7,364,577 B2 4/2008 Wham et al.
7,367,976 B2 5/2008 Lawes et al.
7,371,227 B2 5/2008 Zeiner
RE40,388 E 6/2008 Gines
7,380,695 B2 6/2008 Doll et al.
7,380,696 B2 6/2008 Shelton, IV et al.
7,381,209 B2 6/2008 Truckai et al.
7,384,420 B2 6/2008 Dycus et al.
7,390,317 B2 6/2008 Taylor et al.
7,396,356 B2 7/2008 Mollenauer
7,403,224 B2 7/2008 Fuller et al.
7,404,508 B2 7/2008 Smith et al.
7,407,077 B2 8/2008 Ortiz et al.
7,408,288 B2 8/2008 Hara
7,413,123 B2 8/2008 Ortenzi
7,416,101 B2 8/2008 Shelton, IV et al.
7,416,437 B2 8/2008 Sartor et al.
D576,725 S 9/2008 Shumer et al.
7,419,490 B2 9/2008 Falkenstein et al.
7,422,139 B2 9/2008 Shelton, IV et al.
7,422,463 B2 9/2008 Kuo
D578,643 S 10/2008 Shumer et al.
D578,644 S 10/2008 Shumer et al.
D578,645 S 10/2008 Shumer et al.
7,431,694 B2 10/2008 Stefanichik et al.
7,431,704 B2 10/2008 Babaev
7,435,582 B2 10/2008 Zimmermann et al.
7,441,684 B2 10/2008 Shelton, IV et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

7,442,168 B2	10/2008	Novak et al.	7,632,267 B2	12/2009	Dahla
7,442,193 B2	10/2008	Shields et al.	7,632,269 B2	12/2009	Truckai et al.
7,445,621 B2	11/2008	Dumbauld et al.	7,637,410 B2	12/2009	Marczyk
7,449,004 B2	11/2008	Yamada et al.	7,641,653 B2	1/2010	Dalla Betta et al.
7,451,904 B2	11/2008	Shelton, IV	7,641,671 B2	1/2010	Crainich
7,455,208 B2	11/2008	Wales et al.	7,644,848 B2	1/2010	Swayze et al.
7,455,641 B2	11/2008	Yamada et al.	7,645,245 B2	1/2010	Sekino et al.
7,462,181 B2	12/2008	Kraft et al.	7,645,277 B2	1/2010	McClurken et al.
7,464,846 B2	12/2008	Shelton, IV et al.	7,645,278 B2	1/2010	Ichihashi et al.
7,472,815 B2	1/2009	Shelton, IV et al.	7,648,499 B2	1/2010	Orszulak et al.
7,473,253 B2	1/2009	Dycus et al.	7,654,431 B2	2/2010	Hueil et al.
7,473,263 B2	1/2009	Johnston et al.	7,658,311 B2	2/2010	Boudreaux
7,479,148 B2	1/2009	Beaupre	7,659,833 B2	2/2010	Warner et al.
7,479,160 B2	1/2009	Branch et al.	7,662,151 B2	2/2010	Crompton, Jr. et al.
7,481,775 B2	1/2009	Weikel, Jr. et al.	7,665,647 B2	2/2010	Shelton, IV et al.
7,488,285 B2	2/2009	Honda et al.	7,666,206 B2	2/2010	Taniguchi et al.
7,488,319 B2	2/2009	Yates	7,670,334 B2	3/2010	Hueil et al.
7,491,201 B2	2/2009	Shields et al.	7,670,338 B2	3/2010	Albrecht et al.
7,491,202 B2	2/2009	Odom et al.	7,674,263 B2	3/2010	Ryan
7,494,468 B2	2/2009	Rabiner et al.	7,678,069 B1	3/2010	Baker et al.
7,494,501 B2	2/2009	Ahlberg et al.	7,678,125 B2	3/2010	Shipp
7,498,080 B2	3/2009	Tung et al.	7,682,366 B2	3/2010	Sakurai et al.
7,502,234 B2	3/2009	Goliszek et al.	7,686,763 B2	3/2010	Vaezy et al.
7,503,893 B2	3/2009	Kucklick	7,686,770 B2	3/2010	Cohen
7,503,895 B2	3/2009	Rabiner et al.	7,686,826 B2	3/2010	Lee et al.
7,506,790 B2	3/2009	Shelton, IV	7,688,028 B2	3/2010	Phillips et al.
7,506,791 B2	3/2009	Omaits et al.	7,691,095 B2	4/2010	Bednarek et al.
7,510,107 B2	3/2009	Timm et al.	7,691,098 B2	4/2010	Wallace et al.
7,510,556 B2	3/2009	Nguyen et al.	7,699,846 B2	4/2010	Ryan
7,513,025 B2	4/2009	Fischer	7,703,459 B2	4/2010	Saadat et al.
7,517,349 B2	4/2009	Truckai et al.	7,703,653 B2	4/2010	Shah et al.
7,520,865 B2	4/2009	Radley Young et al.	7,708,735 B2	5/2010	Chapman et al.
7,524,320 B2	4/2009	Tierney et al.	7,708,751 B2	5/2010	Hughes et al.
7,530,986 B2	5/2009	Beaupre et al.	7,708,758 B2	5/2010	Lee et al.
7,533,830 B1	5/2009	Rose	7,713,202 B2	5/2010	Boukhny et al.
7,534,243 B1	5/2009	Chin et al.	7,713,267 B2	5/2010	Pozzato
D594,983 S	6/2009	Price et al.	7,714,481 B2	5/2010	Sakai
7,540,871 B2	6/2009	Gonnering	7,717,312 B2	5/2010	Beetel
7,540,872 B2	6/2009	Schechter et al.	7,717,914 B2	5/2010	Kimura
7,543,730 B1	6/2009	Marczyk	7,717,915 B2	5/2010	Miyazawa
7,544,200 B2	6/2009	Houser	7,721,935 B2	5/2010	Racenet et al.
7,549,564 B2	6/2009	Boudreaux	7,722,527 B2	5/2010	Bouchier et al.
7,550,216 B2	6/2009	Ofer et al.	7,722,607 B2	5/2010	Dumbauld et al.
7,553,309 B2	6/2009	Buyse et al.	D618,797 S	6/2010	Price et al.
7,559,450 B2	7/2009	Wales et al.	7,726,537 B2	6/2010	Olson et al.
7,559,452 B2	7/2009	Wales et al.	7,727,177 B2	6/2010	Bayat
7,563,259 B2	7/2009	Takahashi	7,734,476 B2	6/2010	Wildman et al.
7,563,269 B2	7/2009	Hashiguchi	7,738,969 B2	6/2010	Bleich
7,566,318 B2	7/2009	Haefner	7,740,594 B2	6/2010	Hibner
7,567,012 B2	7/2009	Namikawa	7,749,240 B2	7/2010	Takahashi et al.
7,568,603 B2	8/2009	Shelton, IV et al.	7,749,273 B2	7/2010	Cauthen, III et al.
7,569,057 B2	8/2009	Liu et al.	7,751,115 B2	7/2010	Song
7,572,266 B2	8/2009	Young et al.	7,753,904 B2	7/2010	Shelton, IV et al.
7,572,268 B2	8/2009	Babaev	7,753,908 B2	7/2010	Swanson
7,578,166 B2	8/2009	Ethridge et al.	7,762,445 B2	7/2010	Heinrich et al.
7,578,820 B2	8/2009	Moore et al.	7,762,979 B2	7/2010	Wuchinich
7,582,084 B2	9/2009	Swanson et al.	D621,503 S	8/2010	Otten et al.
7,582,086 B2	9/2009	Privitera et al.	7,766,210 B2	8/2010	Shelton, IV et al.
7,582,095 B2	9/2009	Shipp et al.	7,766,693 B2	8/2010	Sartor et al.
7,585,181 B2	9/2009	Olsen	7,766,910 B2	8/2010	Hixson et al.
7,586,289 B2	9/2009	Andruk et al.	7,770,774 B2	8/2010	Mastri et al.
7,587,536 B2	9/2009	McLeod	7,770,775 B2	8/2010	Shelton, IV et al.
7,588,176 B2	9/2009	Timm et al.	7,771,425 B2	8/2010	Dycus et al.
7,588,177 B2	9/2009	Racenet	7,771,444 B2	8/2010	Patel et al.
7,594,925 B2	9/2009	Danek et al.	7,775,972 B2	8/2010	Brock et al.
7,597,693 B2	10/2009	Garrison	7,776,036 B2	8/2010	Schechter et al.
7,601,119 B2	10/2009	Shahinian	7,776,037 B2	8/2010	Odom
7,604,150 B2	10/2009	Boudreaux	7,778,733 B2	8/2010	Nowlin et al.
7,607,557 B2	10/2009	Shelton, IV et al.	7,780,054 B2	8/2010	Wales
7,608,054 B2	10/2009	Soring et al.	7,780,593 B2	8/2010	Ueno et al.
7,617,961 B2	11/2009	Viola	7,780,651 B2	8/2010	Madhani et al.
7,621,930 B2	11/2009	Houser	7,780,659 B2	8/2010	Okada et al.
7,625,370 B2	12/2009	Hart et al.	7,780,663 B2	8/2010	Yates et al.
7,628,791 B2	12/2009	Garrison et al.	7,784,662 B2	8/2010	Wales et al.
7,628,792 B2	12/2009	Guerra	7,784,663 B2	8/2010	Shelton, IV
			7,789,883 B2	9/2010	Takashino et al.
			7,793,814 B2	9/2010	Racenet et al.
			7,796,969 B2	9/2010	Kelly et al.
			7,798,386 B2	9/2010	Schall et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

7,799,020 B2	9/2010	Shores et al.	7,998,157 B2	8/2011	Culp et al.
7,799,045 B2	9/2010	Masuda	8,002,732 B2	8/2011	Visconti
7,803,152 B2	9/2010	Honda et al.	8,016,843 B2	9/2011	Escaf
7,803,156 B2	9/2010	Eder et al.	8,020,743 B2	9/2011	Shelton, IV
7,803,168 B2	9/2010	Gifford et al.	8,025,630 B2	9/2011	Murakami et al.
7,806,891 B2	10/2010	Nowlin et al.	8,028,885 B2	10/2011	Smith et al.
7,810,693 B2	10/2010	Broehl et al.	8,033,173 B2	10/2011	Ehlert et al.
7,811,283 B2	10/2010	Moses et al.	8,038,693 B2	10/2011	Allen
7,815,641 B2	10/2010	Dodde et al.	8,048,070 B2	11/2011	O'Brien et al.
7,815,658 B2	10/2010	Murakami	8,052,672 B2	11/2011	Laufer et al.
7,819,298 B2	10/2010	Hall et al.	8,056,720 B2	11/2011	Hawkes
7,819,299 B2	10/2010	Shelton, IV et al.	8,057,467 B2	11/2011	Faller et al.
7,819,819 B2	10/2010	Quick et al.	8,057,468 B2	11/2011	Konesky
7,819,872 B2	10/2010	Johnson et al.	8,057,498 B2	11/2011	Robertson
7,821,143 B2	10/2010	Wiener	8,058,771 B2	11/2011	Giordano et al.
D627,066 S	11/2010	Romero	8,061,014 B2	11/2011	Smith et al.
7,824,401 B2	11/2010	Manzo et al.	8,066,167 B2	11/2011	Measamer et al.
7,828,808 B2	11/2010	Hinman et al.	8,070,036 B1	12/2011	Knodel
7,832,408 B2	11/2010	Shelton, IV et al.	8,070,711 B2	12/2011	Bassinger et al.
7,832,611 B2	11/2010	Boyden et al.	8,070,762 B2	12/2011	Escudero et al.
7,832,612 B2	11/2010	Baxter, III et al.	8,075,555 B2	12/2011	Truckai et al.
7,834,484 B2	11/2010	Sartor	8,075,558 B2	12/2011	Truckai et al.
7,837,699 B2	11/2010	Yamada et al.	8,089,197 B2	1/2012	Rinner et al.
7,845,537 B2	12/2010	Shelton, IV et al.	8,092,475 B2	1/2012	Cotter et al.
7,846,155 B2	12/2010	Houser et al.	8,097,012 B2	1/2012	Kagarise
7,846,159 B2	12/2010	Morrison et al.	8,100,894 B2	1/2012	Mucko et al.
7,846,160 B2	12/2010	Payne et al.	8,105,230 B2	1/2012	Honda et al.
7,846,161 B2	12/2010	Dumbauld et al.	8,105,323 B2	1/2012	Buysse et al.
7,854,735 B2	12/2010	Houser et al.	8,105,324 B2	1/2012	Palanker et al.
D631,155 S	1/2011	Peine et al.	8,114,104 B2	2/2012	Young et al.
7,861,906 B2	1/2011	Doll et al.	8,128,624 B2	3/2012	Couture et al.
7,862,560 B2	1/2011	Marion	8,133,218 B2	3/2012	Daw et al.
7,867,228 B2	1/2011	Nobis et al.	8,136,712 B2	3/2012	Zingman
7,871,392 B2	1/2011	Sartor	8,137,263 B2	3/2012	Marescaux et al.
7,871,423 B2	1/2011	Livneh	8,141,762 B2	3/2012	Bedi et al.
7,876,030 B2	1/2011	Taki et al.	8,142,421 B2	3/2012	Cooper et al.
D631,965 S	2/2011	Price et al.	8,142,461 B2	3/2012	Houser et al.
7,878,991 B2	2/2011	Babaev	8,147,488 B2	4/2012	Masuda
7,879,033 B2	2/2011	Sartor et al.	8,147,508 B2	4/2012	Madan et al.
7,879,035 B2	2/2011	Garrison et al.	8,152,801 B2	4/2012	Goldberg et al.
7,879,070 B2	2/2011	Ortiz et al.	8,152,825 B2	4/2012	Madan et al.
7,883,465 B2	2/2011	Donofrio et al.	8,157,145 B2	4/2012	Shelton, IV et al.
7,883,475 B2	2/2011	Dupont et al.	8,161,977 B2	4/2012	Shelton, IV et al.
7,892,606 B2	2/2011	Thies et al.	8,162,966 B2	4/2012	Connor et al.
7,896,875 B2	3/2011	Heim et al.	8,172,846 B2	5/2012	Brunnett et al.
7,897,792 B2	3/2011	Iikura et al.	8,172,870 B2	5/2012	Shipp
7,901,400 B2	3/2011	Wham et al.	8,177,800 B2	5/2012	Spitz et al.
7,901,423 B2	3/2011	Stulen et al.	8,182,501 B2	5/2012	Houser et al.
7,905,881 B2	3/2011	Masuda et al.	8,182,502 B2	5/2012	Stulen et al.
7,909,220 B2	3/2011	Viola	8,186,560 B2	5/2012	Hess et al.
7,909,824 B2	3/2011	Masuda et al.	8,186,877 B2	5/2012	Klimovitch et al.
7,918,848 B2	4/2011	Lau et al.	8,187,267 B2	5/2012	Pappone et al.
7,919,184 B2	4/2011	Mohapatra et al.	D661,801 S	6/2012	Price et al.
7,922,061 B2	4/2011	Shelton, IV et al.	D661,802 S	6/2012	Price et al.
7,922,651 B2	4/2011	Yamada et al.	D661,803 S	6/2012	Price et al.
7,922,716 B2	4/2011	Malecki et al.	D661,804 S	6/2012	Price et al.
7,931,611 B2	4/2011	Novak et al.	8,197,472 B2	6/2012	Lau et al.
7,931,649 B2	4/2011	Couture et al.	8,197,479 B2	6/2012	Olson et al.
D637,288 S	5/2011	Houghton	8,197,502 B2	6/2012	Smith et al.
D638,540 S	5/2011	Ijiri et al.	8,207,651 B2	6/2012	Gilbert
7,935,114 B2	5/2011	Takashino et al.	8,210,411 B2	7/2012	Yates et al.
7,936,203 B2	5/2011	Zimlich	8,221,306 B2	7/2012	Okada et al.
7,951,095 B2	5/2011	Makin et al.	8,221,415 B2	7/2012	Francischelli
7,951,165 B2	5/2011	Golden et al.	8,226,665 B2	7/2012	Cohen
7,955,331 B2	6/2011	Truckai et al.	8,226,675 B2	7/2012	Houser et al.
7,959,050 B2	6/2011	Smith et al.	8,231,607 B2	7/2012	Takuma
7,959,626 B2	6/2011	Hong et al.	8,235,917 B2	8/2012	Joseph et al.
7,963,963 B2	6/2011	Francischelli et al.	8,236,018 B2	8/2012	Yoshimine et al.
7,967,602 B2	6/2011	Lindquist	8,236,019 B2	8/2012	Houser
7,972,329 B2	7/2011	Refior et al.	8,236,020 B2	8/2012	Smith et al.
7,976,544 B2	7/2011	McClurken et al.	8,241,235 B2	8/2012	Kahler et al.
7,980,443 B2	7/2011	Scheib et al.	8,241,271 B2	8/2012	Millman et al.
7,981,050 B2	7/2011	Ritchart et al.	8,241,282 B2	8/2012	Unger et al.
7,981,113 B2	7/2011	Truckai et al.	8,241,283 B2	8/2012	Guerra et al.
7,997,278 B2	8/2011	Utley et al.	8,241,284 B2	8/2012	Dycus et al.
			8,241,312 B2	8/2012	Messerly
			8,246,575 B2	8/2012	Viola
			8,246,615 B2	8/2012	Behnke
			8,246,618 B2	8/2012	Bucciaglia et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

8,246,642 B2	8/2012	Houser et al.	8,403,950 B2	3/2013	Palmer et al.
8,251,994 B2	8/2012	McKenna et al.	8,409,234 B2	4/2013	Stahler et al.
8,252,012 B2	8/2012	Stulen	8,414,577 B2	4/2013	Boudreaux et al.
8,253,303 B2	8/2012	Giordano et al.	8,418,073 B2	4/2013	Mohr et al.
8,257,377 B2	9/2012	Wiener et al.	8,418,349 B2	4/2013	Smith et al.
8,257,387 B2	9/2012	Cunningham	8,419,757 B2	4/2013	Smith et al.
8,262,563 B2	9/2012	Bakos et al.	8,419,758 B2	4/2013	Smith et al.
8,267,300 B2	9/2012	Boudreaux	8,419,759 B2	4/2013	Dietz
8,273,087 B2	9/2012	Kimura et al.	8,423,182 B2	4/2013	Robinson et al.
D669,992 S	10/2012	Schafer et al.	8,425,161 B2	4/2013	Nagaya et al.
D669,993 S	10/2012	Merchant et al.	8,425,410 B2	4/2013	Murray et al.
8,277,446 B2	10/2012	Heard	8,425,545 B2	4/2013	Smith et al.
8,277,447 B2	10/2012	Garrison et al.	8,430,811 B2	4/2013	Hess et al.
8,277,471 B2	10/2012	Wiener et al.	8,430,876 B2	4/2013	Kappus et al.
8,282,581 B2	10/2012	Zhao et al.	8,430,897 B2	4/2013	Novak et al.
8,282,669 B2	10/2012	Gerber et al.	8,430,898 B2	4/2013	Wiener et al.
8,286,846 B2	10/2012	Smith et al.	8,435,257 B2	5/2013	Smith et al.
8,287,485 B2	10/2012	Kimura et al.	8,435,258 B2	5/2013	Young et al.
8,287,528 B2	10/2012	Wham et al.	8,439,912 B2	5/2013	Cunningham et al.
8,287,532 B2	10/2012	Carroll et al.	8,439,939 B2	5/2013	Deville et al.
8,292,886 B2	10/2012	Kerr et al.	8,444,637 B2	5/2013	Podmore et al.
8,292,888 B2	10/2012	Whitman	8,444,662 B2	5/2013	Palmer et al.
8,298,223 B2	10/2012	Wham et al.	8,444,663 B2	5/2013	Houser et al.
8,298,225 B2	10/2012	Gilbert	8,444,664 B2	5/2013	Balanev et al.
8,298,232 B2	10/2012	Unger	8,453,906 B2	6/2013	Huang et al.
8,298,233 B2	10/2012	Mueller	8,454,599 B2	6/2013	Inagaki et al.
8,303,576 B2	11/2012	Brock	8,454,639 B2	6/2013	Du et al.
8,303,580 B2	11/2012	Wham et al.	8,460,288 B2	6/2013	Tamai et al.
8,303,583 B2	11/2012	Hosier et al.	8,460,292 B2	6/2013	Truckai et al.
8,303,613 B2	11/2012	Crandall et al.	8,460,326 B2	6/2013	Houser et al.
8,306,629 B2	11/2012	Mioduski et al.	8,461,744 B2	6/2013	Wiener et al.
8,308,040 B2	11/2012	Huang et al.	8,469,981 B2	6/2013	Robertson et al.
8,319,400 B2	11/2012	Houser et al.	8,479,969 B2	7/2013	Shelton, IV
8,323,302 B2	12/2012	Robertson et al.	8,480,703 B2	7/2013	Nicholas et al.
8,323,310 B2	12/2012	Kingsley	8,484,833 B2	7/2013	Cunningham et al.
8,328,061 B2	12/2012	Kasvikis	8,485,413 B2	7/2013	Scheib et al.
8,328,761 B2	12/2012	Widenhouse et al.	8,485,970 B2	7/2013	Widenhouse et al.
8,328,802 B2	12/2012	Deville et al.	8,486,057 B2	7/2013	Behnke, II
8,328,833 B2	12/2012	Cuny	8,486,096 B2	7/2013	Robertson et al.
8,328,834 B2	12/2012	Isaacs et al.	8,491,578 B2	7/2013	Manwaring et al.
8,333,778 B2	12/2012	Smith et al.	8,491,625 B2	7/2013	Homer
8,333,779 B2	12/2012	Smith et al.	8,496,682 B2	7/2013	Guerra et al.
8,334,468 B2	12/2012	Palmer et al.	D687,549 S	8/2013	Johnson et al.
8,334,635 B2	12/2012	Voegele et al.	8,506,555 B2	8/2013	Ruiz Morales
8,337,407 B2	12/2012	Quistgaard et al.	8,509,318 B2	8/2013	Tailliet
8,338,726 B2	12/2012	Palmer et al.	8,512,336 B2	8/2013	Couture
8,343,146 B2	1/2013	Godara et al.	8,512,359 B2	8/2013	Whitman et al.
8,344,596 B2	1/2013	Nield et al.	8,512,364 B2	8/2013	Kowalski et al.
8,348,880 B2	1/2013	Messerly et al.	8,512,365 B2	8/2013	Wiener et al.
8,348,967 B2	1/2013	Stulen	8,518,067 B2	8/2013	Masuda et al.
8,353,297 B2	1/2013	Dacquay et al.	8,523,889 B2	9/2013	Stulen et al.
8,357,103 B2	1/2013	Mark et al.	8,528,563 B2	9/2013	Gruber
8,357,158 B2	1/2013	McKenna et al.	8,529,437 B2	9/2013	Taylor et al.
8,366,727 B2	2/2013	Witt et al.	8,529,565 B2	9/2013	Masuda et al.
8,372,064 B2	2/2013	Douglass et al.	8,531,064 B2	9/2013	Robertson et al.
8,372,099 B2	2/2013	Deville et al.	8,535,311 B2	9/2013	Schall
8,372,101 B2	2/2013	Smith et al.	8,535,340 B2	9/2013	Allen
8,372,102 B2	2/2013	Stulen et al.	8,535,341 B2	9/2013	Allen
8,374,670 B2	2/2013	Selkee	8,540,128 B2	9/2013	Shelton, IV et al.
8,377,044 B2	2/2013	Coe et al.	8,546,996 B2	10/2013	Messerly et al.
8,377,059 B2	2/2013	Deville et al.	8,546,999 B2	10/2013	Houser et al.
8,377,085 B2	2/2013	Smith et al.	8,551,077 B2	10/2013	Main et al.
8,382,748 B2	2/2013	Geisel	8,551,086 B2	10/2013	Kimura et al.
8,382,775 B1	2/2013	Bender et al.	8,562,592 B2	10/2013	Conlon et al.
8,382,782 B2	2/2013	Robertson et al.	8,562,598 B2	10/2013	Falkenstein et al.
8,382,792 B2	2/2013	Chojin	8,562,604 B2	10/2013	Nishimura
8,388,646 B2	3/2013	Chojin	8,568,390 B2	10/2013	Mueller
8,388,647 B2	3/2013	Nau, Jr. et al.	8,568,400 B2	10/2013	Gilbert
8,394,096 B2	3/2013	Moses et al.	8,568,412 B2	10/2013	Brandt et al.
8,394,115 B2	3/2013	Houser et al.	8,569,997 B2	10/2013	Lee
8,397,971 B2	3/2013	Yates et al.	8,573,461 B2	11/2013	Shelton, IV et al.
8,403,926 B2	3/2013	Nobis et al.	8,573,465 B2	11/2013	Shelton, IV
8,403,945 B2	3/2013	Whitfield et al.	8,574,231 B2	11/2013	Boudreaux et al.
8,403,948 B2	3/2013	Deville et al.	8,574,253 B2	11/2013	Gruber et al.
8,403,949 B2	3/2013	Palmer et al.	8,579,176 B2	11/2013	Smith et al.
			8,579,897 B2	11/2013	Vakharia et al.
			8,579,928 B2	11/2013	Robertson et al.
			8,579,937 B2	11/2013	Gresham
			8,591,459 B2	11/2013	Clymer et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

8,591,506 B2	11/2013	Wham et al.	8,784,415 B2	7/2014	Malackowski et al.
8,591,536 B2	11/2013	Robertson	8,784,418 B2	7/2014	Romero
D695,407 S	12/2013	Price et al.	8,790,342 B2	7/2014	Stulen et al.
D696,631 S	12/2013	Price et al.	8,795,276 B2	8/2014	Dietz et al.
8,597,193 B2	12/2013	Grunwald et al.	8,795,327 B2	8/2014	Dietz et al.
8,602,031 B2	12/2013	Reis et al.	8,800,838 B2	8/2014	Shelton, IV
8,602,288 B2	12/2013	Shelton, IV et al.	8,801,710 B2	8/2014	Ullrich et al.
8,608,745 B2	12/2013	Guzman et al.	8,801,752 B2	8/2014	Fortier et al.
8,613,383 B2	12/2013	Beckman et al.	8,808,319 B2	8/2014	Houser et al.
8,616,431 B2	12/2013	Timm et al.	8,814,856 B2	8/2014	Elmouelhi et al.
8,622,274 B2	1/2014	Yates et al.	8,814,870 B2	8/2014	Paraschiv et al.
8,623,011 B2	1/2014	Spivey	8,820,605 B2	9/2014	Shelton, IV
8,623,016 B2	1/2014	Fischer	8,821,388 B2	9/2014	Naito et al.
8,623,027 B2	1/2014	Price et al.	8,827,992 B2	9/2014	Koss et al.
8,623,044 B2	1/2014	Timm et al.	8,827,995 B2	9/2014	Schaller et al.
8,628,529 B2	1/2014	Aldridge et al.	8,834,466 B2	9/2014	Cummings et al.
8,628,534 B2	1/2014	Jones et al.	8,834,518 B2	9/2014	Faller et al.
8,632,461 B2	1/2014	Glossop	8,844,789 B2	9/2014	Shelton, IV et al.
8,636,736 B2	1/2014	Yates et al.	8,845,537 B2	9/2014	Tanaka et al.
8,638,428 B2	1/2014	Brown	8,845,630 B2	9/2014	Mehta et al.
8,640,788 B2	2/2014	Dachs, II et al.	8,848,808 B2	9/2014	Dress
8,641,663 B2	2/2014	Kirschenman et al.	8,851,354 B2	10/2014	Swensgard et al.
8,647,350 B2	2/2014	Mohan et al.	8,852,184 B2	10/2014	Kucklick
8,650,728 B2	2/2014	Wan et al.	8,858,547 B2	10/2014	Brogna
8,651,230 B2	2/2014	Peshkovsky et al.	8,862,955 B2	10/2014	Cesari
8,652,120 B2	2/2014	Giordano et al.	8,864,709 B2	10/2014	Akagane et al.
8,652,132 B2	2/2014	Tsuchiya et al.	8,864,749 B2	10/2014	Okada
8,652,155 B2	2/2014	Houser et al.	8,864,757 B2	10/2014	Klimovitch et al.
8,659,208 B1	2/2014	Rose et al.	8,864,761 B2	10/2014	Johnson et al.
8,663,220 B2	3/2014	Wiener et al.	8,870,865 B2	10/2014	Frankhouser et al.
8,663,222 B2	3/2014	Anderson et al.	8,870,867 B2	10/2014	Walberg et al.
8,663,262 B2	3/2014	Smith et al.	8,882,766 B2	11/2014	Couture et al.
8,668,691 B2	3/2014	Heard	8,882,791 B2	11/2014	Stulen
8,668,710 B2	3/2014	Slipszenko et al.	8,882,792 B2	11/2014	Dietz et al.
8,684,253 B2	4/2014	Giordano et al.	8,888,776 B2	11/2014	Dietz et al.
8,685,016 B2	4/2014	Wham et al.	8,888,783 B2	11/2014	Young
8,685,020 B2	4/2014	Weizman et al.	8,888,809 B2	11/2014	Davison et al.
8,690,582 B2	4/2014	Rohrbach et al.	8,899,462 B2	12/2014	Kostrzewski et al.
8,691,268 B2	4/2014	Weimann	8,900,259 B2	12/2014	Houser et al.
8,695,866 B2	4/2014	Leimbach et al.	8,906,016 B2	12/2014	Boudreaux et al.
8,696,366 B2	4/2014	Chen et al.	8,906,017 B2	12/2014	Rioux et al.
8,696,665 B2	4/2014	Hunt et al.	8,911,438 B2	12/2014	Swoyer et al.
8,702,609 B2	4/2014	Hadjicostis	8,911,460 B2	12/2014	Neurohr et al.
8,702,704 B2	4/2014	Shelton, IV et al.	8,920,412 B2	12/2014	Fritz et al.
8,704,425 B2	4/2014	Giordano et al.	8,920,414 B2	12/2014	Stone et al.
8,708,213 B2	4/2014	Shelton, IV et al.	8,920,421 B2	12/2014	Rupp
8,709,031 B2	4/2014	Stulen	8,926,607 B2	1/2015	Norvell et al.
8,709,035 B2	4/2014	Johnson et al.	8,926,608 B2	1/2015	Bacher et al.
8,715,270 B2	5/2014	Weitzner et al.	8,931,682 B2	1/2015	Timm et al.
8,715,277 B2	5/2014	Weizman	8,936,614 B2	1/2015	Allen, IV
8,715,306 B2	5/2014	Faller et al.	8,939,974 B2	1/2015	Boudreaux et al.
8,721,640 B2	5/2014	Taylor et al.	8,951,248 B2	2/2015	Messerly et al.
8,721,657 B2	5/2014	Kondoh et al.	8,951,272 B2	2/2015	Robertson et al.
8,734,443 B2	5/2014	Hixson et al.	8,956,349 B2	2/2015	Aldridge et al.
8,734,476 B2	5/2014	Rhee et al.	8,961,515 B2	2/2015	Twomey et al.
8,747,238 B2	6/2014	Shelton, IV et al.	8,961,547 B2	2/2015	Dietz et al.
8,747,351 B2	6/2014	Schultz	8,968,283 B2	3/2015	Kharin
8,747,404 B2	6/2014	Boudreaux et al.	8,968,294 B2	3/2015	Maass et al.
8,749,116 B2	6/2014	Messerly et al.	8,968,355 B2	3/2015	Malkowski et al.
8,752,264 B2	6/2014	Ackley et al.	8,974,447 B2	3/2015	Kimball et al.
8,752,749 B2	6/2014	Moore et al.	8,974,477 B2	3/2015	Yamada
8,753,338 B2	6/2014	Widhouse et al.	8,974,479 B2	3/2015	Ross et al.
8,754,570 B2	6/2014	Voegele et al.	8,979,843 B2	3/2015	Timm et al.
8,758,342 B2	6/2014	Bales et al.	8,979,844 B2	3/2015	White et al.
8,758,352 B2	6/2014	Cooper et al.	8,979,890 B2	3/2015	Boudreaux
8,764,735 B2	7/2014	Coe et al.	8,986,287 B2	3/2015	Park et al.
8,764,747 B2	7/2014	Cummings et al.	8,986,302 B2	3/2015	Aldridge et al.
8,767,970 B2	7/2014	Eppolito	8,989,855 B2	3/2015	Murphy et al.
8,770,459 B2	7/2014	Racenet et al.	8,989,903 B2	3/2015	Weir et al.
8,771,269 B2	7/2014	Sherman et al.	8,991,678 B2	3/2015	Wellman et al.
8,771,270 B2	7/2014	Burbank	8,992,422 B2	3/2015	Spivey et al.
8,773,001 B2	7/2014	Wiener et al.	8,992,526 B2	3/2015	Brodbeck et al.
8,777,944 B2	7/2014	Frankhouser et al.	9,005,199 B2	4/2015	Beckman et al.
8,779,648 B2	7/2014	Giordano et al.	9,011,437 B2	4/2015	Woodruff et al.
8,783,541 B2	7/2014	Shelton, IV et al.	9,011,471 B2	4/2015	Timm et al.
			9,017,326 B2	4/2015	DiNardo et al.
			9,017,355 B2	4/2015	Smith et al.
			9,017,372 B2	4/2015	Artale et al.
			9,023,071 B2	5/2015	Miller et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

9,023,072 B2	5/2015	Young et al.	9,226,750 B2	1/2016	Weir et al.
9,028,397 B2	5/2015	Naito	9,226,751 B2	1/2016	Shelton, IV et al.
9,028,476 B2	5/2015	Bonn	9,226,766 B2	1/2016	Aldridge et al.
9,028,494 B2	5/2015	Shelton, IV et al.	9,226,767 B2	1/2016	Stulen et al.
9,028,519 B2	5/2015	Yates et al.	9,232,979 B2	1/2016	Parihar et al.
9,031,667 B2	5/2015	Williams	9,237,891 B2	1/2016	Shelton, IV
9,033,973 B2	5/2015	Krapohl et al.	9,237,921 B2	1/2016	Messerly et al.
9,035,741 B2	5/2015	Hamel et al.	9,237,923 B2	1/2016	Worrell et al.
9,039,690 B2	5/2015	Kersten et al.	9,241,060 B1	1/2016	Fujisaki
9,039,695 B2	5/2015	Giordano et al.	9,241,692 B2	1/2016	Gunday et al.
9,039,705 B2	5/2015	Takashino	9,241,728 B2	1/2016	Price et al.
9,043,018 B2	5/2015	Mohr	9,241,730 B2	1/2016	Babaev
9,044,227 B2	6/2015	Shelton, IV et al.	9,241,731 B2	1/2016	Boudreaux et al.
9,044,243 B2	6/2015	Johnson et al.	9,241,768 B2	1/2016	Sandhu et al.
9,044,245 B2	6/2015	Condie et al.	9,247,953 B2	2/2016	Palmer et al.
9,044,256 B2	6/2015	Cadeddu et al.	9,254,165 B2	2/2016	Aronow et al.
9,044,261 B2	6/2015	Houser	9,254,171 B2	2/2016	Trees et al.
9,050,093 B2	6/2015	Aldridge et al.	9,259,234 B2	2/2016	Robertson et al.
9,050,098 B2	6/2015	Deville et al.	9,259,265 B2	2/2016	Harris et al.
9,050,124 B2	6/2015	Houser	9,265,567 B2	2/2016	Orban, III et al.
9,055,961 B2	6/2015	Manzo et al.	9,265,926 B2	2/2016	Strobl et al.
9,059,547 B2	6/2015	McLawhorn	9,265,973 B2	2/2016	Akagane
9,060,770 B2	6/2015	Shelton, IV et al.	9,277,962 B2	3/2016	Koss et al.
9,060,775 B2	6/2015	Wiener et al.	9,282,974 B2	3/2016	Shelton, IV
9,060,776 B2	6/2015	Yates et al.	9,283,027 B2	3/2016	Monson et al.
9,063,049 B2	6/2015	Beach et al.	9,283,045 B2	3/2016	Rhee et al.
9,066,723 B2	6/2015	Beller et al.	9,289,256 B2	3/2016	Shelton, IV et al.
9,066,747 B2	6/2015	Robertson	9,295,514 B2	3/2016	Shelton, IV et al.
9,072,535 B2	7/2015	Shelton, IV et al.	9,301,759 B2	4/2016	Spivey et al.
9,072,536 B2	7/2015	Shelton, IV et al.	9,301,772 B2	4/2016	Kimball et al.
9,072,539 B2	7/2015	Messerly et al.	9,307,388 B2	4/2016	Liang et al.
9,084,624 B2	7/2015	Larkin et al.	9,307,986 B2	4/2016	Hall et al.
9,084,878 B2	7/2015	Kawaguchi et al.	9,308,009 B2	4/2016	Madan et al.
9,089,327 B2	7/2015	Worrell et al.	9,308,014 B2	4/2016	Fischer
9,089,360 B2	7/2015	Messerly et al.	9,314,292 B2	4/2016	Trees et al.
9,095,362 B2	8/2015	Dachs, II et al.	9,314,301 B2	4/2016	Ben-Haim et al.
9,095,367 B2	8/2015	Olson et al.	9,326,754 B2	5/2016	Polster
9,101,385 B2	8/2015	Shelton, IV et al.	9,326,787 B2	5/2016	Sanai et al.
9,107,684 B2	8/2015	Ma	9,326,788 B2	5/2016	Batross et al.
9,107,689 B2	8/2015	Robertson et al.	9,333,025 B2	5/2016	Monson et al.
9,107,690 B2	8/2015	Bales, Jr. et al.	9,339,289 B2	5/2016	Robertson
9,113,900 B2	8/2015	Buyse et al.	9,339,323 B2	5/2016	Eder et al.
9,113,940 B2	8/2015	Twomey	9,339,326 B2	5/2016	McCullagh et al.
9,114,245 B2	8/2015	Dietz et al.	9,345,534 B2	5/2016	Artale et al.
9,119,657 B2	9/2015	Shelton, IV et al.	9,345,900 B2	5/2016	Wu et al.
9,119,957 B2	9/2015	Gantz et al.	9,351,642 B2	5/2016	Nadkarni et al.
9,125,662 B2	9/2015	Shelton, IV	9,351,754 B2	5/2016	Vakharia et al.
9,125,667 B2	9/2015	Stone et al.	9,352,173 B2	5/2016	Yamada et al.
9,125,722 B2	9/2015	Schwartz	9,358,065 B2	6/2016	Ladtkow et al.
9,147,965 B2	9/2015	Lee	9,358,407 B2	6/2016	Akagane
9,149,324 B2	10/2015	Huang et al.	9,364,230 B2	6/2016	Shelton, IV et al.
9,149,325 B2	10/2015	Worrell et al.	9,370,400 B2	6/2016	Parihar
9,161,803 B2	10/2015	Yates et al.	9,370,611 B2	6/2016	Ross et al.
9,168,054 B2	10/2015	Turner et al.	9,375,230 B2	6/2016	Ross et al.
9,168,055 B2	10/2015	Houser et al.	9,375,232 B2	6/2016	Hunt et al.
9,168,085 B2	10/2015	Juzkiw et al.	9,375,267 B2	6/2016	Kerr et al.
9,168,089 B2	10/2015	Buyse et al.	9,381,058 B2	7/2016	Houser et al.
9,168,090 B2 *	10/2015	Strobl A61B 18/1445	9,386,983 B2	7/2016	Swensgard et al.
9,173,656 B2	11/2015	Schurr et al.	9,393,037 B2	7/2016	Olson et al.
9,179,912 B2	11/2015	Yates et al.	D763,442 S	8/2016	Price et al.
9,186,199 B2	11/2015	Strauss et al.	9,402,680 B2	8/2016	Ginnebaugh et al.
9,186,204 B2	11/2015	Nishimura et al.	9,402,682 B2	8/2016	Worrell et al.
9,192,380 B2	11/2015	Racenet et al.	9,408,606 B2	8/2016	Shelton, IV
9,192,431 B2	11/2015	Woodruff et al.	9,408,622 B2	8/2016	Stulen et al.
9,198,714 B2	12/2015	Worrell et al.	9,408,660 B2	8/2016	Strobl et al.
9,198,715 B2	12/2015	Livneh	9,414,853 B2	8/2016	Stulen et al.
9,204,879 B2	12/2015	Shelton, IV	9,414,880 B2	8/2016	Monson et al.
9,204,891 B2	12/2015	Weitzman	9,421,060 B2	8/2016	Monson et al.
9,204,918 B2	12/2015	Germain et al.	9,427,249 B2	8/2016	Robertson et al.
9,204,923 B2	12/2015	Manzo et al.	9,439,668 B2	9/2016	Timm et al.
9,216,050 B2	12/2015	Condie et al.	9,439,669 B2	9/2016	Wiener et al.
9,216,062 B2	12/2015	Duque et al.	9,439,671 B2	9/2016	Akagane
9,220,483 B2	12/2015	Frankhouser et al.	9,445,784 B2	9/2016	O'Keeffe
9,220,527 B2	12/2015	Houser et al.	9,445,832 B2	9/2016	Wiener et al.
9,220,559 B2	12/2015	Worrell et al.	9,445,833 B2	9/2016	Akagane
			9,451,967 B2	9/2016	Jordan et al.
			9,456,863 B2	10/2016	Moua
			9,456,864 B2	10/2016	Witt et al.
			9,468,498 B2	10/2016	Sigmon, Jr.

(56)

References Cited

U.S. PATENT DOCUMENTS

9,474,542 B2	10/2016	Slipszenko et al.	9,872,725 B2	1/2018	Worrell et al.
9,486,235 B2	11/2016	Harrington et al.	9,877,720 B2	1/2018	Worrell et al.
9,486,236 B2	11/2016	Price et al.	9,877,776 B2 *	1/2018	Boudreaux A61B 18/1445
9,492,187 B2	11/2016	Ravikumar et al.	9,883,884 B2	2/2018	Neurohr et al.
9,492,224 B2	11/2016	Boudreaux et al.	9,888,958 B2	2/2018	Evans et al.
9,498,245 B2	11/2016	Voegele et al.	9,901,339 B2	2/2018	Farascioni
9,504,483 B2	11/2016	Houser et al.	9,901,359 B2	2/2018	Faller et al.
9,504,524 B2	11/2016	Behnke, II	9,907,563 B2	3/2018	Germain et al.
9,504,855 B2	11/2016	Messerly et al.	9,913,655 B2	3/2018	Scheib et al.
9,510,850 B2	12/2016	Robertson et al.	9,913,656 B2	3/2018	Stulen
9,510,906 B2	12/2016	Boudreaux et al.	9,913,680 B2	3/2018	Voegele et al.
9,522,029 B2	12/2016	Yates et al.	9,918,736 B2	3/2018	Van Tol et al.
9,526,564 B2	12/2016	Rusin	9,925,003 B2	3/2018	Parihar et al.
9,526,565 B2	12/2016	Strobl	9,943,325 B2	4/2018	Faller et al.
9,545,253 B2	1/2017	Worrell et al.	9,949,785 B2	4/2018	Price et al.
9,545,497 B2	1/2017	Wenderow et al.	9,949,788 B2	4/2018	Boudreaux
9,554,846 B2	1/2017	Boudreaux	9,962,182 B2	5/2018	Dietz et al.
9,554,854 B2	1/2017	Yates et al.	9,987,033 B2	6/2018	Neurohr et al.
9,561,038 B2	2/2017	Shelton, IV et al.	10,010,339 B2	7/2018	Witt et al.
9,574,644 B2	2/2017	Parihar	10,010,341 B2	7/2018	Houser et al.
9,592,072 B2	3/2017	Akagane	10,016,207 B2	7/2018	Suzuki et al.
9,597,143 B2	3/2017	Madan et al.	10,022,142 B2	7/2018	Aranyi et al.
9,610,091 B2	4/2017	Johnson et al.	10,022,567 B2	7/2018	Messerly et al.
9,610,114 B2	4/2017	Baxter, III et al.	10,022,568 B2	7/2018	Messerly et al.
9,615,877 B2	4/2017	Tyrrell et al.	10,028,765 B2	7/2018	Hibner et al.
9,622,729 B2	4/2017	Dewaale et al.	10,028,786 B2	7/2018	Mucilli et al.
9,623,237 B2	4/2017	Turner et al.	10,034,684 B2	7/2018	Weisenburgh, II et al.
9,636,135 B2	5/2017	Stulen	10,034,685 B2	7/2018	Boudreaux et al.
9,638,770 B2	5/2017	Dietz et al.	10,034,704 B2	7/2018	Asher et al.
9,642,644 B2	5/2017	Houser et al.	10,039,588 B2	8/2018	Harper et al.
9,642,669 B2	5/2017	Takashino et al.	10,045,794 B2	8/2018	Witt et al.
9,643,052 B2	5/2017	Tchao et al.	10,045,819 B2	8/2018	Jensen et al.
9,649,111 B2	5/2017	Shelton, IV et al.	10,070,916 B2	9/2018	Artale
9,649,126 B2	5/2017	Robertson et al.	10,085,762 B2	10/2018	Timm et al.
9,662,131 B2	5/2017	Omori et al.	10,092,310 B2	10/2018	Boudreaux et al.
9,668,806 B2	6/2017	Unger et al.	10,092,344 B2	10/2018	Mohr et al.
9,671,860 B2	6/2017	Ogawa et al.	10,092,348 B2	10/2018	Boudreaux
9,675,374 B2	6/2017	Stulen et al.	10,092,350 B2	10/2018	Rothweiler et al.
9,675,375 B2	6/2017	Houser et al.	10,111,699 B2	10/2018	Boudreaux
9,687,290 B2	6/2017	Keller	10,117,667 B2	11/2018	Robertson et al.
9,700,339 B2	7/2017	Nield	10,117,702 B2	11/2018	Danziger et al.
9,700,343 B2	7/2017	Messerly et al.	10,130,410 B2	11/2018	Strobl et al.
9,707,004 B2	7/2017	Houser et al.	10,154,852 B2	12/2018	Conlon et al.
9,707,027 B2	7/2017	Ruddenklau et al.	10,159,524 B2	12/2018	Yates et al.
9,707,030 B2	7/2017	Davison et al.	10,166,060 B2	1/2019	Johnson et al.
9,713,507 B2	7/2017	Stulen et al.	10,172,669 B2	1/2019	Felder et al.
9,724,118 B2	8/2017	Schulte et al.	10,179,022 B2	1/2019	Yates et al.
9,724,152 B2	8/2017	Horlle et al.	10,182,837 B2	1/2019	Isola et al.
9,737,326 B2	8/2017	Worrell et al.	10,188,385 B2	1/2019	Kerr et al.
9,737,355 B2	8/2017	Yates et al.	10,194,972 B2	2/2019	Yates et al.
9,737,358 B2	8/2017	Beckman et al.	10,194,973 B2	2/2019	Wiener et al.
9,737,735 B2	8/2017	Dietz et al.	10,194,976 B2	2/2019	Boudreaux
9,743,947 B2	8/2017	Price et al.	10,194,977 B2	2/2019	Yang
9,757,142 B2	9/2017	Shimizu	10,201,365 B2	2/2019	Boudreaux et al.
9,757,186 B2 *	9/2017	Boudreaux A61B 18/1445	10,201,382 B2	2/2019	Wiener et al.
9,764,164 B2	9/2017	Wiener et al.	10,226,273 B2	3/2019	Messerly et al.
9,782,214 B2	10/2017	Houser et al.	10,231,747 B2	3/2019	Stulen et al.
9,788,851 B2	10/2017	Dannaher et al.	10,245,064 B2	4/2019	Rhee et al.
9,795,405 B2	10/2017	Price et al.	10,245,065 B2	4/2019	Witt et al.
9,795,436 B2	10/2017	Yates et al.	10,245,095 B2	4/2019	Boudreaux
9,795,808 B2	10/2017	Messerly et al.	10,251,664 B2	4/2019	Shelton, IV et al.
9,801,648 B2	10/2017	Houser et al.	10,263,171 B2	4/2019	Wiener et al.
9,801,675 B2	10/2017	Sanai et al.	10,265,094 B2	4/2019	Witt et al.
9,808,308 B2	11/2017	Faller et al.	10,265,117 B2	4/2019	Wiener et al.
9,814,514 B2	11/2017	Shelton, IV et al.	10,265,118 B2	4/2019	Gerhardt
9,820,768 B2	11/2017	Gee et al.	D847,990 S	5/2019	Kimball
9,820,771 B2	11/2017	Norton et al.	10,278,721 B2	5/2019	Dietz et al.
9,820,806 B2	11/2017	Lee et al.	10,285,723 B2	5/2019	Conlon et al.
9,826,976 B2	11/2017	Parihar et al.	10,285,724 B2	5/2019	Faller et al.
9,839,443 B2	12/2017	Brockman et al.	10,299,810 B2	5/2019	Robertson et al.
9,839,796 B2	12/2017	Sawada	10,299,821 B2	5/2019	Shelton, IV et al.
9,848,901 B2	12/2017	Robertson et al.	10,314,638 B2	6/2019	Gee et al.
9,848,902 B2	12/2017	Price et al.	10,321,950 B2	6/2019	Yates et al.
9,848,937 B2 *	12/2017	Trees A61B 18/1445	10,335,182 B2	7/2019	Stulen et al.
9,861,428 B2	1/2018	Trees et al.	10,335,614 B2	7/2019	Messerly et al.
			10,342,602 B2	7/2019	Strobl et al.
			10,357,303 B2	7/2019	Conlon et al.
			10,368,892 B2	8/2019	Stulen et al.
			10,368,894 B2	8/2019	Madan et al.

(56)

References Cited

- U.S. PATENT DOCUMENTS
- 2005/0256405 A1 11/2005 Makin et al.
2005/0261588 A1 11/2005 Makin et al.
2005/0267464 A1 12/2005 Truckai et al.
2005/0273090 A1 12/2005 Nieman et al.
2005/0288659 A1 12/2005 Kimura et al.
2006/0030797 A1 2/2006 Zhou et al.
2006/0030848 A1 2/2006 Craig et al.
2006/0058825 A1 3/2006 Ogura et al.
2006/0063130 A1 3/2006 Hayman et al.
2006/0064086 A1 3/2006 Odom
2006/0066181 A1 3/2006 Bromfield et al.
2006/0074442 A1 4/2006 Noriega et al.
2006/0079874 A1 4/2006 Faller et al.
2006/0079877 A1 4/2006 Houser et al.
2006/0079879 A1 4/2006 Faller et al.
2006/0095046 A1 5/2006 Trieu et al.
2006/0159731 A1 7/2006 Shoshan
2006/0190034 A1 8/2006 Nishizawa et al.
2006/0206100 A1 9/2006 Eskridge et al.
2006/0206115 A1 9/2006 Schomer et al.
2006/0211943 A1 9/2006 Beaupre
2006/0217729 A1 9/2006 Eskridge et al.
2006/0224160 A1 10/2006 Trieu et al.
2006/0247558 A1 11/2006 Yamada
2006/0253050 A1 11/2006 Yoshimine et al.
2006/0257819 A1 11/2006 Johnson
2006/0264809 A1 11/2006 Hansmann et al.
2006/0270916 A1 11/2006 Skwarek et al.
2006/0271030 A1 11/2006 Francis et al.
2006/0293656 A1 12/2006 Shaddock et al.
2007/0016235 A1 1/2007 Tanaka et al.
2007/0016236 A1 1/2007 Beaupre
2007/0032704 A1 2/2007 Gandini et al.
2007/0055228 A1 3/2007 Berg et al.
2007/0056596 A1 3/2007 Fanney et al.
2007/0060935 A1 3/2007 Schwardt et al.
2007/0063618 A1 3/2007 Bromfield
2007/0073185 A1 3/2007 Nakao
2007/0073341 A1 3/2007 Smith et al.
2007/0074584 A1 4/2007 Talarico et al.
2007/0106317 A1 5/2007 Shelton et al.
2007/0118115 A1 5/2007 Artale et al.
2007/0130771 A1 6/2007 Ehlert et al.
2007/0149881 A1 6/2007 Rabin
2007/0156163 A1 7/2007 Davison et al.
2007/0166663 A1 7/2007 Telles et al.
2007/0173803 A1 7/2007 Wham et al.
2007/0173813 A1 7/2007 Odom
2007/0173872 A1 7/2007 Neuenfeldt
2007/0185474 A1 8/2007 Nahen
2007/0191712 A1 8/2007 Messerly et al.
2007/0191713 A1 8/2007 Eichmann et al.
2007/0203483 A1 8/2007 Kim et al.
2007/0208340 A1 9/2007 Ganz et al.
2007/0219481 A1 9/2007 Babaev
2007/0232926 A1 10/2007 Stulen et al.
2007/0232928 A1 10/2007 Wiener et al.
2007/0236213 A1 10/2007 Paden et al.
2007/0239101 A1 10/2007 Kellogg
2007/0249941 A1 10/2007 Salehi et al.
2007/0260242 A1 11/2007 Dycus et al.
2007/0265560 A1 11/2007 Soltani et al.
2007/0265613 A1 11/2007 Edelstein et al.
2007/0265616 A1 11/2007 Couture et al.
2007/0275348 A1 11/2007 Lemon
2007/0282333 A1 12/2007 Fortson et al.
2007/0287933 A1 12/2007 Phan et al.
2007/0288055 A1 12/2007 Lee
2008/0013809 A1 1/2008 Zhu et al.
2008/0015575 A1 1/2008 Odom et al.
2008/0033465 A1 2/2008 Schmitz et al.
2008/0039746 A1 2/2008 Hissong et al.
2008/0051812 A1 2/2008 Schmitz et al.
2008/0058775 A1 3/2008 Darian et al.
2008/0058845 A1 3/2008 Shimizu et al.
2008/0071269 A1
2008/0077145 A1
2008/0082039 A1
2008/0082098 A1
2008/0097281 A1
2008/0097501 A1
2008/0114355 A1
2008/0114364 A1
2008/0125768 A1
2008/0147058 A1
2008/0147062 A1
2008/0147092 A1
2008/0171938 A1
2008/0177268 A1
2008/0188755 A1
2008/0200940 A1
2008/0208108 A1
2008/0208231 A1
2008/0214967 A1
2008/0234709 A1
2008/0243162 A1
2008/0281200 A1
2008/0281315 A1
2008/0287948 A1
2008/0296346 A1
2008/0300588 A1
2009/0012516 A1
2009/0023985 A1
2009/0043228 A1
2009/0048537 A1
2009/0048589 A1
2009/0054886 A1
2009/0054889 A1
2009/0054894 A1
2009/0069830 A1
2009/0076506 A1
2009/0082716 A1
2009/0082766 A1
2009/0088785 A1
2009/0118751 A1
2009/0143678 A1
2009/0143799 A1
2009/0143800 A1
2009/0163807 A1
2009/0182322 A1
2009/0182331 A1
2009/0182332 A1
2009/0216157 A1
2009/0223033 A1
2009/0248021 A1
2009/0254077 A1
2009/0254080 A1
2009/0259149 A1
2009/0264909 A1
2009/0270771 A1
2009/0270812 A1
2009/0270853 A1
2009/0270891 A1
2009/0270899 A1
2009/0287205 A1
2009/0299141 A1
2009/0327715 A1
2010/0004508 A1
2010/0022825 A1
2010/0030233 A1
2010/0034605 A1
2010/0036370 A1
2010/0042126 A1
2010/0049180 A1
2010/0057118 A1
2010/0063525 A1
2010/0063528 A1
2010/0081863 A1
2010/0081864 A1
2010/0081883 A1
2010/0094323 A1
2010/0106173 A1
2010/0109480 A1
2010/0158307 A1
3/2008 Hilario et al.
3/2008 Boyden et al.
4/2008 Babaev
4/2008 Tanaka et al.
4/2008 Zusman et al.
4/2008 Blier
5/2008 Whayne et al.
5/2008 Goldin et al.
5/2008 Tahara et al.
6/2008 Horrell et al.
6/2008 Truckai et al.
6/2008 Rogge et al.
7/2008 Masuda et al.
7/2008 Daum et al.
8/2008 Hart
8/2008 Eichmann et al.
8/2008 Kimura
8/2008 Ota et al.
9/2008 Aranyi et al.
9/2008 Houser
10/2008 Shibata et al.
11/2008 Voic et al.
11/2008 Gines
11/2008 Newton et al.
12/2008 Shelton, IV et al.
12/2008 Groth et al.
1/2009 Curtis et al.
1/2009 Ewers
2/2009 Northrop et al.
2/2009 Lydon et al.
2/2009 Takashino et al.
2/2009 Yachi et al.
2/2009 Newton et al.
2/2009 Yachi
3/2009 Mulvihill et al.
3/2009 Baker
3/2009 Akahoshi
3/2009 Unger et al.
4/2009 Masuda
5/2009 Wiener et al.
6/2009 Keast et al.
6/2009 Smith et al.
6/2009 Deville et al.
6/2009 Sliwa
7/2009 D'Amelio et al.
7/2009 D'Amelio et al.
7/2009 Long et al.
8/2009 Yamada
9/2009 Houser
10/2009 McKenna
10/2009 Craig
10/2009 Honda
10/2009 Tahara et al.
10/2009 Beaupre
10/2009 Takahashi
10/2009 Litscher et al.
10/2009 Yachi et al.
10/2009 Beaupre
10/2009 Carusillo et al.
11/2009 Ingle
12/2009 Downey et al.
12/2009 Smith et al.
1/2010 Naito et al.
1/2010 Yoshie
2/2010 Whitman et al.
2/2010 Huckins et al.
2/2010 Mirel et al.
2/2010 Houser et al.
2/2010 Wells et al.
3/2010 Dietz et al.
3/2010 Beaupre et al.
3/2010 Beaupre
4/2010 Hess et al.
4/2010 Hess et al.
4/2010 Murray et al.
4/2010 Isaacs et al.
4/2010 Yoshimine
5/2010 Forslund et al.
6/2010 Kubota et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2020/0046401 A1 2/2020 Witt et al.
 2020/0054386 A1 2/2020 Houser et al.
 2020/0054899 A1 2/2020 Wiener et al.
 2020/0085462 A1 3/2020 Robertson
 2020/0085466 A1 3/2020 Faller et al.

FOREIGN PATENT DOCUMENTS

CN 2460047 Y 11/2001
 CN 1634601 A 7/2005
 CN 1775323 A 5/2006
 CN 1922563 A 2/2007
 CN 2868227 Y 2/2007
 CN 202027624 U 11/2011
 CN 102335778 A 2/2012
 CN 103668171 A 3/2014
 CN 103921215 A 7/2014
 CN 106077718 A 11/2016
 DE 2065681 A1 3/1975
 DE 3904558 A1 8/1990
 DE 9210327 U1 11/1992
 DE 4300307 A1 7/1994
 DE 4434938 C1 2/1996
 DE 29623113 U1 10/1997
 DE 20004812 U1 9/2000
 DE 20021619 U1 3/2001
 DE 10042606 A1 8/2001
 DE 10201569 A1 7/2003
 EP 0171967 A2 2/1986
 EP 0336742 A2 10/1989
 EP 0136855 B1 11/1989
 EP 0705571 A1 4/1996
 EP 1543854 A1 6/2005
 EP 1698289 A2 9/2006
 EP 1862133 A1 12/2007
 EP 1972264 A1 9/2008
 EP 2060238 A1 5/2009
 EP 1747761 B1 10/2009
 EP 2131760 A1 12/2009
 EP 1214913 B1 7/2010
 EP 1946708 B1 6/2011
 EP 1767164 B1 1/2013
 EP 2578172 A2 4/2013
 EP 2510891 B1 6/2016
 FR 2454351 A1 11/1980
 FR 2964554 A1 3/2012
 GB 2032221 A 4/1980
 GB 2317566 A 4/1998
 GB 2318298 A 4/1998
 GB 2425480 A 11/2006
 JP S50100891 A 8/1975
 JP S5968513 U 5/1984
 JP S59141938 A 8/1984
 JP S62221343 A 9/1987
 JP S62227343 A 10/1987
 JP S62292153 A 12/1987
 JP S62292154 A 12/1987
 JP S63109386 A 5/1988
 JP S63315049 A 12/1988
 JP H01151452 A 6/1989
 JP H01198540 A 8/1989
 JP H0271510 U 5/1990
 JP H02286149 A 11/1990
 JP H02292193 A 12/1990
 JP H0337061 A 2/1991
 JP H0425707 U 2/1992
 JP H0464351 A 2/1992
 JP H0430508 U 3/1992
 JP H04152942 A 5/1992
 JP H04161078 A 6/1992
 JP H0595955 A 4/1993
 JP H05115490 A 5/1993
 JP H0647048 A 2/1994
 JP H0670938 A 3/1994
 JP H06104503 A 4/1994

JP H07185457 A 7/1995
 JP H0824266 A 1/1996
 JP H08229050 A 9/1996
 JP H08275950 A 10/1996
 JP H08275951 A 10/1996
 JP H08299351 A 11/1996
 JP H08336545 A 12/1996
 JP H09135553 A 5/1997
 JP H09140722 A 6/1997
 JP H105236 A 1/1998
 JP H105237 A 1/1998
 JP H10295700 A 11/1998
 JP H11128238 A 5/1999
 JP 2000139943 A 5/2000
 JP 2000210296 A 8/2000
 JP 2000210299 A 8/2000
 JP 2000271145 A 10/2000
 JP 2000287987 A 10/2000
 JP 2000312682 A 11/2000
 JP 2001029353 A 2/2001
 JP 2001057985 A 3/2001
 JP 2001170066 A 6/2001
 JP 2001198137 A 7/2001
 JP 2002186901 A 7/2002
 JP 2002233533 A 8/2002
 JP 2002263579 A 9/2002
 JP 2002330977 A 11/2002
 JP 2003000612 A 1/2003
 JP 2003010201 A 1/2003
 JP 2003116870 A 4/2003
 JP 2003126104 A 5/2003
 JP 2003126110 A 5/2003
 JP 2003153919 A 5/2003
 JP 2003230567 A 8/2003
 JP 2003339730 A 12/2003
 JP 2004129871 A 4/2004
 JP 2004147701 A 5/2004
 JP 2004209043 A 7/2004
 JP 2005027026 A 1/2005
 JP 2005074088 A 3/2005
 JP 2005094552 A 4/2005
 JP 2005253674 A 9/2005
 JP 2006217716 A 8/2006
 JP 2006288431 A 10/2006
 JP 3841627 B2 11/2006
 JP D1339835 S 8/2008
 JP 2009297352 A 12/2009
 JP 2010009686 A 1/2010
 JP 2010121865 A 6/2010
 JP 2011160586 A 8/2011
 JP 2012235658 A 11/2012
 KR 100789356 B1 12/2007
 RU 2154437 C1 8/2000
 RU 22035 U1 3/2002
 RU 2201169 C2 3/2003
 RU 2405603 C1 12/2010
 SU 850068 A1 7/1981
 WO WO-8103272 A1 11/1981
 WO WO-9308757 A1 5/1993
 WO WO-9314708 A1 8/1993
 WO WO-9421183 A1 9/1994
 WO WO-9424949 A1 11/1994
 WO WO-9639086 A1 12/1996
 WO WO-9800069 A1 1/1998
 WO WO-9805437 A1 2/1998
 WO WO-9816157 A1 4/1998
 WO WO-9920213 A1 4/1999
 WO WO-9923960 A1 5/1999
 WO WO-0024322 A1 5/2000
 WO WO-0024330 A1 5/2000
 WO WO-0064358 A2 11/2000
 WO WO-0128444 A1 4/2001
 WO WO-0132087 A1 5/2001
 WO WO-0167970 A1 9/2001
 WO WO-0195810 A2 12/2001
 WO WO-02076685 A1 10/2002
 WO WO-02080799 A1 10/2002
 WO WO-2004037095 A2 5/2004
 WO WO-2004078051 A2 9/2004

(56)

References Cited

FOREIGN PATENT DOCUMENTS

WO	WO-2004098426	A1	11/2004
WO	WO-2005084250	A2	9/2005
WO	WO-2007008710	A2	1/2007
WO	WO-2008118709	A1	10/2008
WO	WO-2008130793	A1	10/2008
WO	WO-2010104755	A1	9/2010
WO	WO-2011008672	A2	1/2011
WO	WO-2011052939	A2	5/2011
WO	WO-2011060031	A1	5/2011
WO	WO-2012044606	A2	4/2012
WO	WO-2012066983	A1	5/2012
WO	WO-2013048963	A2	4/2013

OTHER PUBLICATIONS

Sherrit et al., "Novel Horn Designs for Ultrasonic/Sonic Cleaning Welding, Soldering, Cutting and Drilling," Proc. SPIE Smart Structures Conference, vol. 4701, Paper No. 34, San Diego, CA, pp. 353-360, Mar. 2002.

Lim et al., "A Review of Mechanism Used in Laparoscopic Surgical Instruments," Mechanism and Machine Theory, vol. 38, pp. 1133-1147, (2003).

Gooch et al., "Recommended Infection-Control Practices for Dentistry, 1993," Published: May 28, 1993; [retrieved on Aug. 23, 2008]. Retrieved from the internet: URL: <http://wonder.cdc.gov/wonder/prevguid/p0000191/p0000191.asp> (15 pages).

Covidien Brochure, The LigaSure Precise™ Instrument, dated Mar. 2011 (2 pages).

AST Products, Inc., "Principles of Video Contact Angle Analysis," 20 pages, (2006).

Mitsui Chemicals Names DuPont™ Vespel® Business as Exclusive U.S., European Distributor of AUTUM® Thermoplastic Polyimide Resin, Feb. 24, 2003; http://www2.dupont.com/Vespel/en_US/news_events/article20030224.html.

Sadiq Muhammad et al: "High-performance planar ultrasonic tool based on d31-mode piezocrystal", IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control, IEEE, US, vol. 62, No. 3, Mar. 30, 2015 (Mar. 30, 2015), pp. 428-438, XP011574640, ISSN: 0885-3010, DOI: 10.1109/TUFFC.2014.006437.

Leonard I. Malis, M.D., "The Value of Irrigation During Bipolar Coagulation," 1989.

Huston et al., "Magnetic and Magnetostrictive Properties of Cube Textured Nickel for Magnetostrictive Transducer Applications," IEEE Transactions on Magnetics, vol. 9(4), pp. 636-640 (Dec. 1973).

Orr et al., "Overview of Bioheat Transfer," pp. 367-384 in Optical-Thermal Response of Laser-Irradiated Tissue, A. J. Welch and M. J. C. van Gemert, eds., Plenum, New York (1995).

F. A. Duck, "Optical Properties of Tissue Including Ultraviolet and Infrared Radiation," pp. 43-71 in Physical Properties of Tissue (1990).

Campbell et al, "Thermal Imaging in Surgery," p. 19-3, in Medical Infrared Imaging, N. A. Diakides and J. D. Bronzino, Eds. (2008).

Gerhard, Glen C., "Surgical Electrotechnology: Quo Vadis?," IEEE Transactions on Biomedical Engineering, vol. BME-31, No. 12, pp. 787-792, Dec. 1984.

Fowler, K.R., "A Programmable, Arbitrary Waveform Electrosurgical Device," IEEE Engineering in Medicine and Biology Society 10th Annual International Conference, pp. 1324, 1325 (1988).

Sullivan, "Cost-Constrained Selection of Strand Diameter and Number in a Litz-Wire Transformer Winding," IEEE Transactions on Power Electronics, vol. 16, No. 2, Mar. 2001, pp. 281-288.

Graff, K.F., "Elastic Wave Propagation in a Curved Sonic Transmission Line," IEEE Transactions on Sonics and Ultrasonics, SU-17(1), 1-6 (1970).

Makarov, S. N., Ochmann, M., Desinger, K., "The longitudinal vibration response of a curved fiber used for laser ultrasound surgical therapy," Journal of the Acoustical Society of America 102, 1191-1199 (1997).

Morley, L. S. D., "Elastic Waves in a Naturally Curved Rod," Quarterly Journal of Mechanics and Applied Mathematics, 14: 155-172 (1961).

Walsh, S. J., White, R. G., "Vibrational Power Transmission in Curved Beams," Journal of Sound and Vibration, 233(3), 455-488 (2000).

Covidien Brochure, [Value Analysis Brief], LigaSure Advance™ Pistol Grip, dated Rev. Apr. 2010 (7 pages).

Wright, et al., "Time-Temperature Equivalence of Heat-Induced Changes in Cells and Proteins," Feb. 1998. ASME Journal of Biomechanical Engineering, vol. 120, pp. 22-26.

Covidien Brochure, LigaSure Impact™ Instrument LF4318, dated Feb. 2013 (3 pages).

Covidien Brochure, LigaSure Atlas™ Hand Switching Instruments, dated Dec. 2008 (2 pages).

Covidien Brochure, The LigaSure™ 5 mm Blunt Tip Sealer/Divider Family, dated Apr. 2013 (2 pages).

Erbe Electrosurgery VIO® 200 S, (2012), p. 7, 12 pages, accessed Mar. 31, 2014 at http://www.erbe-med.com/erbe/media/Marketing/materialien/85140170_ERBE_EN_VIO_200_S_D027541.

Jang, J. et al. "Neuro-fuzzy and Soft Computing." Prentice Hall, 1997, pp. 13-89, 199-293, 335-393, 453-496, 535-549.

Sullivan, "Optimal Choice for Number of Strands in a Litz-Wire Transformer Winding," IEEE Transactions on Power Electronics, vol. 14, No. 2, Mar. 1999, pp. 283-291.

Weir, C.E., "Rate of shrinkage of tendon collagen—heat, entropy and free energy of activation of the shrinkage of untreated tendon. Effect of acid salt, pickle, and tannage on the activation of tendon collagen." Journal of the American Leather Chemists Association, 44, pp. 108-140 (1949).

Henriques, F.C., "Studies in thermal injury V. The predictability and the significance of thermally induced rate processes leading to irreversible epidermal injury." Archives of Pathology, 434, pp. 489-502 (1947).

Wall et al., "Thermal modification of collagen," J Shoulder Elbow Surg, No. 8, pp. 339-344 (Jul./Aug. 1999).

Arnoczky et al., "Thermal Modification of Connective Tissues: Basic Science Considerations and Clinical Implications," J. Am Acad Orthop Surg, vol. 8, No. 5, pp. 305-313 (Sep./Oct. 2000).

Chen et al., "Heat-Induced Changes in the Mechanics of a Collagenous Tissue: Isothermal Free Shrinkage," Transactions of the ASME, vol. 119, pp. 372-378 (Nov. 1997).

Chen et al., "Heat-Induced Changes in the Mechanics of a Collagenous Tissue: Isothermal, Isotonic Shrinkage," Transactions of the ASME, vol. 120, pp. 382-388 (Jun. 1998).

Chen et al., "Phenomenological Evolution Equations for Heat-Induced Shrinkage of a Collagenous Tissue," IEEE Transactions on Biomedical Engineering, vol. 45, No. 10, pp. 1234-1240 (Oct. 1998).

Harris et al., "Kinetics of Thermal Damage to a Collagenous Membrane Under Biaxial Isotonic Loading," IEEE Transactions on Biomedical Engineering, vol. 51, No. 2, pp. 371-379 (Feb. 2004).

Harris et al., "Altered Mechanical Behavior of Epicardium Due to Isothermal Heating Under Biaxial Isotonic Loads," Journal of Biomechanical Engineering, vol. 125, pp. 381-388 (Jun. 2003).

Lee et al., "A multi-sample denaturation temperature tester for collagenous biomaterials," Med. Eng. Phy., vol. 17, No. 2, pp. 115-121 (Mar. 1995).

Moran et al., "Thermally Induced Shrinkage of Joint Capsule," Clinical Orthopaedics and Related Research, No. 281, pp. 248-255 (Dec. 2000).

Wells et al., "Altered Mechanical Behavior of Epicardium Under Isothermal Biaxial Loading," Transactions of the ASME, Journal of Biomedical Engineering, vol. 126, pp. 492-497 (Aug. 2004).

Gibson, "Magnetic Refrigerator Successfully Tested," U.S. Department of Energy Research News, accessed online on Aug. 6, 2010 at <http://www.eurekaalert.org/features/doe/2001-11/dl-mrs062802.php> (Nov. 1, 2001).

Humphrey, J.D., "Continuum Thermomechanics and the Clinical Treatment of Disease and Injury," Appl. Mech. Rev., vol. 56, No. 2 pp. 231-260 (Mar. 2003).

(56)

References Cited

OTHER PUBLICATIONS

National Semiconductors Temperature Sensor Handbook—<http://www.national.com/appinfo/tempsensors/files/tempnb.pdf>; accessed online: Apr. 1, 2011.

Hayashi et al., “The Effect of Thermal Heating on the Length and Histologic Properties of the Glenohumeral Joint Capsule,” *American Journal of Sports Medicine*, vol. 25, Issue 1, 11 pages (Jan. 1997), URL: <http://www.mdconsult.com/das/article/body/156183648-2/jorg=journal&source=M1&sp=1> . . . , accessed Aug. 25, 2009.

Douglas, S.C. “Introduction to Adaptive Filter”. *Digital Signal Processing Handbook*. Ed. Vijay K. Madisetti and Douglas B. Williams. Boca Raton: CRC Press LLC, 1999.

Chen et al., “Heat-induced changes in the mechanics of a collagenous tissue: pseudoelastic behavior at 37° C.,” *Journal of Biomechanics*, 31, pp. 211-216 (1998).

Kurt Gieck & Reiner Gieck, *Engineering Formulas § Z.7* (7th ed. 1997).

Glaser and Subak-Sharpe, *Integrated Circuit Engineering*, Addison-Wesley Publishing, Reading, MA (1979). (book—not attached).

Covidien 501(k) Summary Solicitud, dated Feb. 24, 2011 (7 pages).

LaCourse, J.R.; Vogt, M.C.; Miller, W.T., III; Selikowitz, S.M., “Spectral Analysis Interpretation of Electrosurgical Generator Nerve and Muscle Stimulation,” *IEEE Transactions on Biomedical Engineering*, vol. 35, No. 7, pp. 505-509, Jul. 1988.

<https://www.kjmagnetics.com/fieldcalculator.asp>, retrieved Jul. 11, 2016, backdated to Nov. 11, 2011 via <https://web.archive.org/web/20111116164447/http://www.kjmagnetics.com/fieldcalculator.asp>.

Emam, Tarek A. et al., “How Safe is High-Power Ultrasonic Dissection?,” *Annals of Surgery*, (2003), pp. 186-191, vol. 237, No. 2, Lippincott Williams & Wilkins, Inc., Philadelphia, PA.

Feil, Wolfgang, M.D., et al., “Ultrasonic Energy for Cutting, Coagulating, and Dissecting,” (2005), pp. IV, 17, 21, and 23; ISBN 3-13-127521-9 (New York, NY, Thieme, New York).

McCarus, Steven D. M.D., “Physiologic Mechanism of the Ultrasonically Activated Scalpel,” *The Journal of the American Association of Gynecologic Laparoscopists*; (Aug. 1996), vol. 3, No. 4., pp. 601-606 and 608.

* cited by examiner

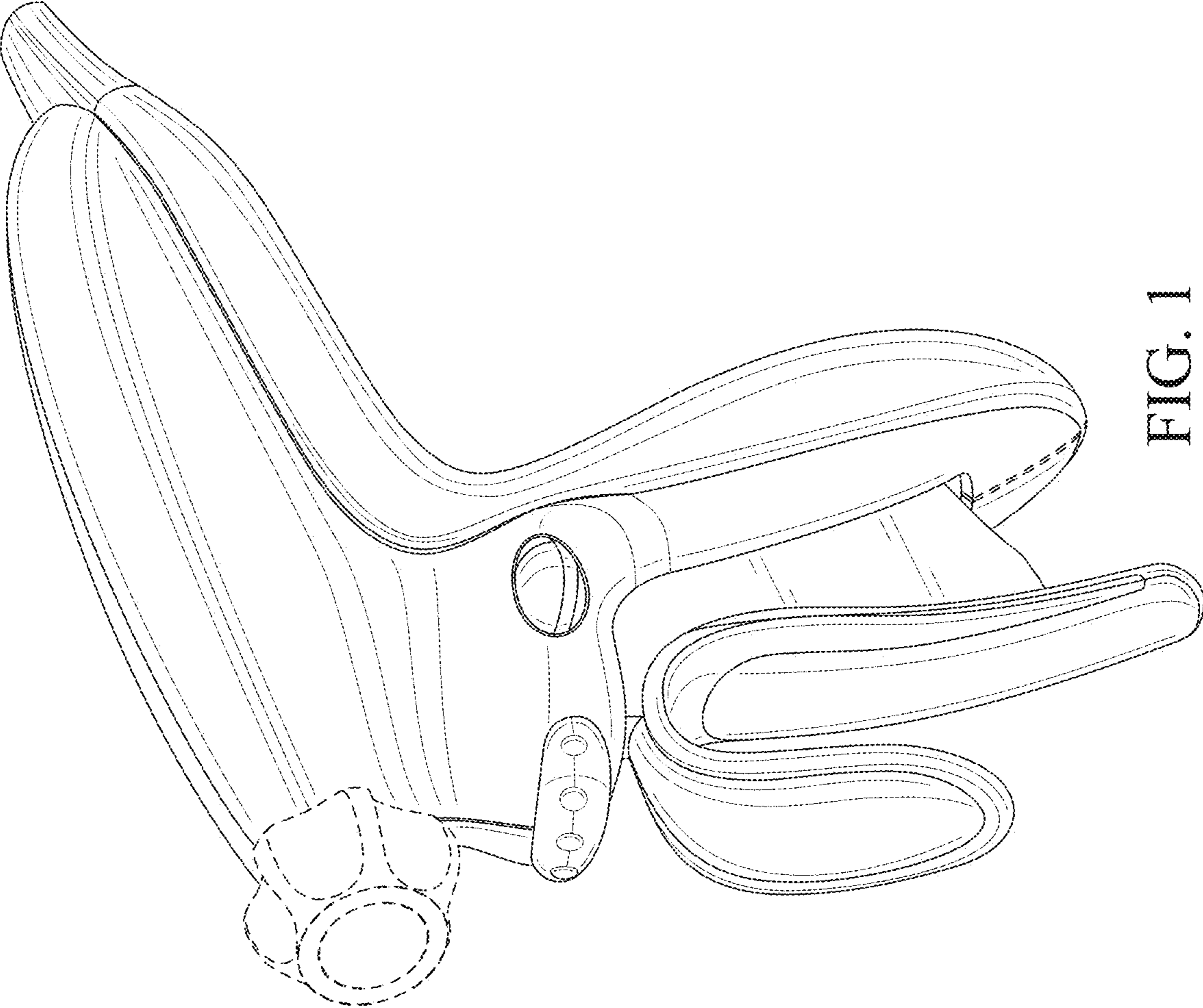


FIG. 1

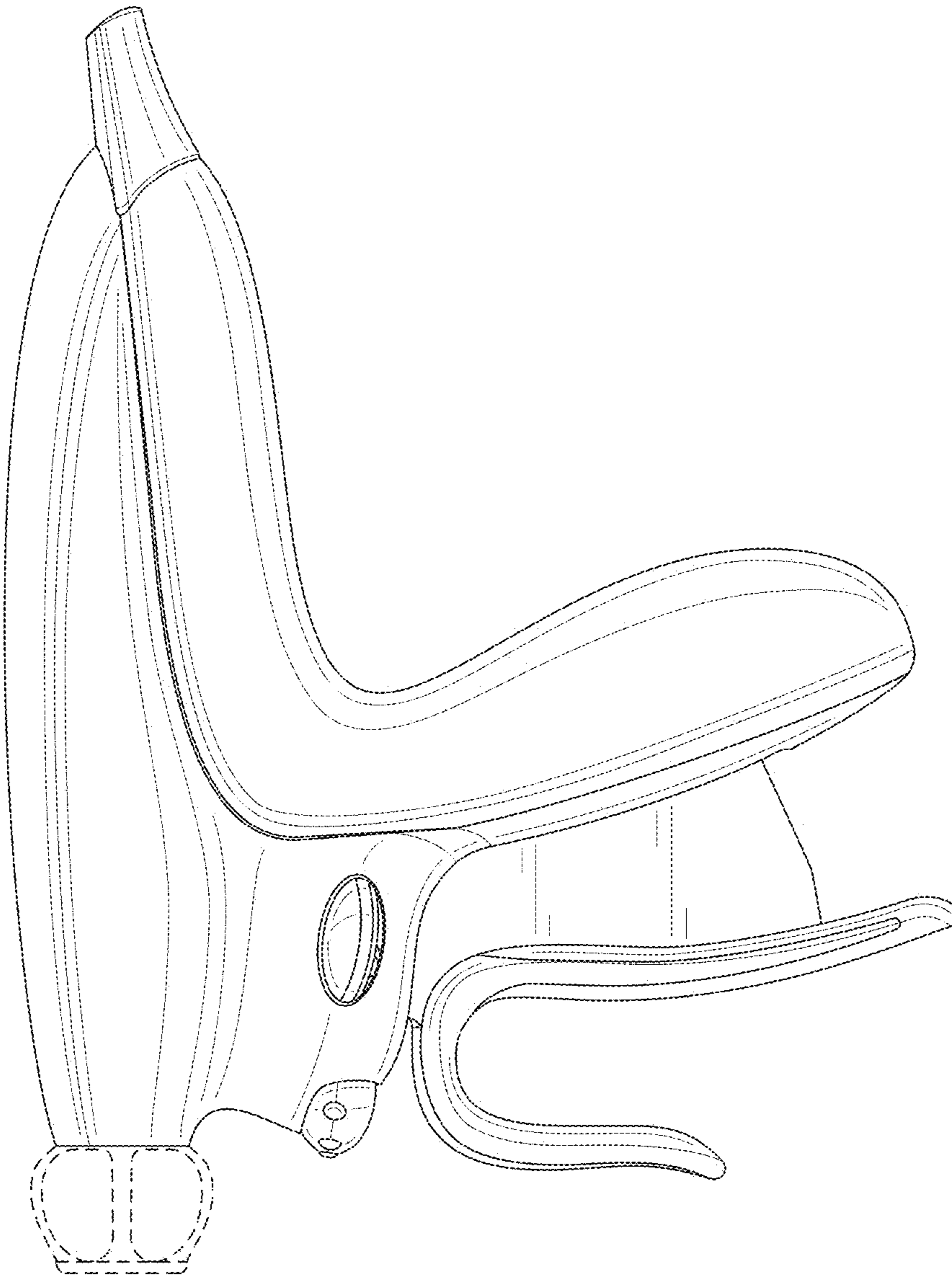


FIG. 2

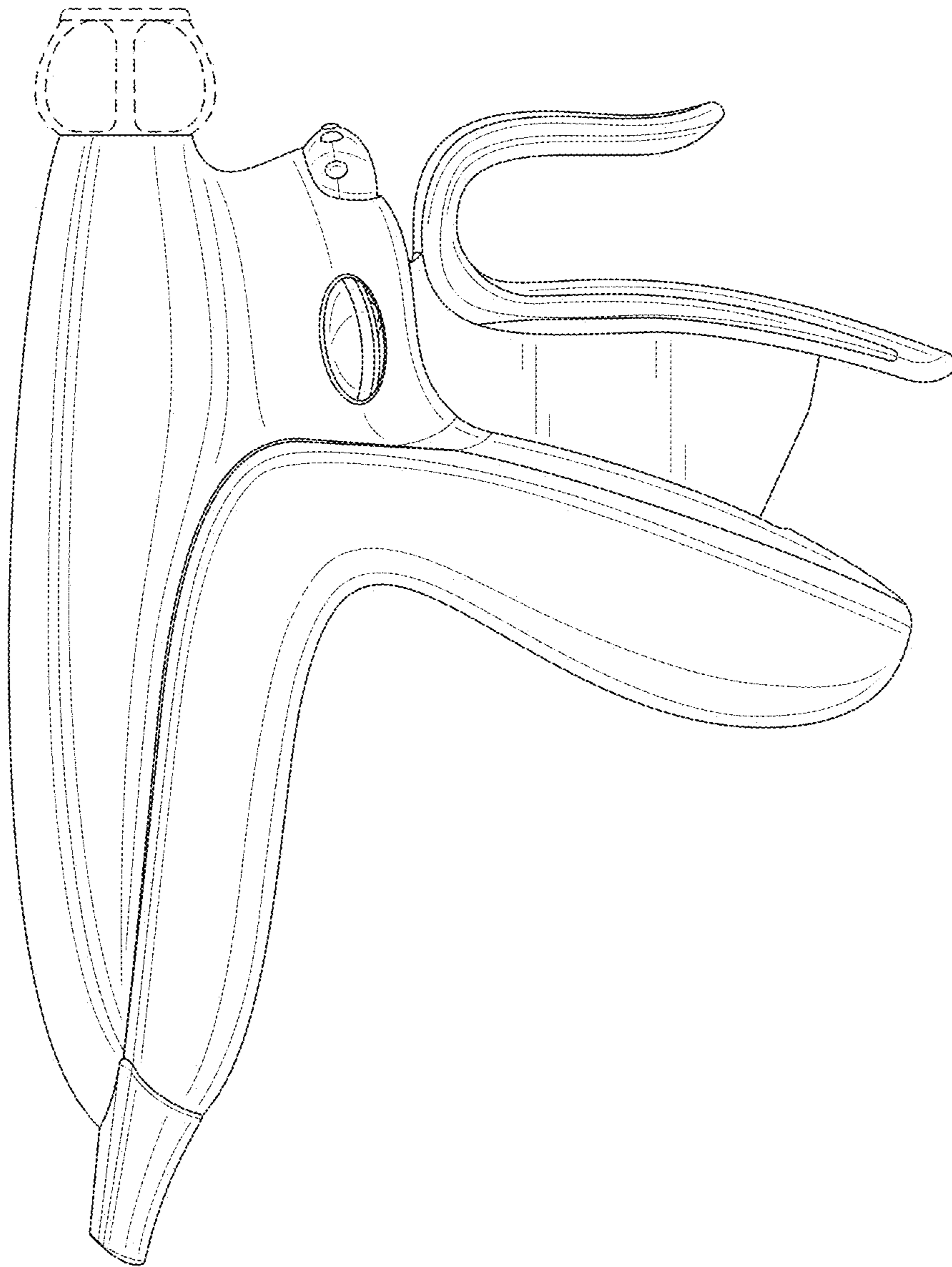


FIG. 3

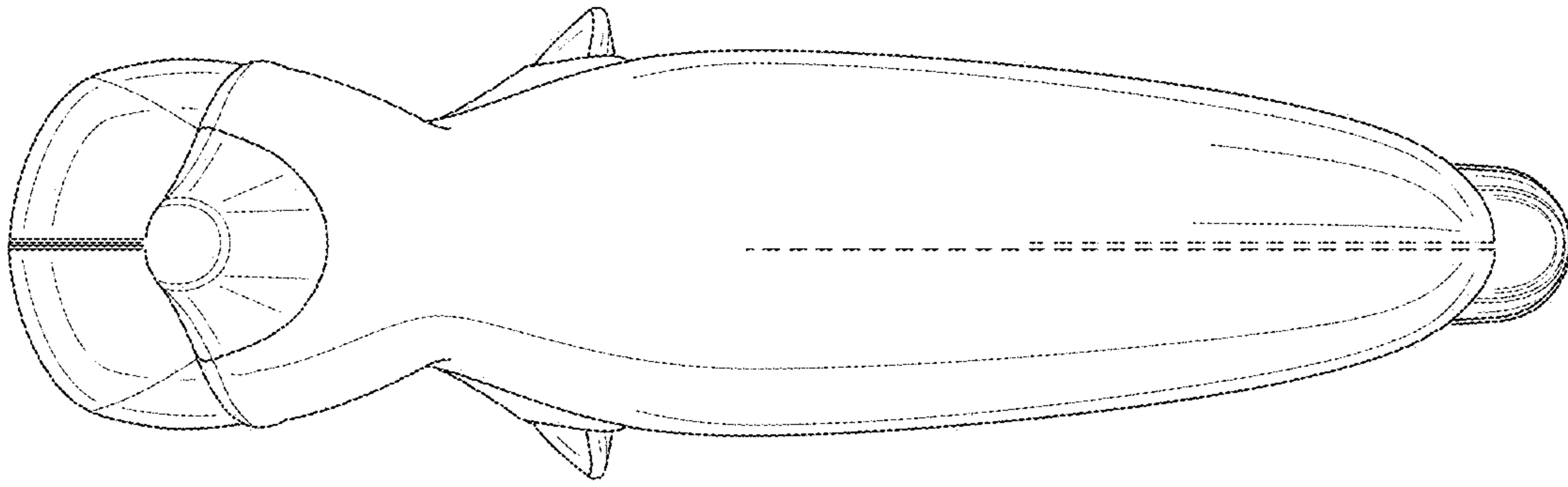


FIG. 5

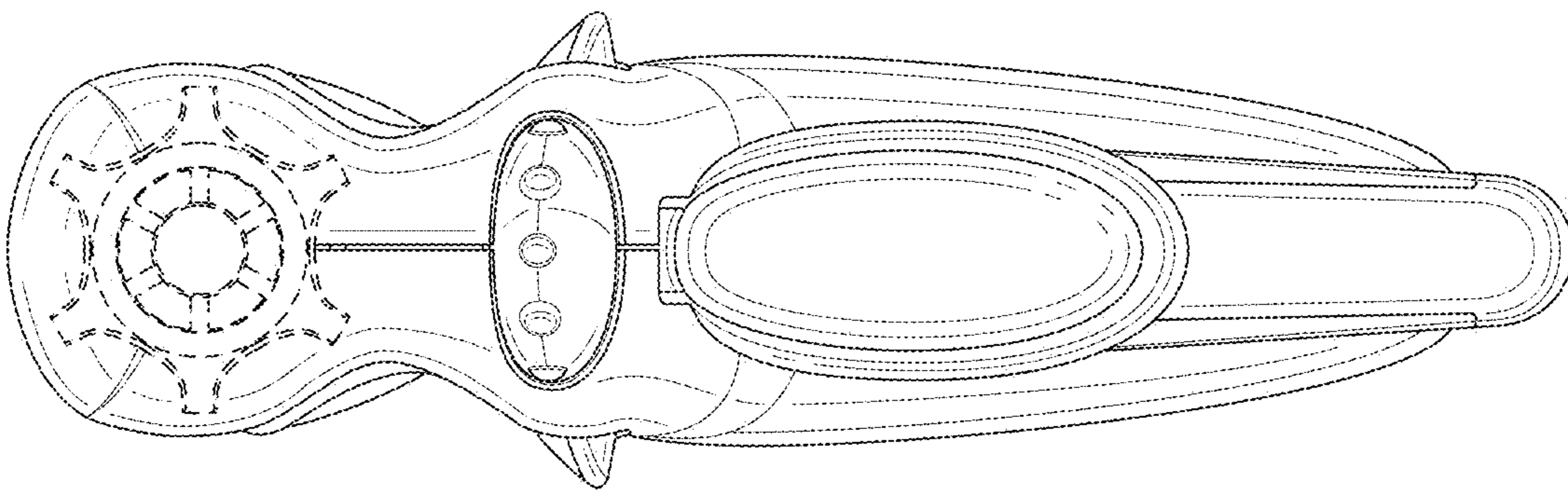


FIG. 4

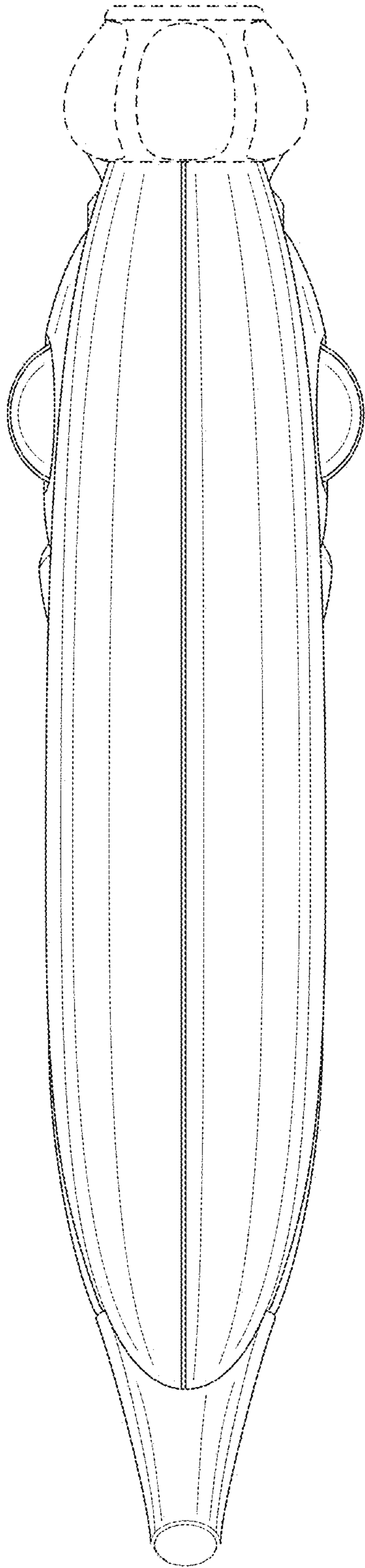


FIG. 6

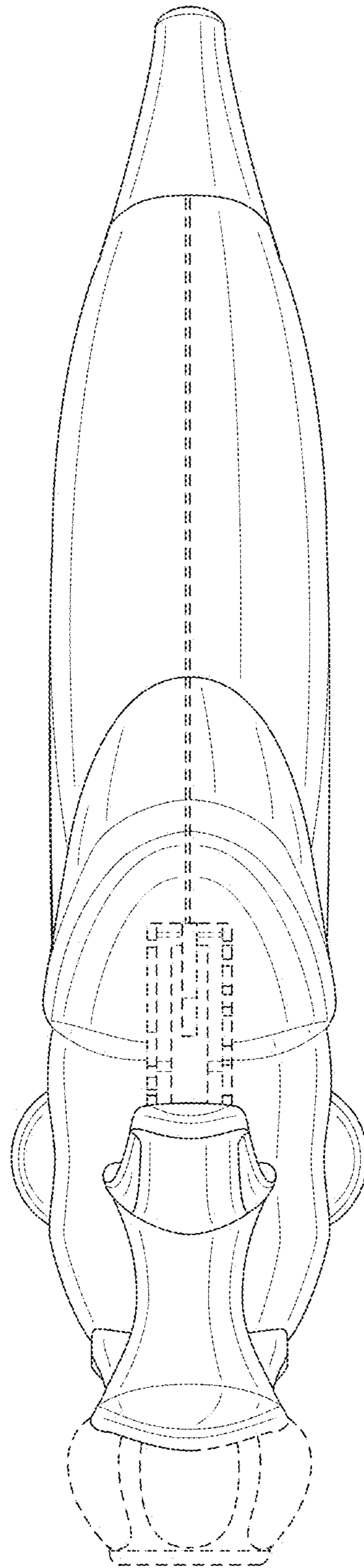


FIG. 7